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North West Treatment Hub Plant Upgrades – Growth Package

Rouse Hill WRRF Air Quality Impact Assessment

June 2024

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North West Treatment Hub Plant Upgrades – Growth Package
Rouse Hill WRRF Air Quality Impact Assessment

Sydney Water

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1 Introduction

1.1 Project background

Sydney Water's North West Treatment Hub (NWTH) comprises of the Castle Hill Water Resource Recovery Facility (WRRF), Rouse Hill WRRF and Riverstone WRRF. The NWTH provides wastewater servicing to Sydney's north west, including the North West Growth Area (NWGA) and North West Urban Renewal Corridor along the new Metro North West Line.

In 2022, Sydney Water proposed the NWTH upgrades to address rapid growth, meet future regulatory requirements and provide a solution that minimises impacts to the community and the environment. The proposed works included:

- Upgrade at Rouse Hill WRRF and Riverstone WRRF
- construct a new sludge transfer system between the three WRRFs to centralise solid treatment at Riverstone.

The potential environmental impacts and mitigation measures for these works were assessed under the NWTH Upgrades and Sludge Transfer System – Growth Package, July 2022 (approved Review of Environmental Factors (REF)).

Following this, Sydney Water identified an opportunity to diversify methods for solids processing. A review of technology available for advanced processing of biosolids to reduce contaminants of concern found that carbonisation with upstream digestion, dewatering and drying was the preferred technology for the NWTH upgrade project.

The proposed changes to the approved REF include the following:

- Riverstone WRRF
  - a new carbonisation plant and associated infrastructure including drying, heating and carbonisation systems, this will result in production of biochar rather than biosolids
  - no expansion of existing anaerobic digestion and no upgrade to waste gas burners
  - deletion of cogeneration unit.
- Rouse Hill WRRF
  - new dewatering and out-loading building to cater for sludge treatment
  - expansion of the construction footprint to include a compound site in 7 Money Close, Rouse Hill (5/-/DP1158760) and new access roads into the facility
  - ongoing use of part of existing biological nutrient removal (BNR) treatment and existing aerobic digester.
- Sludge transfer systems
  - deletion of both sludge transfer pipelines (Rouse Hill WRRF to Riverstone WRRF, and Castle Hill WRRF to Rouse Hill WRRF).

WSP Australia Pty Ltd (WSP) was appointed by Sydney Water to prepare this Air Quality Impact Assessment (AQIA) for Rouse Hill WRRF, to inform the REF Addendum, which will be assessed against under Part 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

Construction impacts are expected to be consistent with those previously assessed by Jacobs Group (Australia) Pty Ltd (Jacobs) for the REF (documented in *IS373500_NWH Growth Project_Rouse Hill_Air Quality_Final_rev0.docx*), and no additional assessment of construction impacts was required.

This assessment will supersede the operational impacts assessed in 2022 (Jacobs, 2022).

1.2 Scope of assessment

This AQIA was prepared in accordance with the NSW Environment protection Authority (EPA) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (Approved Methods). Following the level 2 assessment approach, this report details the following steps taken in the assessment:

- **Section 2 –** Identification of applicable legislation for the proposed upgrades
- **Section 3** – Description of the existing environment and review of baseline odour data.
- **Section 4** – Development of an emissions inventory for the proposed changes to the existing facility and original REF, using available information such as the Sydney Water odour emissions database, and data available from other facilities that have published monitoring data for equivalent processes.
- **Section 5** – Detailing specific assessment criteria for the Rouse Hill WRRF AQIA based on the legislation identified in Section 2.
- **Section 6 –** Air dispersion modelling, using (CALPUFF) to predict ground level concentrations for pollutants of interests at identified sensitive receptors.
- **Section 7** – Assessing air quality impacts by comparing modelling results against assessment criteria for each pollutant identified.

2 Legislation and policy context

The legislative considerations and advisory documents relevant to assessing air pollutants associated with the operation of the proposed Rouse Hill WRRF are discussed below.

2.1 Commonwealth legislation and policy

2.1.1 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.

While the NEPM[1] doesn't specifically address odours, it does set standards for various air pollutants to ensure adequate protection for the community.

2.2 NSW Legislation and policy

2.2.1 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 risks 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 on Plant (Other Than Domestic Plant): Similar to Section 124, this section focuses on maintenance work related to industrial plant (excluding domestic plant). It emphasizes 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 128: Standards of 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.

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1 National Environment Protection (Air Quality) Measure 2021 and National Environment Protection (Air Toxics) Measure 2011

2.2.2 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 New South Wales (NSW), Australia. It plays a crucial role in governing various aspects related to land use planning and development, including:

- Planning Administration: The EP&A Act establishes the framework for planning administration in NSW. It outlines the roles and responsibilities of planning authorities, councils, and other relevant bodies involved in land use planning.
- Development Assessments: The EP&A Act sets out the process for assessing development applications. It defines the criteria for determining whether a proposed development complies with planning regulations. The Act also covers integrated development assessments, which involve multiple approvals (e.g., planning and environmental approvals).
- Building Certification: Building regulation and certification provisions within the EP&A Act ensure the design, construction, and safety of buildings in NSW. These provisions work alongside the Building Professionals Act 2005 and the Home Building Act 1981.
- Infrastructure Finance: The Act addresses infrastructure financing related to development. It provides mechanisms for funding infrastructure projects required to support new developments.
- Appeals and Enforcement: The EP&A Act outlines the process for appealing decisions made by planning authorities. It also includes provisions for enforcement actions against non-compliance with planning regulations.

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

Division 5.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act) pertains to specific activities that may be undertaken without requiring formal development consent. These activities are often carried out by councils, government departments, or state agencies.

Certain projects, such as the Rouse Hill WRRF, fall under the category of “development permitted without consent.” These activities do not require formal approval. Many of these activities are permitted under the State Environmental Planning Policy (Transport and Infrastructure) 2021. Examples include essential infrastructure projects and other activities that contribute to public benefit.

Before work can commence, public authorities must assess the environmental impacts of a project. This assessment process is called a Review of Environmental Factors (REF). The Guidelines for Division 5.1 Assessment provide guidance on conducting REFs.

2.2.3 Approved methods for the modelling and assessment of air quality in NSW (2022)

Pursuant to the POEO Act, the Approved Methods for Modelling and Assessment of Air Quality in NSW 2022 (Approved Methods) prescribes the statutory methods for modelling and assessing air emission sources in NSW.

The Approved Methods establishes the criteria for evaluating the effects of complex odour combinations and recognises the community’s spectrum of odour sensitivities. This is implemented through a statistical strategy that varies with the population count. An increase in population density tends to raise the fraction of odour-sensitive individuals, signifying the need for stricter assessment criteria in such conditions (NSW EPA, 2022). The criteria relevant to this assessment are further discussed in Section 5.

3 Existing environment

3.1 Location

The Rouse Hill WRRF is located at South 307302 m East, 6272613 m South[2] on Mile End Road in Rouse Hill, New South Wales, approximately 35 km north-west (NW) of the Sydney city centre.

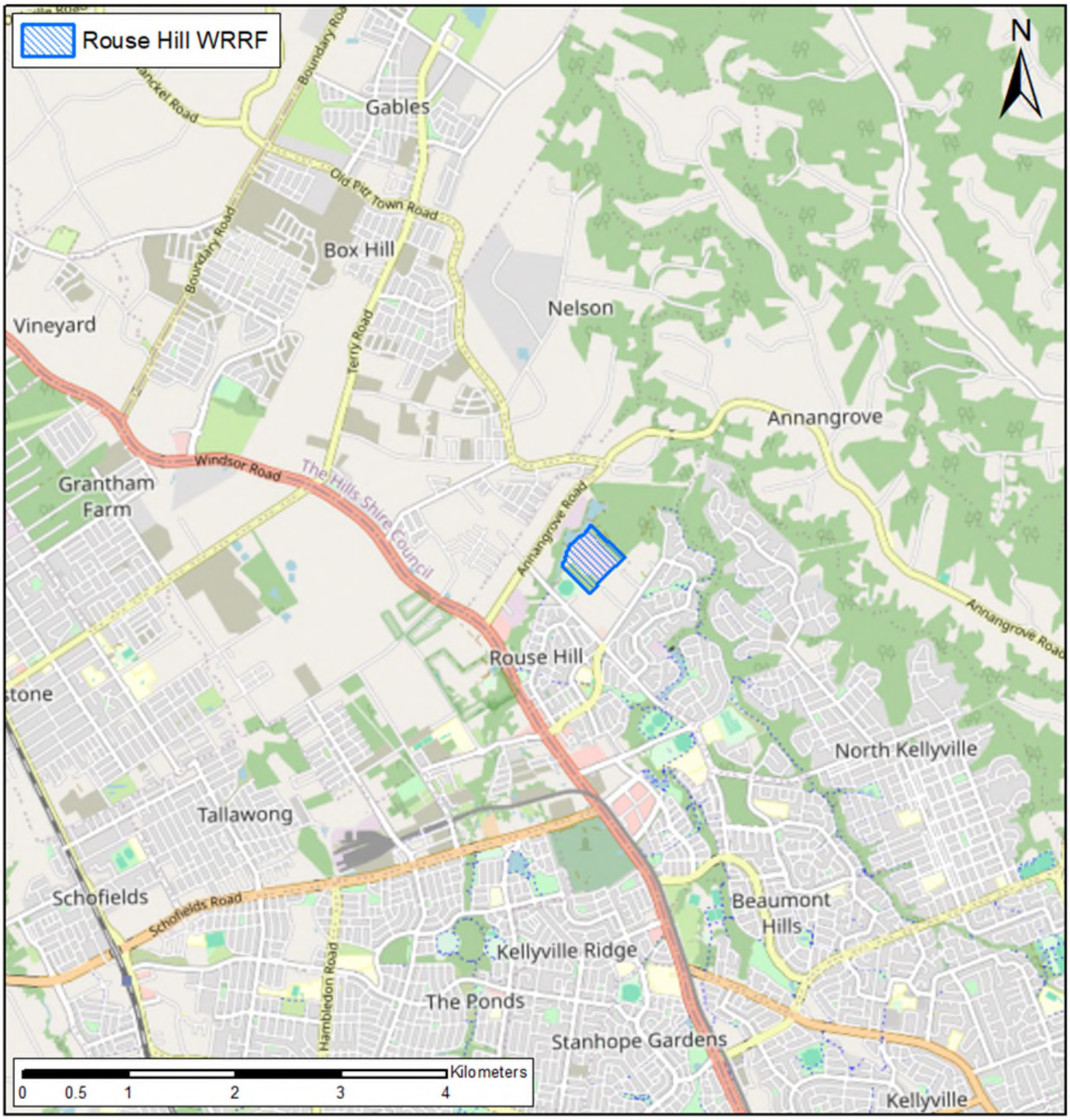

Figure 3.1 Location of the Rouse Hill WRRF

2 Universal Transverse Mercator (UTM) Zone 56

3.2 Sensitive receptors

The Approved Methods (NSW EPA, 2022) describes a sensitive receptor as '*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 receptor*.'

The sensitive receptors identified for this AQIA are summarised in Table 3.1. The location of these receptors in relation to the Rouse Hill WRRF is presented in Figure 3.2.

Table 3.1 Sensitive receptors

ID	Name	Type	X(m)	Y(m)
R01	Residences on Mile End Rd (Central)	Commercial	307954	6272456
R02	Baxter Basics Group Personal Training	Commercial	307509	6272428
R03	Secret Sofa Sydney Showroom	Commercial	307687	6272590
R04	Base 181 Studios	Commercial	307674	6272491
R05	Fit Kidz Learning Centre	Early Learning	307777	6272362
R06	Puddle Ducks Swim Academy	Early Learning	307663	6272303
R07	Rouse Hill Business Cafe	Commercial	307758	6272297
R08	Future Development	Commercial	307390	6272318
R09	Commercial Park (including gyms and retail)	Commercial	307272	6272112
R10	Russell Reserve	Recreational	307180	6272255
R11	Hills Self Storage	Commercial	307049	6272797
R12	Commercial Park (including gyms and retail)	Commercial	307182	6272860
R13	Rouse Hill Preschool Kindergarten	Early Learning	307111	6273016
R14	The Grove Dental	Commercial	307086	6272986
R15	Fire Station	Service	306997	6272274
R16	Residences on Mile End Rd (North)	Residential	308047	6272851
R17	Residences on Mile End Rd (South)	Residential	307685	6272060
R18	Residences on Mailey Cct	Residential	307030	6272132
R19	Residences on Rivergum Way	Residential	307257	6271891
R20	Residences on Outback St	Residential	306830	6273083
R21	Build IQ	Commercial	307640	6273340
R22	Residences on the corner of Rainforest St and Plateau Ave	Residential	306471	6272601
R23	Residences on Annangrove Rd	Residential	307325	6273358
R24	Residences on Annangrove Rd	Residential	307516	6273571

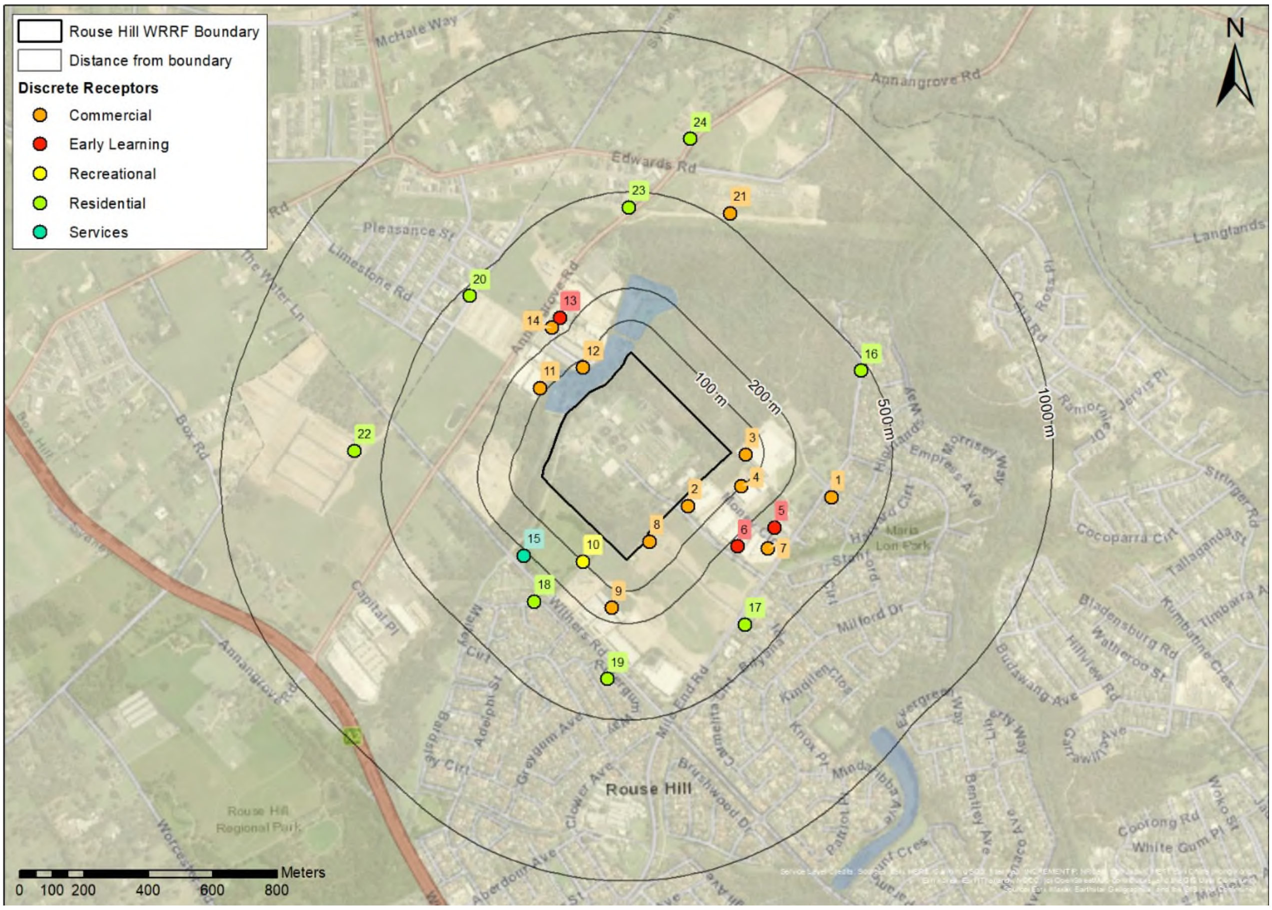

Figure 3.2 Sensitive receptors identified in the vicinity of the Rouse Hill WRRF

3.3 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. Historical meteorological data in the vicinity of the Project study area was reviewed in this section to demonstrate the existing local meteorological conditions.

Meteorological monitoring is not carried out at the plant, however the DPIE commenced operation of a meteorological station at Rouse Hill, 2 km to the southwest of the plant, in mid-2019. Based on the topography and proximity of this station to the plant, this station would be classified as "site-representative" under the *Approved Methods* terminology.

Table 3.2 summarises the climatology between 2019 and 2023 at Rouse Hill meteorological station.

Table 3.2 Summary statistics of the climate at Rouse Hill AQMS for 2019-2023 by season

Parameter	Units	Summer (DJF)	Autumn (MAM)	Winter (JJA)	Spring (SON)
Max. Temp	°C	29.6	24.7	19.0	25.8
Min. Temp	°C	18.0	12.3	4.7	11.9
RH (9a m)	%	64.2	73.0	74.4	61.9
RH (3 pm)	%	85.7	90.2	92.7	85.1
Monthly Rainfall	mm	68.8	35.0	16.6	38.2
Days of rain	#	4	4	3	4
Wind Speed	m/s	5.3	5.0	4.6	5.6

3.3.1 Temperature

Figure 3.3 presents the mean temperature at Rouse Hill over a year. The area is characterised by cool to mild winters and warm summers, typical for the Sydney region. The mean maximum temperature is around 29.6 °C and 19 °C for summer and winter, respectively.

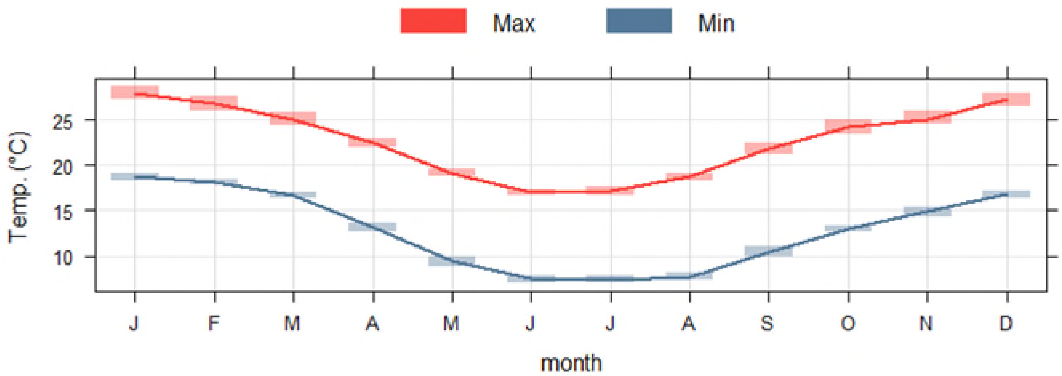

Figure 3.3 Mean monthly maximum and minimum temperature for 2019-2023 at Rouse Hill AQMS. The shaded bars indicate 95% confidence intervals.

3.3.2 Relative humidity

Figure 3.4 presents the mean monthly relative humidity (RH) at Rouse Hill and demonstrates the humid climate throughout the year, with the highest humidity observed in the Autumn months.

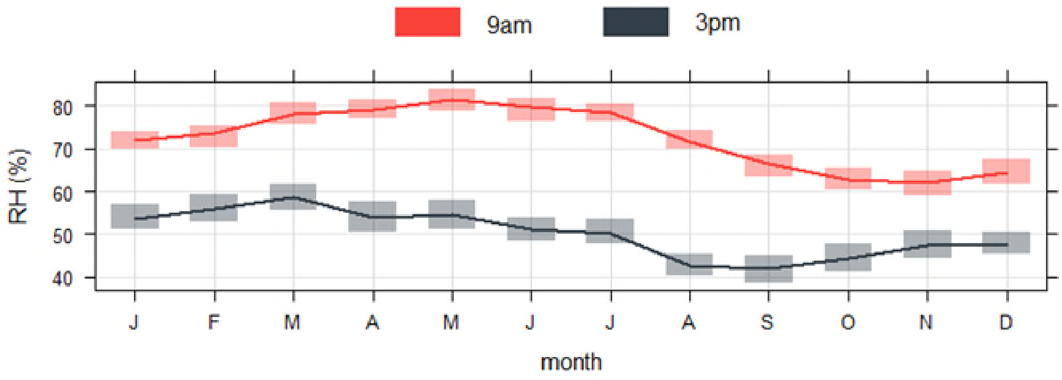

Figure 3.4 Mean monthly relative humidity for 2019-2023 at Rouse Hill AQMS. The shaded bars indicate 95% confidence intervals.

3.3.3 *Precipitation*

The mean monthly precipitation at Rouse Hill is presented in Figure 3.5. Typical of the region, the highest rainfall is during the summer to early spring. However, significant rain events are also observed during the winter period (Figure 3.6).

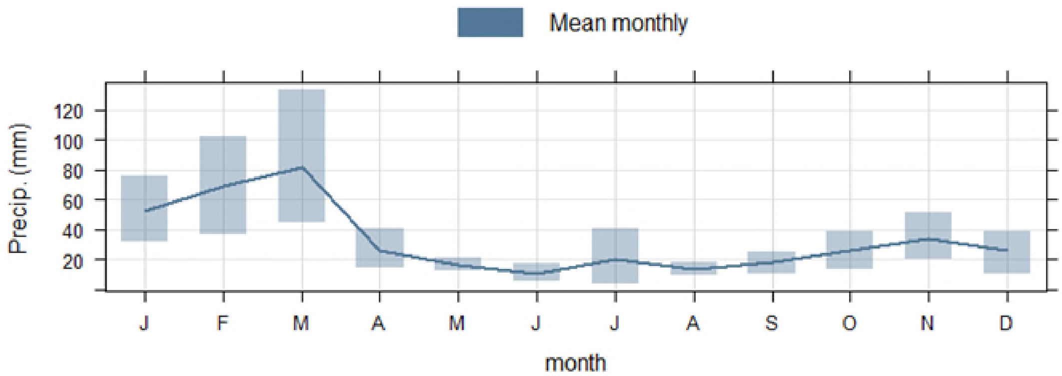

Figure 3.5 Mean monthly precipitation (mm) for 2019-2023 at Rouse Hill AQMS. The shaded bars indicate 95% confidence intervals.

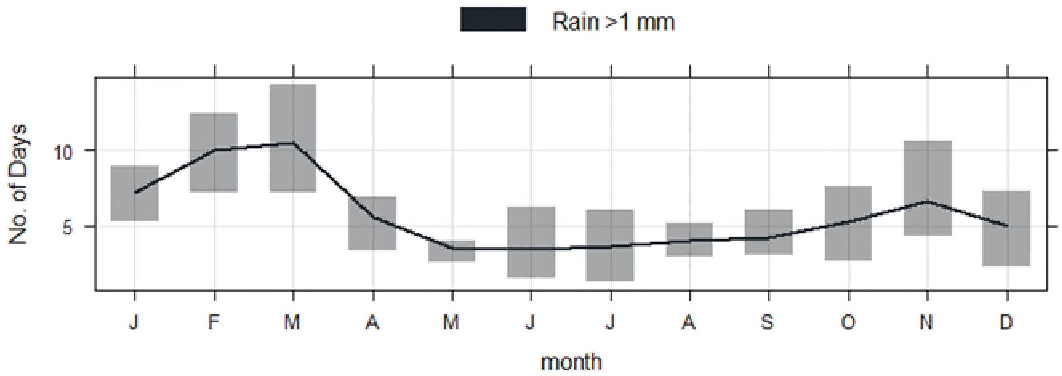

Figure 3.6 Mean number of days per month when rainfall was greater than 1 mm for 2019-2023 at Rouse Hill AQMS. The shaded bars indicate 95% confidence intervals.

3.3.4 Winds

Wind rose plots for each season between 2019 and 2023 are shown in for Rouse Hill. Figure 3.7 indicates that the predominant wind direction is from the north for all seasons. Figure 3.8 indicates lower wind speeds are typically observed in the winter and autumn. The highest wind speeds are observed from the southwest during spring and summer.

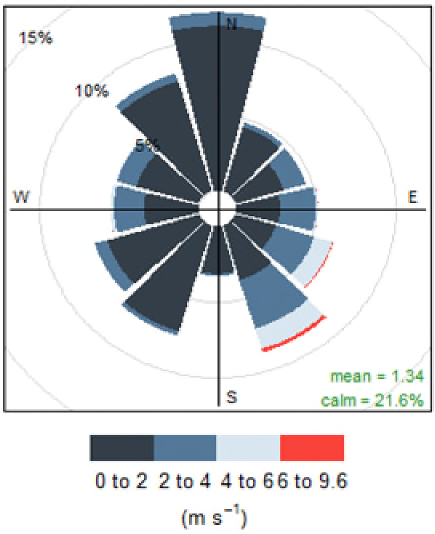

Figure 3.7 Annual average wind rose plot for 2019 to 2023 for Rouse Hill.

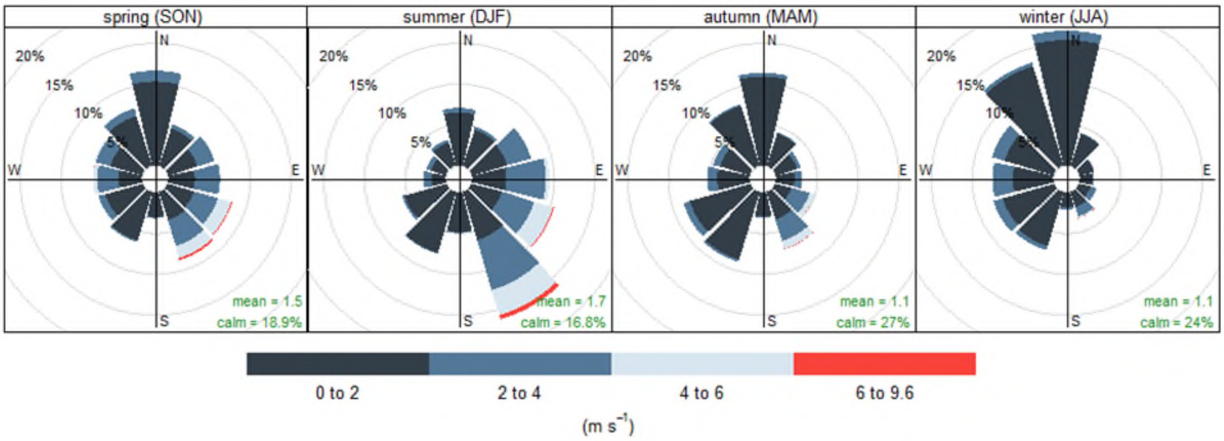

Figure 3.8 Seasonal average wind rose plot for 2019 to 2023 for Rouse Hill.

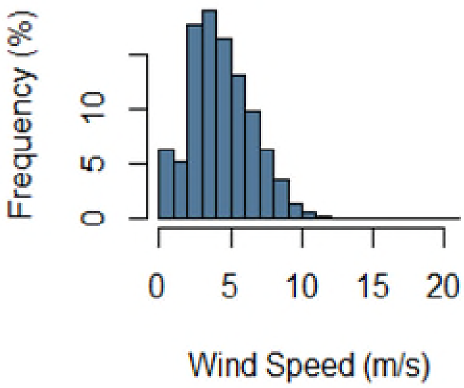

Figure 3.9 Histogram of wind speed frequencies at Rouse Hill during 2019-2023.

3.4 Existing ambient air quality

3.4.1 Existing "baseline" REF scenario

The approved REF project conditions were previously assessed by Jacobs Group (Australia) Pty Ltd (Jacobs) (document reference: *IS373500_NWH Growth Project_Rouse Hill_Air Quality_Final_rev0.docx*). This was considered the existing scenario and included the following sources of potential impacts to air quality.

Table 3.3 Baseline scenario emission sources (Jacobs, 2022)

Source	Type	Area	Height	Stack diameter	Base elevation	Temperature	Velocity	Air flow	Odour concentration	Soer	Toer
		m^2	M	M	M	K	M/S	M^3/S	OU	$OU.M^3/M^2/S$	$OU.M^3/S$
Existing OCU	Point	-	6	1.25	49	293	10.5	12.9	389	-	5032
Bioreactor	Area	2416	0	-	47	-	-	-	1009	0.39	942
Sludge Averaging Tank	Area	196	0	-	40	-	-	-	52	0.02	4
Aerobic digestor	Area	1660	0	-	47	-	-	-	121	0.08	133
Selector	Area	260	0	-	49	-	-	-	1235	0.48	124
MBR – aerating	Area	2138	0	-	46	-	-	-	789	0.3	652
MBR – decanting	Area	948	0	-	48	-	-	-	287	0.11	105
ISAL 0 settling	Area	924	0	-	49	-	-	-	266	0.1	95
Catch Pond	Area	1300	0	-	43	-	-	-	294	0.11	140
Clarifier 1	Area	729	1	-	40	-	-	-	267	0.15	109
Clarifier 2	Area	729	1	-	41	-	-	-	267	0.15	109
Clarifier 3	Area	729	1	-	41	-	-	-	267	0.15	109
Dewatering Plant	Volume	-	3	-	39	-	-	0.321	2147	-	690
SP1139 OCU	Point	-	6	0.16	37	293	15	0.3	200	-	60
Sludge Balance Tank OCU	Point	-	3	0.29	39	293	15	0.975	250	-	244

The Jacobs, 2022 report noted *"historically, there has been up to 8 complaints in a one year period (2012/13) however there have not been any complaints in the past three years (i.e. from 2017/18 to 2019/20)"*. In the period of time between the Jacobs, 2022 report and this assessment two odour complaints have been received. Both complaints were from commercial properties on Money Close immediately adjacent to the WRRF.

The results of the modelling exercise showed that the 2 OU contours did not encroach on any private sensitive receptors or residential areas in the baseline scenario (Figure 3.10). The 2 OU contour did extend into workplaces and commercial developments along Money Close on the south-eastern boundary of the plant. It was estimated that the occupancy of these developments would be no more than 125 people at any given time, therefore a criterion of 4 OU was applied for that population. The 4 OU criterion extended approximately 50 m from the plant boundary and was not predicted to impact the adjacent workplaces (Jacobs, 2022).

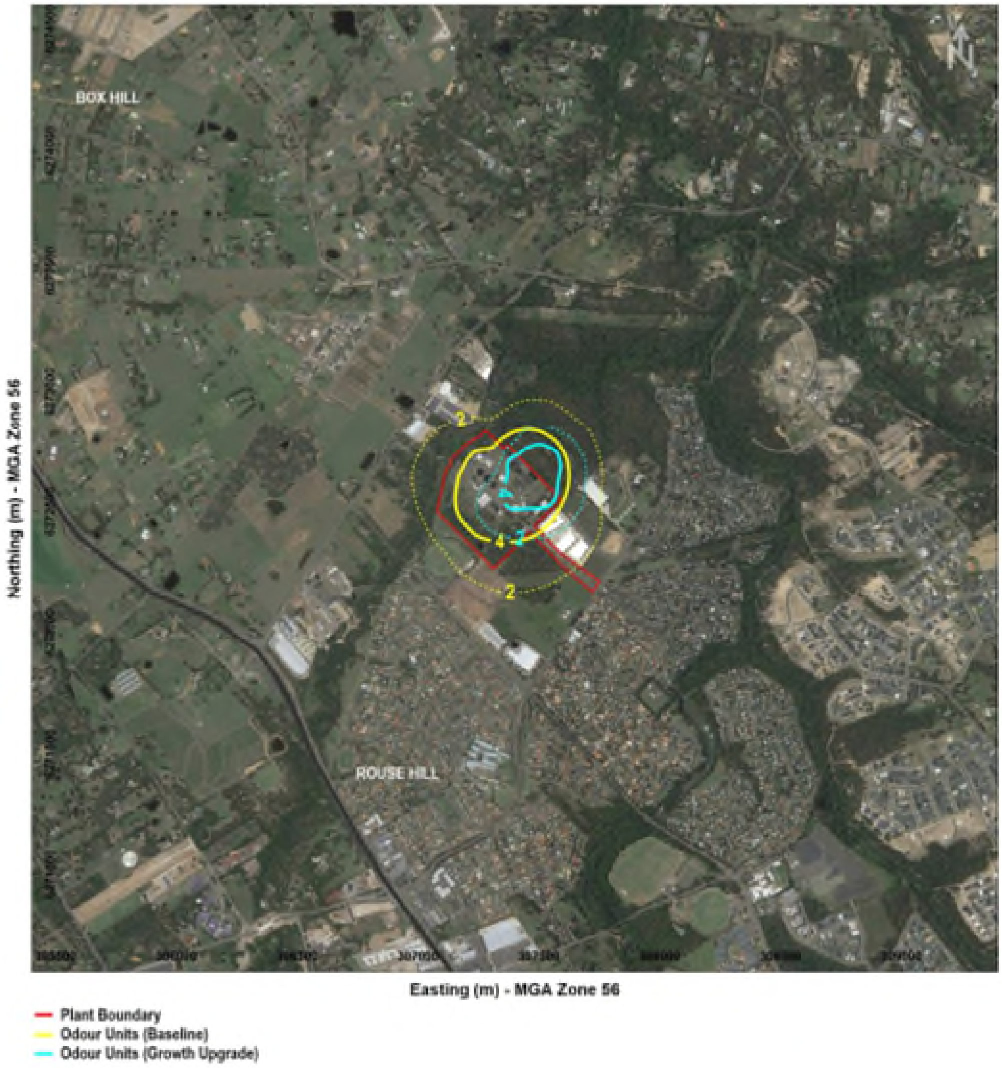

Figure 3.10 Baseline “existing” odour modelling results, from (Jacobs, 2022)

4 Emissions inventory

4.1 Odour emissions

Odours in domestic wastewater treatment plants primarily result from the decomposition of organic matter. During the anaerobic decomposition process, various chemical compounds are released, contributing to the unpleasant smells. Some key compounds include:

- Hydrogen Sulphide (H_2S): This compound is a natural byproduct produced during the breakdown of biosolids. It's often associated with the characteristic "rotten egg" smell.
- Ammonia (NH_4): Ammonia is another volatile compound emitted during wastewater treatment. It has a pungent odour.
- Mercaptans and Amines: These organic compounds containing nitrogen and sulphur emit strong odours detectable even at low concentrations1.
- Other Volatile Organic Compounds (VOCs): These contribute to the overall odour mixture.

The Rouse Hill WRRF sources modelled under the "growth" scenario are shown in Figure 4.1. These sources include:

- The existing (previously modelled):
  - Bioreactor (BIOR)
  - Sludge Averaging Tank (SLUD)
  - Aerobic digestor (AEROB)
  - Clarifier 1 (CLAR1)
  - Clarifier 2 (CLAR2)
  - Clarifier 3 (CLAR3)
  - SP1139 Odour Control Unit (SP1139OCU)
- The proposed:
  - Inlet Works (compliance) (IW-C) and Odour Control Facility (compliance) (OCF2-C)
  - Upgraded Dewatering Plant (DWP), including:
    - Sludge silo 1 (SS1)
    - Sludge silo 2 (SS2)
    - Out-loading Bay (OUT)
    - Out-loading odour control unit (OUTOCU)
  - MBRS and associated infrastructure:
    - MBR 1 – anoxic (MBR1_X)
    - MBR 1 – aerobic (MBR1_B)
    - MBR 2 – anoxic (MBR2_X)
    - MBR 2 – aerobic (MBR2_B)
    - MBR 3 – anoxic (MBR3_X)

- MBR 3 – aerobic (MBR3_B)
- MBR 4 – anoxic (MBR4_X)
- MBR 4 – aerobic (MBR4_B)
- Equalisation Basin (EQB)
- De-aeration 1 (DAER1)
- De-aeration 2 (DAER2)
- Feed Channel (Raw Sewage) (FC)

- Secondary Anoxic Tank (ANOX)
- Aerated Membrane Trains (MBR)
- MBR RAS Channel (RAS)

In order to maintain consistency with the REF, this assessment adopts the approved REF odour emissions previously compiled by Jacobs Group (Australia) Pty Ltd (Jacobs) (document reference: *IS373500_NWH Growth Project_Rouse Hill_Air Quality_Final_rev0.docx*) for the existing sources.

The odour emissions inventory (Table 3.3) compiled by Jacobs (2022) referenced the extensive Sydney Water odour emissions database which provides odour emissions data for all key wastewater treatment processes at almost all plants in their network. Emission data were derived from historical site reviews and sampling programs and were measured using dynamic olfactometry according to the "Australian/New Zealand Standard: Stationary source emissions – Part 3: Determination of odour concentration by dynamic olfactometry (AS/NZS4323.3:2001).

Note: The intention of the (Jacobs , 2022) *inventory was to capture the most significant emission sources that may influence off-site odour. Not every source was captured. It is possible that there were other sources of odour, such as leaks from covers and maintenance activities including cleaning that were not captured. These potential sources were not expected to be significant enough to change odour impact outcomes.*

The following sources were referenced in the development of the emissions inventory for the proposed new and upgraded sources:

1. Data available from the site operations.
2. Data from Sydney Water and contractors associated with the NWTH Growth Project
3. Data from the REF
4. The Sydney Water odour emissions database
5. Data from similar facilities within the Sydney Water network.

Emissions source parameters, odour emissions rates, data sources and assumptions are provided in Table 4.1.

Emissions from the key odour generating sources, such as the inlet works, drying plant and out-loading bay, will be covered and ducted to the proposed odour control facilities, where it will be treated and exhausted via a stack. This arrangement is consistent with best practice for odour management at wastewater treatment plants.

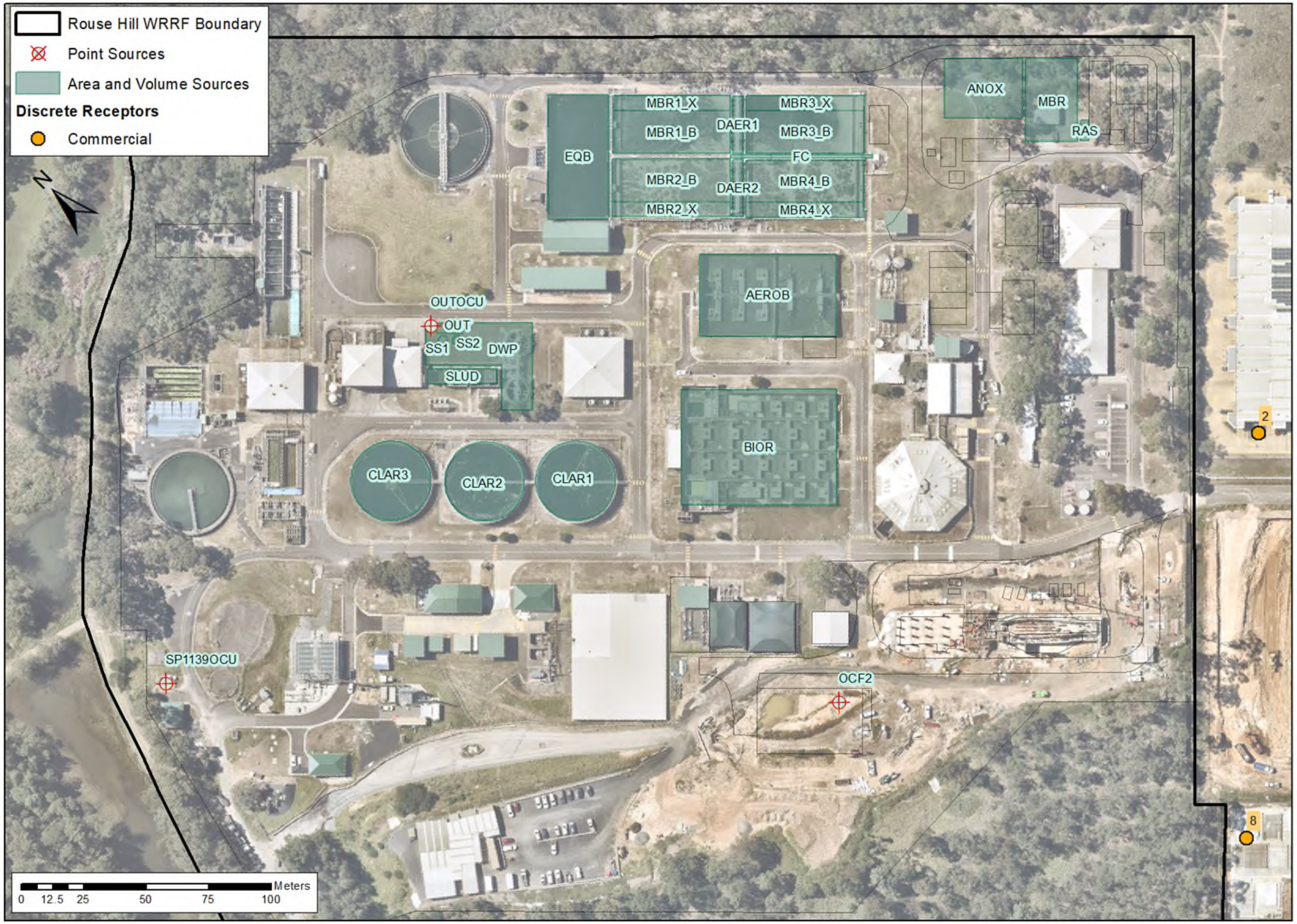

Figure 4.1 Rouse Hill WRRF "Growth" layout

Table 4.1 Emissions source rates and parameters for the "Growth" phase of the Rouse Hill WRRF

Source	Ref.	Type	Hours	Length	Width	Area	Height	Volume	Stack diameter	Temperature	Velocity	Flow rate	Concentration	Soer	Toer	Notes	Reference
				m	m	m^2	m	m^3	m	k	m/s	m^3/s	OU	$ou.m^3/m^2/s$	$ou.m^3/s$		
Bioreactor	BIOR	Area	24/7	40	60	2400	0	-	-	-	-	-	1009	0.39	942	Existing Stage 1 bioreactor retained	REF AQIA (Jacobs, 2022)
Sludge Averaging Tank	SLUD	Area	24/7	7	28	196	0	-	-	-	-	-	52	0.02	4	Existing Digested sludge holding tank retained	
Aerobic digestor	AEROB	Area	24/7	34	48	1632	0	-	-	-	-	-	121	0.08	133	Existing aerobic digester retained	
Clarifier 1	CLAR1	Area	24/7	-	-	804.2	1	-	-	-	-	-	267	0.15	109	Existing Stage 1 BNR clarifier retained	
Clarifier 2	CLAR2	Area	24/7	-	-	804.2	1	-	-	-	-	-	267	0.15	109		
Clarifier 3	CLAR3	Area	24/7	-	-	804.2	1	-	-	-	-	-	267	0.15	109		
SP1139 OCU	SP1139OCU	Point	24/7	-	-	-	6	-	0.16	293	15	0.3	200		60	Stack discharge for the pump station SPS1189	
Inlet Works (compliance)	IW-C	N/A	24/7	-	-	-	-	-	-	-	-	-	-	-	-	Covered and controlled. Emissions are assumed to be 0 as per the REF.	
OCF2 (compliance)	OCF2-C	Point	24/7	-	-	-	15		1	293	14.1	11.11	500		5556	Compliance Inlet Works Odour Control	(Jacobs, 2022)
Dewatering Plant	DWP	Volume	24/7	30	30	900	20	18000	-	293	-	-	-	305.8	-	Based on the Riverstone Odour Assessment It is assumed: A 95% capture rate is applied to the out-loading bay Out-loading will take place between 7:30 am – 3:30 pm	(Stantec, 2019)
Sludge silo 1	SS1	Volume	24/7	-	-	3.7	3.6	13.32	-	-	-	-	-	3.6	48		
Sludge silo 2	SS2	Volume	24/7	-	-	3.7	3.6	13.32	-	-	-	-	-	3.6	48		
Out-loading Bay	OUT	Volume	8 hours	3	4	12	3	36	-	293	-	-	-	15.00	540		
Out-loading OCU	OUTOCU	Point	2 hrs/day	-	-	-	23	-	0.5	293	15	3.1	500	-	1528	Proposed design parameters and provided by Sydney Water and Stantec It is assumed this will operate from 10:00 am – 12:00 pm	
MBR 1 – Anoxic	MBR1_X	Area	24/7	42	8	330	4	-	-	293	-	-	-	0.34	112	Converted MBR layout provided by Sydney Water and Stantec Rouse Hill Anoxic and Aerobic Reactor SOERs from the Sydney Water Odour Database	Sydney Water Odour Database
MBR 1 – Aerobic	MBR1_B	Area	24/7	42	16	656	4	-	-	293	-	-	-	0.16	102		
MBR 2 – Anoxic	MBR2_X	Area	24/7	42	8	330	4	-	-	293	-	-	-	0.34	112		
MBR 2 – Aerobic	MBR2_B	Area	24/7	42	16	656	4	-	-	293	-	-	-	0.16	102		
MBR 3 – Anoxic	MBR3_X	Area	24/7	42	8	330	4	-	-	293	-	-	-	0.34	112		
MBR 3 – Aerobic	MBR3_B	Area	24/7	42	16	656	4	-	-	293	-	-	-	0.16	102		
MBR 4 – Anoxic	MBR4_X	Area	24/7	42	8	330	4	-	-	293	-	-	-	0.34	112		
MBR 4 – Aerobic	MBR4_B	Area	24/7	42	16	656	4	-	-	293	-	-	-	0.16	102		
Equalisation basin	EQB	N/A	-	-	-	-	-	-	-	-	-	-	-	-	-	It is assumed, based on information received from Sydney Water, that Equalisation Basin will be bypassed	
De-aeration 1	DAER1	Area	24/7	23.75	3.82	90.7	4	-	-	293	-	-	-	2.73	248	Converted MBR layout provided by Sydney Water and Stantec. Rouse Hill Anerobic Reactor SOER from the Sydney Water Odour Database	Sydney Water Odour Database
De-aeration 2	DAER2	Area	24/7	23.75	3.82	90.7	4	-	-	293	-	-	-	2.73	248		
Feed Channel (Raw Sewage)	FC	Area	24/7	54	2	108	4	-	-	293	-	-	-	1.96	212	Average taken of the Warriewood, Shellharbour, West Hornsby and West Camden SOER for Settled Sewage Channel	Sydney Water Odour Database

Source	Ref.	Type	Hours	Length	Width	Area	Height	Volume	Stack diameter	Temperature	Velocity	Flow rate	Concentration	Soer	Toer	Notes	Reference
				m	m	m^2	m	m^3	m	k	m/s	m_3/s	OU	ou.m^3/m^2/s	ou.m^3/s		
Secondary Anoxic Tank	ANOX	Area	24/7	33.7	21.1	711.0	3	-	-	293	-	-	-	0.34	245	Secondary Anoxic/MBR Layout provided by Sydney Water and Stantec. Rouse Hill Anoxic Reactor SOER from the Sydney Water Odour Database	Sydney Water Odour Database
Aerated Membrane Trains	MBR	Area	24/7	25.6	17.3	442.9	3	-	-	293	-	-	-	0.22	99	Secondary Anoxic/MBR Layout provided by Sydney Water and Stantec. Average taken of the Riverstone and Castle Hill Aeration Tank SOER from the Sydney Water Odour Database	Sydney Water Odour Database
MBR RAS Channel	RAS	Area	24/7	6.05	2.5	15.2	3	-	-	293	-	-	-	0.39	6	Secondary Anoxic/MBR Layout provided by Sydney Water and Stantec. Average taken of the Warriewood, Glenfield, Shellharbour, St Mary's and Luggage Point SOER for Settled Sewage Channel from the Sydney Water Odour Database	Sydney Water Odour Database

5 Assessment criteria

5.1 Odour assessment criteria

Table 5.1 provides a summary of appropriate impact assessment criteria for various population densities according to the *Approved Methods*. The odour criteria are prescribed in odour units, not to be exceeded more than 1% of the time, for different population densities. The criteria assume that 7 odour units at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a higher chance that sensitive individuals would be exposed. The criterion of 2 odour units at the 99th percentile is considered acceptable for the whole population.

A 2 OU criterion was adopted for all receptors identified in Section 3.2, except for the workplaces and commercial developments neighbouring the Rouse Hill WRRF, along Money Close. As per the REF AQIA (Jacobs, 2022), it is assumed that the occupancy of these developments will not exceed 125 people at any one time, and therefore the corresponding assessment criterion to be applied for this population is 4 OU.

Table 5.1 Odour assessment criteria (NSW EPA, 2022)

Population of affected community	Impact assessment criteria for complex mixtures of odorous air pollutants (OU)
Urban (≥2000) &/or schools and hospitals	2
~ 500	3
~ 125	4
~ 30	5
~ 10	6
Single rural residence (≤ ~ 2)	7

6 Dispersion modelling

The CALPUFF dispersion model (Version 7.2.1) was used to predict the ground level concentrations (GLCs) of all identified pollutants based on a year-long period (2020) of hourly meteorological data.

CALPUFF is an advanced, integrated Gaussian puff modelling system for the prediction of atmospheric pollution dispersion. The model has been accepted by the United States Environmental Protection Agency (USEPA) in its Guideline on Air Quality Models as a preferred model for i) assessing long range transport of pollutants and ii) on a case-by case basis for certain near-field applications involving complex meteorological conditions.

The modelling system consists of three main components: CALMET (a diagnostic 3-dimensional meteorological model), CALPUFF (the air quality dispersion model), and CALPOST (a post-processing package).

The following sections describe the model development process and the inputs used in the construction of the model.

6.1 Meteorology

In order to maintain consistency with the REF, meteorological data was sourced from the same meteorological station (Rouse Hill) for the same year (2020) as the 2022 Rouse Hill AQIA (Jacobs , 2022). The data was processed using the same methodology described in the 2022 Rouse Hill AQIA as far as practicable. The following sections describe this process.

6.1.1 The Air Pollution Model (TAPM)

In the absence of a full suite of site-specific meteorological data, The Air Pollution Model (TAPM) was used to generate meteorological files. The meteorological component of TAPM is an incompressible, optionally non-hydrostatic, primitive equation model with a terrain-following vertical co-ordinate for three-dimensional simulations. The model is connected to databases containing terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic scale meteorological analysis for various regions around the world.

TAPM (Version 4.0.5) was run in accordance with the requirements from the Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, 2016 (Barklay & Scire, 2016), using the following parameters (Table 6.1):

Table 6.1 TAPM Configuration

Parameter	TAPM configuration
Model version	4.0.5
Reference point (Centre)	UTM Zone 56H 305336 m E 6270975 m S
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grid points	35 x 35 x 25
Vertical levels	25 (10 m, 25 m, 50 m, 100 m, 150 m, 200 m, 250 m, 300 m, 400 m, 500 m, 600 m, 750 m, 1000 m, 1250 m, 1500 m, 1750 m, 2000 m, 2500 m, 3000 m, 3500 m, 4000 m, 5000 m, 6000 m, 7000 m and 8000 m)
Year(s) of analysis)	2020
Terrain data source	STRM 30 m
Land use data source	Default

Parameter	TAPM configuration
Observation file for wind speed and wind direction assimilation	Rouse Hill met station (2020)
Radius of influence	15 km (4 vertical levels for assimilation)

The prognostic TAPM data covered a domain of 50 km x 50 km centred on the Project Site, at a resolution of 1 km x 1 km grid. CALTAPM was used to convert the TAPM prognostic hourly meteorological data outputs into CALMET inputs.

6.1.2 CALMET

CALMET is a meteorological model which includes a diagnostic wind field generator. It accounts for the treatment of slope flows and terrain effects, such as blocking and the micrometeorological effects on overland and overwater boundary layers. CALMET can be run using gridded data fields generated by models (such as the TAPM or WRF model), hourly observational data from weather stations, or a combination of the two. CALMET links to a database (http://www.webgis.com), which accesses both terrain (SRTM1) and land use files specific to the study area being modelled.

The prognostic hourly meteorological outputs from TAPM for 2020 were input to CALMET as an initial guess wind field, which enabled higher resolution three-dimensional hourly wind and temperature fields to be generated over the modelled domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties were also included in the CALMET output file.

The diagnostic CALMET wind field was modelled at a resolution of 100 m over a 10 km x 10 km grid. A total of 10 vertical cells (layers) were modelled within the grid, ranging from ground level to 3 km. Most these cells were within the bottom 1 km of the atmosphere to provide better coverage of boundary layer circulations, within which dispersion of pollutants from low-level sources would occur. The output of the diagnostic data was in a format suitable for input to the CALPUFF atmospheric dispersion model.

Table 6.2 CALMET configuration parameters

CALMET	Configuration
Model version	7.2.1
Met data option	Hybrid
Simulation length	8784 hours
Grid domain	20 km x 20 km
Grid resolution	200 m
Year(s) of analysis)	2020
Surface meteorological station	Rouse Hill AQMS
Upper air data	Derived from TAPM (biased towards surface observations: -1, -0.8, -0.6, -0.4, -0.2, 0, 0, 0)
Terrain data source	STRM 30 m
Land use data source	Default
R1, R2	0.5, 1
RMAX1, RMAX2	5, 20
TERRAD	5

6.1.3 Site specific environment

6.1.3.1 Wind roses

Site-specific wind direction and wind speed data were extracted from CALMET for 2020. Annual and seasonal wind roses are presented in Figure 6.1 and Figure 6.2, respectively. Figure 6.1 indicates that the predominant wind direction is from the northeast and southeast for all seasons. Figure 6.2 indicates that there was seasonal variability in both wind direction and speed. During spring, wind speeds were typically higher and from the northeast, while during the autumn/winter the wind speeds were typically lower and from the southeast.

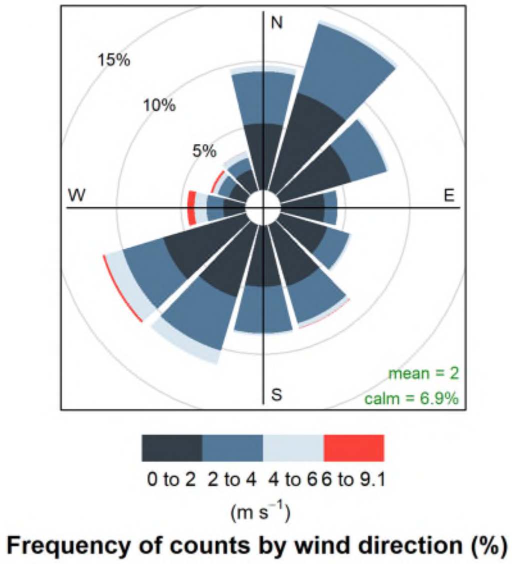

Figure 6.1 Annual average wind rose plot

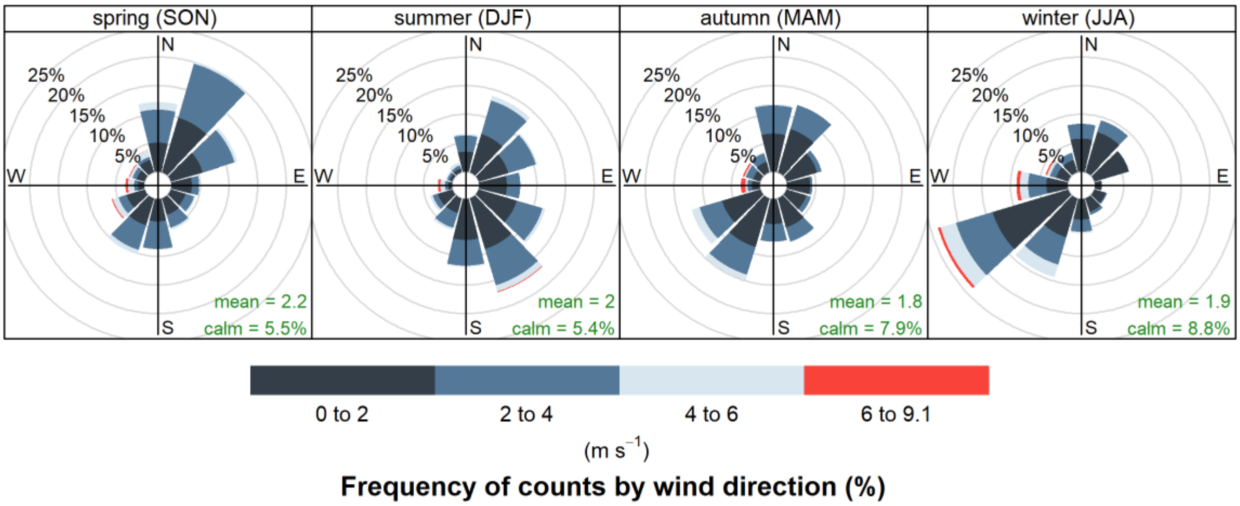

Figure 6.2 Seasonal average wind rose plots

6.1.3.2 Stability class

Stability categories are used as indicators of atmospheric turbulence and the dispersive properties of the atmosphere by Gaussian plume dispersion models. Higher stability of the atmosphere typically results in poor dispersion conditions and higher ground level concentrations, whilst unstable atmospheres typically have the opposite impact.

Stability classes described by Pasquill-Gifford are presented in Table 6.3. Usually, Class F and G are combined into one class, F.

Table 6.3 Atmospheric stability classes

Stability class	Category	Description
A	Very stable	Low winds, clear skies, hot daytime conditions
B	Unstable	Moderate winds, clear skies, daytime conditions
C	Slightly unstable	Moderate winds, slightly overcast daytime conditions
D	Neutral	High winds or cloudy days and nights
E	Slightly stable	Moderate winds, slightly overcast night-time conditions
F	Stable	Low winds, clear skies, cold night-time conditions
G	Very stable	

Figure 6.3 and Figure 6.4 show the predicted frequency of stability classes at the Rouse Hill WRRF site.

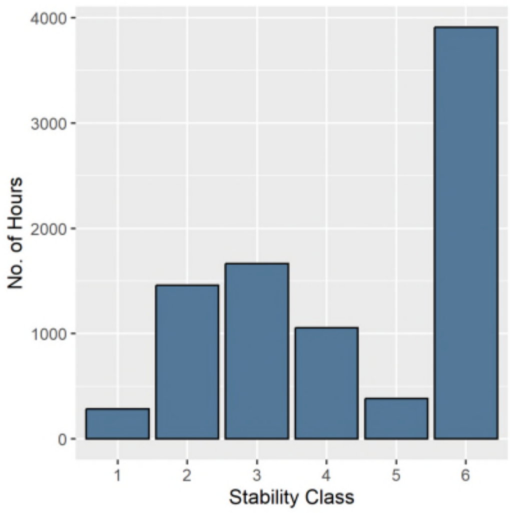

Figure 6.3 Annual frequency of stability classes.

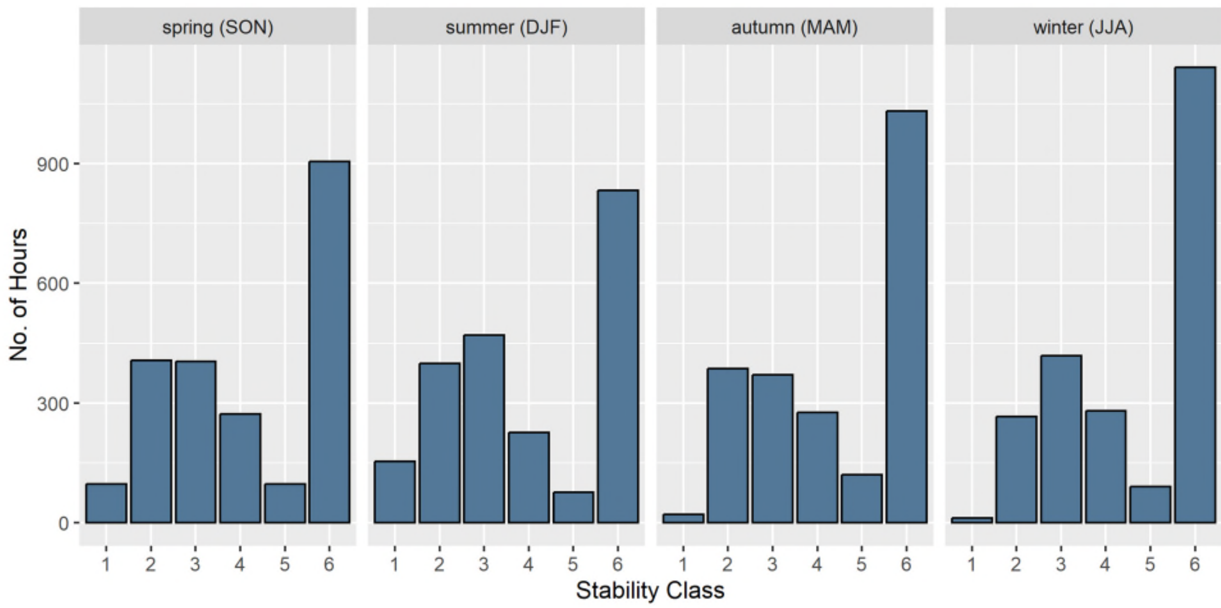

Figure 6.4 Seasonal frequency of stability classes

6.2 CALPUFF Dispersion modelling

A summary of the CALPUFF configuration parameters for the Project is presented in Table 6.4.

CALPUFF is a transport and dispersion model that advects "puffs" of a given material/gaseous species emitted from modelled sources, in turn simulating dispersion and transformation processed within the atmosphere as dictated by the CALMET-generated meteorological fields. The model produces hourly concentration outputs at discrete and/or gridded receptors, generated by the model user, which are subsequently processed (using CALPOST) and converted into tabulated concentration results equivalent to the required averaging time.

Table 6.4 CALPUFF configuration parameters

Parameter	Value
Depletion options	Concentration and deposition
Exponential decay	None
Dispersion coefficient	Micrometeorology
Terrain included	Yes (30 m grid spacing)
Map projection	UTM Zone 56S
Meteorological Grid	5 km x 5 km
Computational Grid	20 km x 20 km
Modelled year	2020
Discrete receptors	See Sensitive Receptors (Section 3.2)
Gridded receptors	500 m from centre: 20 m spacing 1000 m from centre: 30 m spacing 1500 m from centre: 100 m spacing 3000 m from centre: 250 m spacing 4000 m from centre: 500 m spacing Total: 7165 receptors
Output type	Odour units (OU)

6.2.1 Modelling scenarios

One "Growth" scenarios for the Rouse Hill WRRF was modelled according to the emissions parameters and assumptions listed in Section 4.1.

6.2.2 Treatment of terrain and land use data

To represent the influence of terrain elevations in the dispersion of pollutants, a digital elevation file was used in CALPUFF, based on Shuttle Radar Topography Mission (SRTM1) data with a resolution of 30 m (Figure 6.5). For both the modelled discrete receptors and grid points, the recommended Lakes Inverse Distance interpolation was used. This function interpolates the neighbouring points using inverse distance to obtain the elevation at the desired point.

Global Land Cover Characterisation (GLCC) data were obtained from CALPUFF's database (http://www.webgis.com) for the modelled area at a resolution of 1 km.

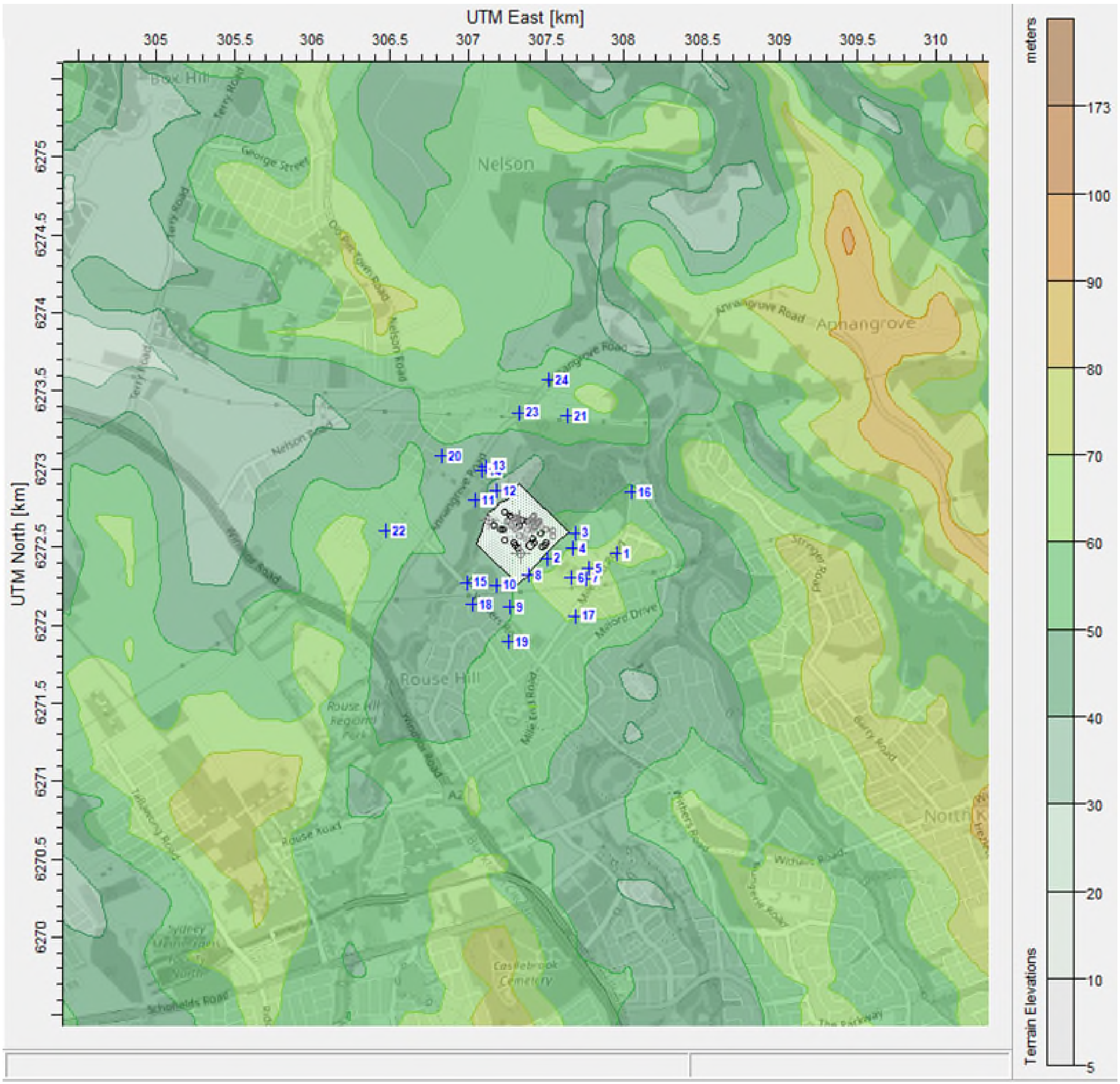

Figure 6.5 Shuttle Radar Topography Mission (SRTM1) data used in the Rouse Hill WRRF model.

6.2.3 Building downwash

The Building Profile Input Program-Plume Rise Model Enhancements (BPIP-PRIME) downwash module within CALPUFF accounts of the influence of buildings and structures that may influence the dispersion of air emissions, through entering the heights and corner locations of buildings and infrastructure in the vicinity.

The following data was included in the BPIP-PRIME (Table 6.5):

Table 6.5 Buildings and structures included in the model

ID	Base elevation	Height	Diameter	X length	Y length	Rotation angle	X1	Y1
	[m]	[m]	[m]	[m]	[m]	(deg)	[m]	[m]
BLD_1	47.4	8.0	-	13.4	26.0	44.5	307380.4	6272663.8
BLD_2	44.9	8.0	-	32.3	13.7	313.1	307342.3	6272675.0
BLD_3	43.9	8.0	-	24.2	22.9	314.4	307325.0	6272635.9
BLD_4	39.5	16.0	-	14.9	18.3	314.1	307267.1	6272701.2
BLD_5	39.8	10.0	-	14.2	15.7	316.4	307278.3	6272689.5
BLD_6	39.5	10.0	-	22.7	18.2	315.0	307233.7	6272723.5
BLD_7	41.0	8.0	-	18.2	17.7	315.0	307169.3	6272634.8
BLD_8	41.7	8.0	-	40.2	9.5	314.3	307206.4	6272608.7
BLD_9	41.0	8.0	-	22.3	11.4	314.4	307224.4	6272615.4
BLD_10	45.3	8.0	-	37.5	50.5	314.1	307235.5	6272543.2
BLD_11	46.6	8.0	-	15.4	19.9	312.8	307293.1	6272525.0
BLD_12	46.9	8.0	-	17.5	20.4	313.9	307304.3	6272512.0
BLD_13	47.6	10.0	-	13.9	14.3	314.5	307323.6	6272495.1
BLD_14	51.2	14.0	35.6	-	-	-	307401.2	6272509.6
BLD_15	50.3	8.0	-	11.3	12.3	315.0	307415.6	6272551.2
BLD_16	51.1	10.0	-	17.3	21.0	314.2	307422.6	6272526.8
BLD_17	52.3	10.0	-	18.6	26.3	314.6	307470.6	6272500.5
BLD_18	53.6	10.0	-	24.5	24.4	313.9	307501.1	6272530.7
BLD_19	53.3	10.0	-	11.6	17.0	315.6	307494.3	6272513.6
BLD_20	50.5	6.0	-	8.3	9.0	315.0	307462.6	6272590.4

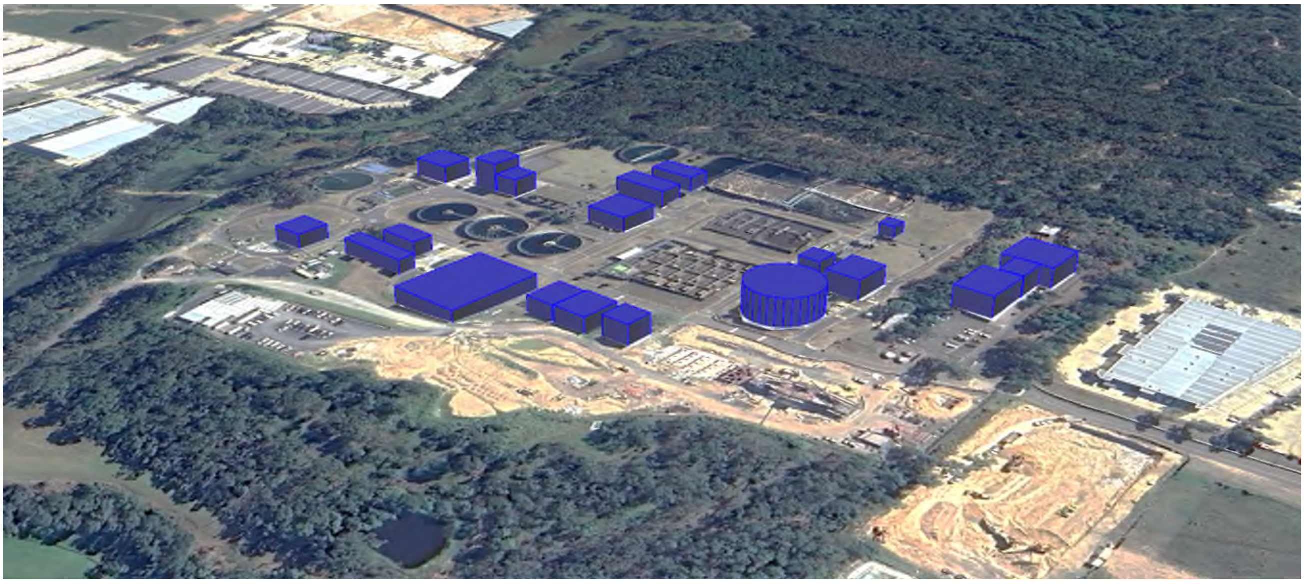

Figure 6.6 Modelled buildings at Rouse Hill (oblique view)

6.2.4 Peak-to-mean factors

The *NSW EPA Approved Methods* requires odour impacts to be evaluated on a nose-response-time average which is approximately one second. The odour emissions data have been multiplied by "peak-to-mean" factors to convert the model's one hour averaging time to a nose-response averaging time, as developed by Katestone Scientific (1995, 1998) and adopted by the NSW EPA.

The ratios presented in Table 6.6 were applied to the emission rates entered into the dispersion model.

Table 6.6 Peak-to-mean factors for each stability class

Source	Ref.	A	B	C	D	E	F
Bioreactor	BIOR	2.3	2.3	2.3	2.3	1.9	1.9
Sludge Averaging Tank	SLUD	2.3	2.3	2.3	2.3	1.9	1.9
Aerobic digestor	AEROB	2.3	2.3	2.3	2.3	1.9	1.9
Clarifier 1	CLAR1	2.3	2.3	2.3	2.3	1.9	1.9
Clarifier 2	CLAR2	2.3	2.3	2.3	2.3	1.9	1.9
Clarifier 3	CLAR3	2.3	2.3	2.3	2.3	1.9	1.9
SP1139 OCU	SP1139OCU	3	3	3	6	6	6
OCF2 (compliance)	OCF2-C	2.3	2.3	2.3	2.3	2.3	2.3
Dewatering Plant	DWP	2.3	2.3	2.3	2.3	2.3	2.3
Sludge silo 1	SS1	2.3	2.3	2.3	2.3	2.3	2.3
Sludge silo 2	SS2	2.3	2.3	2.3	2.3	2.3	2.3
Out-loading Bay	OUT	2.3	2.3	2.3	2.3	2.3	2.3
Out-loading OCU	OUTOCU	2.3	2.3	2.3	2.3	2.3	2.3
MBR 1 – ANOXIC	MBR1_X	2.3	2.3	2.3	2.3	1.9	1.9
MBR 1 – AEROBIC	MBR1_B	2.3	2.3	2.3	2.3	1.9	1.9

Source	Ref.	A	B	C	D	E	F
MBR 2 – ANOXIC	MBR2_X	2.3	2.3	2.3	2.3	1.9	1.9
MBR 2 – AEROBIC	MBR2_B	2.3	2.3	2.3	2.3	1.9	1.9
MBR 3 – ANOXIC	MBR3_X	2.3	2.3	2.3	2.3	1.9	1.9
MBR 3 – AEROBIC	MBR3_B	2.3	2.3	2.3	2.3	1.9	1.9
MBR 4 – ANOXIC	MBR4_X	2.3	2.3	2.3	2.3	1.9	1.9
MBR 4 – AEROBIC	MBR4_B	2.3	2.3	2.3	2.3	1.9	1.9
De-aeration 1	DAER1	2.3	2.3	2.3	2.3	1.9	1.9
De-aeration 2	DAER2	2.3	2.3	2.3	2.3	1.9	1.9
Feed Channel (Raw Sewage)	FC	2.3	2.3	2.3	2.3	1.9	1.9
Secondary Anoxic Tank	ANOX	2.3	2.3	2.3	2.3	1.9	1.9
Aerated Membrane Trains	MBR	2.3	2.3	2.3	2.3	1.9	1.9
MBR RAS Channel	RAS	2.3	2.3	2.3	2.3	1.9	1.9

6.3 Assumptions and limitations

6.3.1 Modelled emissions data

The following key assumptions were made in the development of the Rouse Hill WRRF emissions inventory and subsequent modelling exercise:

- Building heights were estimated based on Google Earth 3D building observations.
- Out-loading bay (OUT) odour emission capture rates are 95% or more.
- The out-loading bay (OUT) will operate for approximately 8 hours per day (from ~7:30 am – 3:30 pm).
- The equalisation basin (EQB) will be bypassed and will therefore no longer be a source of odour emissions.
- The Inlet Works (compliance) (IW-C) is covered, and odours are captured to the extent that it is not considered to be a source of emissions (as per the REF).
- The Feed Channel (FC) is uncovered.
- Emission sources are as described in Section 4.1.

6.3.2 Atmospheric dispersion modelling limitations

Atmospheric dispersion models are mathematical tools that link an emission source to a receptor, simulate the substance (gas or aerosol) behaviour, and predict its fate. They use differential equations that account for transport, turbulent diffusion, chemical transformation, and soil deposition (dry and wet) 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 source(s).

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

In general, models have difficulty in accurately predicting dispersion under light wind speeds (less than 1 m/s) due to the dominance of physical processes other than advection and or turbulent diffusion under such conditions. The inability to accurately predict the minimum mixing height is another limiting factor of dispersion modelling and is particularly important when dealing with low level, non-buoyant (or low buoyancy) emission sources.

Different metrics can be used to evaluate model performance such as maximum concentrations, frequency of exceedances, or temporal and spatial correlations. However, these metrics often disagree with each other, and a model may perform well in some aspects but poorly in others. It is therefore recommended that model performance be considered holistically, taking into account the quality and representativeness of the input data, the suitability and accuracy of the model for the application, and the errors and biases in the measured data.

7 Dispersion modelling results

7.1 Odour modelling

The 99th percentile predicted odour concentrations (OU) resulting from the Rouse Hill WRRF "Growth" phase are provided in Table 7.1. The assessment criteria are based on the population affected as stated in the *NSW EPA Approved Methods* (see Section 5.1).

There are no exceedances of the assessment criteria predicted. Odour concentrations at the neighbouring workplaces and commercial developments along Money Close (R02, R03, R04 and R08) range from 2.4 OU to 2.9 OU. GLCs at all remaining receptors, including commercial, early learning and residential receptors, are predicted to remain below 2 OU.

As presented in Figure 7.1, the 2 OU contour extends by approximately 200 m beyond the Rouse Hill WRRF boundary towards the north-east, into the bushland area surrounding Second Ponds Creek. The 4 OU contour is largely confined to the Rouse Hill WRRF, extending up to 70 m beyond the north-eastern boundary into the bushland area. Receptors Baxter Basics Group Personal Training (R02) and the Secret Sofa Sydney Showroom (R03), located approximately 30 m east of the Rouse Hill boundary, are 10 – 15 m outside the 3 OU contour.

Table 7.1 Predicted ground level odour concentrations at the receptor locations.

ID	Receptor	Type	Assessment criteria	Ou	Percentage of criteria
R01	Residences on Mile End Rd (Central)	Commercial	2	1.0	48%
R02	Baxter Basics Group Personal Training	Commercial	4	2.9	73%
R03	Secret Sofa Sydney Showroom	Commercial	4	2.8	69%
R04	Base 181 Studios	Commercial	4	2.4	61%
R05	Fit Kidz Learning Centre	Early Learning	2	1.4	69%
R06	Puddle Ducks Swim Academy	Early Learning	2	1.5	76%
R07	Rouse Hill Business Cafe	Commercial	2	1.3	66%
R08	Future Development	Commercial	4	2.7	67%
R09	Commercial Park (including gyms and retail)	Commercial	2	1.4	72%
R10	Russell Reserve	Recreational	2	1.8	88%
R11	Hills Self Storage	Commercial	2	1.6	78%
R12	Commercial Park (including gyms and retail)	Commercial	2	1.4	69%
R13	Rouse Hill Preschool Kindergarten	Early Learning	2	1.4	68%
R14	The Grove Dental	Commercial	2	1.3	66%
R15	Fire Station	Services	2	1.0	51%
R16	Residences on Mile End Rd (North)	Residential	2	1.0	52%
R17	Residences on Mile End Rd (South)	Residential	2	0.9	46%
R18	Residences on Mailey Cct	Residential	2	1.1	54%
R19	Residences on Rivergum Way	Residential	2	1.1	54%

ID	Receptor	Type	Assessment criteria	Ou	Percentage of criteria
R20	Residences on Outback St	Residential	2	1.0	48%
R21	Build IQ	Commercial	2	0.9	44%
R22	Residences on the corner of Rainforest St and Plateau Ave	Residential	2	0.7	36%
R23	Residences on Annangrove Rd	Residential	2	1.0	48%
R24	Residences on Annangrove Rd	Residential	2	0.6	32%

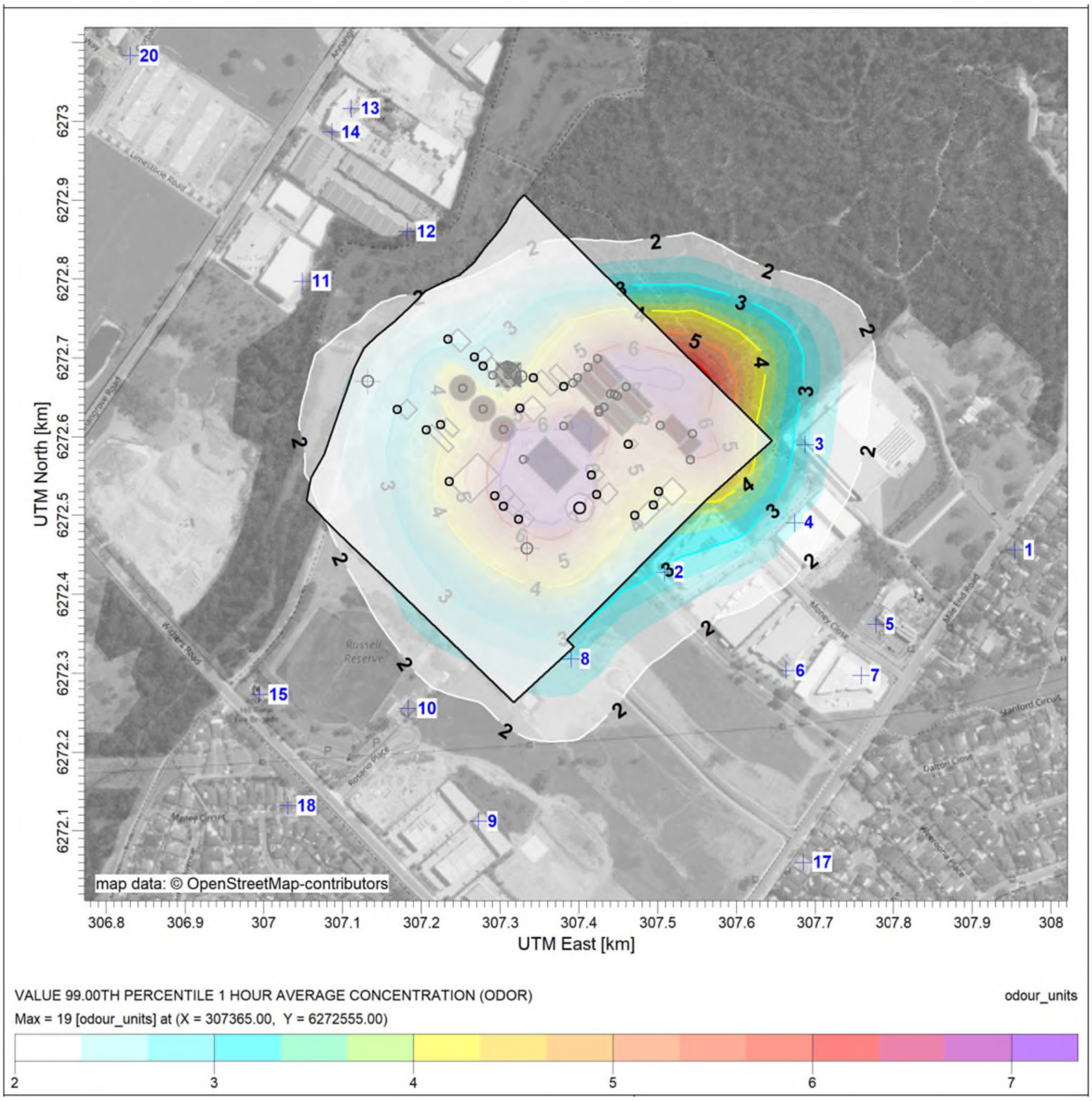

Figure 7.1 Odour dispersion modelling results for the Rouse Hill WRRF future growth scenario.

8 Conclusions

8.1 Conclusions

This air quality impact assessment was conducted for the proposed changes to the Rouse Hill WRRF approved REF. The changes include the following:

- new dewatering and out-loading building to cater for sludge treatment
- expansion of the construction footprint to include a compound site in 7 Money Close, Rouse Hill (5/-/DP1158760) and new access roads into the facility
- ongoing use of part of existing biological nutrient removal (BNR) treatment and existing aerobic digester.
- Sludge transfer systems
- deletion of both sludge transfer pipelines (Rouse Hill WRRF to Riverstone WRRF, and Castle Hill WRRF to Rouse Hill WRRF).

Construction impacts are expected to be consistent with those previously assessed by Jacobs Group (Australia) Pty Ltd (Jacobs) for the REF (documented in *IS373500_NWH Growth Project_Rouse Hill_Air Quality_Final_rev0.docx*), and no additional assessment of construction impacts was required.

Operational impacts of the proposed changes considered NSW legislative and policy requirements. Considerations of the Clean Air Regulation and Approved Methods for Modelling and Assessment of Air Quality in NSW 2022 are discussed in Section 2.2.

In order to maintain consistency with the REF, estimated emissions from the proposed changes were assessed by CALPUFF dispersion model configured in the same manner as the REF Air Quality Assessment.

Dispersion modelling indicated odour emissions associated with the proposed Rouse Hill WRRF growth scenario were largely confined to the Rouse Hill WRRF. The 2 OU contour was predicted to extend by approximately 200 m beyond the Rouse Hill WRRF boundary in a north-easterly direction, into the bushland area surrounding Second Ponds Creek. The 4 OU contour extended approximately 70 m beyond the same north-eastern boundary into the bushland area.

Predicted odour concentrations did not exceed the assessment criteria at any of the identified receptors. Odour concentrations at the neighbouring workplaces and commercial developments along Money Close ranged from 2.4 OU to 2.9 OU, averaging 67% of the 4 OU criterion. Odour at all remaining receptors, including: commercial, services, early learning and residential receptors, were predicted to remain below 2 OU.

In summary, the Rouse Hill WRRF air quality impact assessment for the REF addendum concludes the following:

- Construction dust impacts are expected to be consistent with the approved REF.
- Predicted odour concentrations are below the nominated assessment criteria at all sensitive receptor locations.
- Overall the odour environmental outcomes for the addendum REF for Riverstone WRRF are consistent with the approved REF.

9 Limitations

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