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PROPOSED PET CREMATORIUM

3/41 Steel Place, Morningside

Air Quality and Odour Assessment

Pet Haven Crematorium

Date
27 May 2026

Report
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Prepared by: Trinity Consultants Australia
ABN 62 630 202 201
A: Level 3, 43 Peel Street
South Brisbane, QLD 4101
T: +61 7 3255 3355
E: brisbane@trinityconsultants.com

Reference	Date	Description	Prepared	Checked
267401.0098.R01V01	27/05/2026	Final	Scarlett Jackson	Hector Machado / Samuel Wong

Document Approval	
Approver Signature	
Name	Samuel Wong
Title	Manager - Air & Noise

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CONTENTS

APPENDICES

FIGURES

TABLES

1. INTRODUCTION

1.1 Overview

Trinity Consultants Australia (Trinity) was commissioned by Pet Haven Crematorium to provide air quality consultancy services for their proposed pet crematorium at 3/41 Steel Place, Morningside, QLD.

A development approval (DA) application has been lodged, and Brisbane City Council (BCC) requested the following additional information on 10 March 2026:

- *Air Quality*
  - *Provide an aerial image showing the accurate location of the sensitive receptors modelled.*
  - *Provide a figure (e.g., roof plan or aerial image) showing the stack location*
  - *Provide the contour plots showing the extent of impacts*
  - *Confirm and rectify inconsistencies between the Information request response and the air quality report including, but not limited to, the stack height, fuel type, and hours of operation*
  - *Provide further detail regarding the PM_{10} and $PM_{2.5}$ emission rated used in the modelling.*
  - *Provide any conditions, limitations, or caveats associated with the emissions concentration data supplied by the equipment manufacturer*
  - *Given the separation distance to sensitive receptors, a sensitivity analysis of key emission parameters (e.g. maximum/minimum exhaust velocity, stack temperature) is required. Note that maximum velocity/temperature may result in greater impacts at distance compared to minimum parameters, which typically yield the worst-case impacts close to the source.*
  - *Provide the air quality model files.*

This assessment has been undertaken to assess the potential air quality and odour impacts of the proposed development and to address BCC's information request.

1.2 Scope

This report describes the assessment of air quality and odour impacts, which is based on the following tasks:

- Review the proposed site operations and the associated potential air emissions.
- Review air quality monitoring data applicable to the site.
- Identify the pollutants of concern to be assessed and determine their emission rates using manufacturer data and appropriate emission factors.
- Model meteorological conditions using TAPM and CALMET.
- Model the dispersion of expected air pollutants and odour using CALPUFF to predict concentrations at nearby receptor locations and develop concentration plots over the modelling domain.
- Analyse the results of meteorological and pollutant dispersion modelling, and compare modelling results with the relevant air quality criteria.

To aid in the understanding of the terms in this report, a glossary is included in **Appendix A**.

2. PROPOSED SITE OPERATIONS

2.1 Site Description

The proposed pet crematorium will occupy Unit 3 of a multi-unit warehouse complex located at 41 Steel Place, Morningside, Lot 3 SP105717. The incinerator will be located in the northeastern corner of the building, and the stack location has been modelled accordingly. **Figure 2.1** shows the site boundary and the proposed stack location.

Figure 2.1: Site Boundary and Stack Location

2.2 Description of Operations

Operating a pet crematorium involves a series of steps to ensure respectful and efficient handling of pet remains. The process is designed to meet regulatory standards while providing a dignified service for pet owners. The key stages of the cremation process are outlined below:

- Pre-heating
  - Secondary chamber is pre-heated to 850ºC before the cremation process begins.
  - Primary chamber is heated to 600ºC for efficient initial combustion.
- Charging
  - Cadavers that are contained within acceptable packaging are left within them and a check is made to ensure there are no other items contained, such as blankets or pet toys. If other items are present, they are removed before the cremation process. Packaging is kept to a minimum.

- First Phase: Initial combustion
  - Due to the influx of air when the cadaver is charged, the secondary chamber's temperature may drop below 850 ºC, which is brough back up as quickly as possible.
- Second Phase: Combustion of the cadaver
  - This phase occurs when the cadaver starts to reach maximum combustion.
  - Primary chamber temperature will exhibit a rise in temperature, and consequently the temperature of the secondary chamber will increase as the maximum amount of volatile gases is given off.
  - Secondary burner will automatically switch off (or manually controlled) as the temperature exceeds 850ºC, otherwise smoke is produced.
  - Observation of the stack is made during this phase, and the process is shutdown if visible smoke emission is observed from the stack.
- Third Phase: Calcination
  - Rate of combustion begins to decline, and the temperature and pressure decrease within the primary chamber.
  - During this phase, the charging door may need to be opened, and the remains raked to re-position them to burn off any remaining material.
  - Combustion process is complete when the only identifiable material visible on the hearth are skeletal remains. The high temperature will have calcified them, and the remaining skeletal material will be brittle.
- Raking down and collecting the cremated remains
  - Burners are switched off, and air is introduced to cool the primary chamber.
  - When the desired temperature is reached, the cremated remains are then raked forward and brushed into a collection tray.
- Reducing the remains
  - Remains are then taken to be reduced within a ball mill or other form of pulveriser, often referred to as a cremulator
  - Vacuum systems may be incorporated into the machines to reduce dust.
- Dealing with the cremated remains
  - Once the remains are safely bagged in an airtight container and carry the identification label, they are moved to an office area for packing.

The maximum continuous operation time of the crematoria is 45-minutes, based on an animal weight limit of 110 kg with weights exceeding 100 kg noted to be very infrequent. A 2-hour cool down window is required between batch cycles, therefore, a maximum of 3 cycles will be processed per day. The site has been conservatively assumed to operate 7-days a week, 7:00 am to 5:00 pm.

2.3 Emission Sources and Control Measures

The primary source of emissions from the proposed facility is the Yuanda YDF-100 diesel / gas fired incinerator, where combustion emissions are vented to the atmosphere through the stack. The incinerator is housed within a purposely designed room measuring 7 x 5 metres and comprises of the following components:

- Air blower;
- Primary and secondary chambers;
- Primary and secondary burners;
- Smoke adsorption chamber; and
- Exhaust stack.

Table 2.1 specifies the expected emission concentrations for various pollutants, as declared by the manufacturer, Henan Yuanda Boiler Corporation. The manufacturer states compliance with the Chinese standard GB 18484-2020 for hazardous waste incineration.

Table 2.1: Incinerator Emissions Concentrations

Pollutant	Emission Concentration	Unit
Dust	87.6	mg/m^3
Carbon monoxide (CO)	72.5	mg/m^3
Sulfur dioxide (SO_2)	39.6	mg/m^3
Hydrogen fluoride (HF)	5.9	mg/m^3
Hydrogen chloride (HCl)	85.5	mg/m^3
Nitrogen dioxide (NO_2)	151.5	mg/m^3
Mercury (Hg)	0.045	mg/m^3
Cadmium (Cd)	0.009	mg/m^3
Arsenic (As) + Nickel (Ni)	0.061	mg/m^3
Lead (Pb)	0.478	mg/m^3
Chromium (Cr) + Tin (Sn) + Antimony (Sb) + Copper (Cu) + Manganese (Mn)	0.191	mg/m^3

The proposed system uses the multi-stage YDF-100 advanced incineration filtration unit for emissions control. This filtration system is designed for small-to-medium animal crematoriums and complies with the European Union animal incineration standards where applicable. The filtration unit minimises pollutant emissions through the following measures:

- Cyclone separator removes coarse particulates, preventing carryover into fine filtration
- Ceramic / HEPA-grade filter block with high-efficiency particulate removal, capturing ash, inorganic and organic pollutants
- Activated carbon bed for adsorption of odour, VOCs and organic compounds.
- Polishing filter ensures emission stream is consistent and captures trace residuals.

The proposed process includes multiple considerations of emission control including:

- High-temperature secondary combustion operating at greater than 1300 ºC ensuring complete burnout to reduce CO and VOCs.
- Fugitive emissions are minimised by the negative pressure control system, allowing for flow balancing and prevention of smoke release during loading and unloading.

- Regular servicing of burners, fans, dampers and refractor lining will be undertaken to ensure the incinerator is operating at maximum efficiency. The stack will be kept free of corrosion and obstruction.
- Should visible smoke or strong odour be observed, load will be immediately reduced / further loading halted. Temperature and airflow will be checked while operation is suspended until the cause is rectified.

3. STUDY AREA DESCRIPTION

3.1 Zoning of Site and Surrounds

The site is located at 3/41 Steel Place, Morningside, and is currently occupied by a single-storey warehouse. It lies within the General Industry B Zone of the Brisbane City Council (BCC) City Plan 2014 Zoning Overlay and is included as Priority Infrastructure Area in the Local Government Infrastructure Plan (LGIP). The site is surrounded by industrial uses to the west and sport and recreation areas to the east. In the wider area, there is a mix of uses including educational establishment, residential areas, low impact industry, open space and environmental management. The location zoning according to the Brisbane City Plan 2014 is shown in **Figure 3.1.**

Figure 3.1: Site Location Zoning

3.2 Identification of Sensitive Receptors

The BCC City Plan 2014 defines a sensitive use as a use that is:

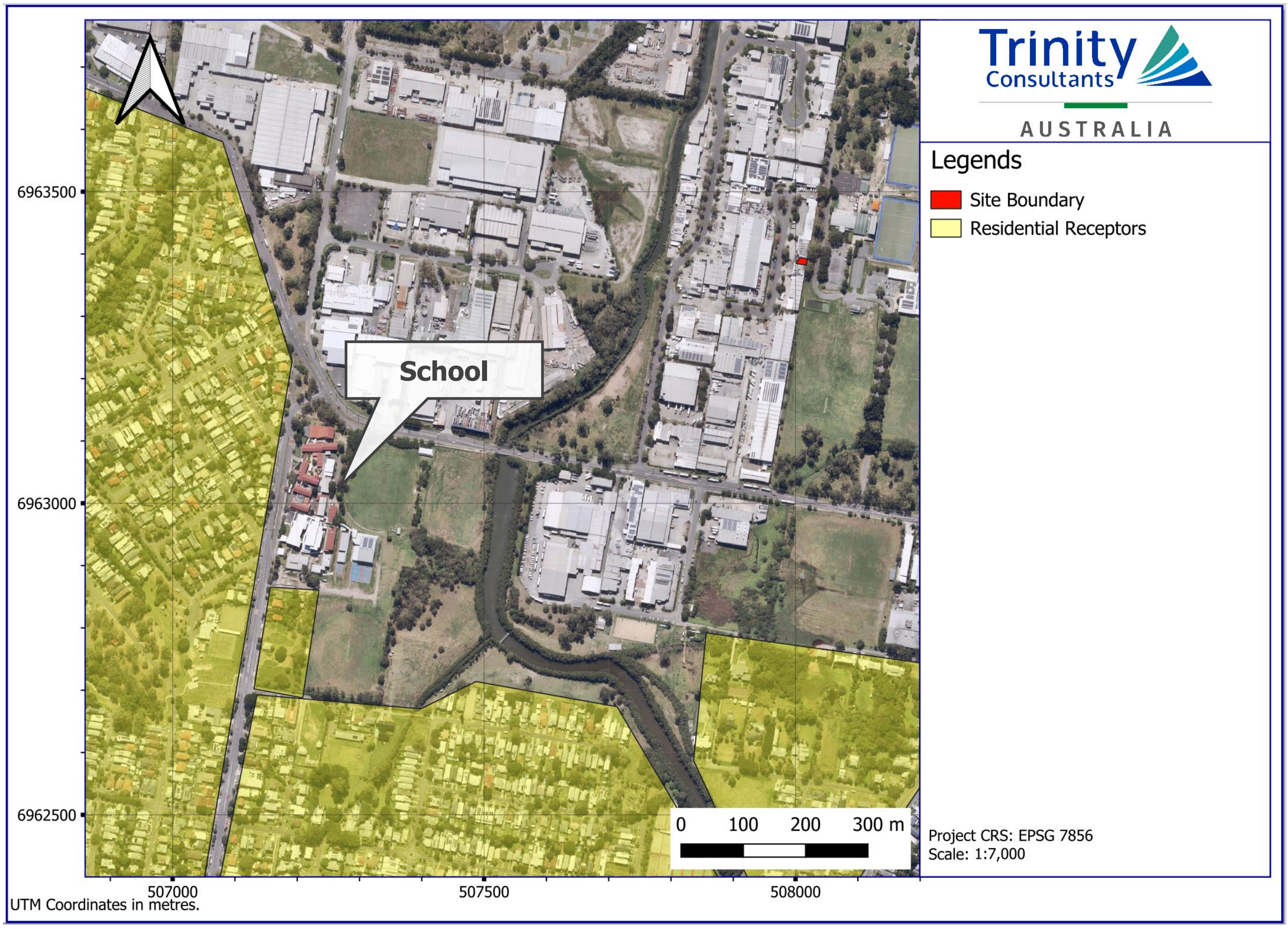
- *A childcare centre,*
- *A community care centre,*
- *A community residence,*
- *A detention facility,*
- *A dual occupancy,*
- *A dwelling house,*
- *A dwelling unit,*

- *An educational establishment (excluding an educational establishment for trade or industry related training, where not involving overnight accommodation),*
- *A health care service*
- *A hospital*
- *A hotel, to the extent the hotel provides accommodation for tourists or travellers,*
- *A multiple dwelling,*
- *A relocatable home park,*
- *A residential care facility,*
- *A resort complex,*
- *A retirement facility,*
- *Rooming accommodation,*
- *Rural workers' accommodation,*
- *Short-term accommodation, or*
- *A tourist park.*

Based on this, the nearest sensitive uses (sensitive receptors) are the residences located 400 metres south-southeast, and the educational establishment located 600 metres southwest of the site. Additional residential precincts are located to the south and southwest, although at greater distances.

Figure 3.2 presents the locations of nearby identified sensitive receptors.

Figure 3.2: Location of Sensitive Receptors



4. AIR QUALITY VALUES AND CRITERIA

4.1 Relevant Pollutants

Air emissions from cremation primarily result from the combustion process and include pollutants listed in **Section 2.3**. All pollutants listed in the National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Crematoria (DSEWPC, 2011) are outlined below:

- carbon monoxide (CO)
- fluoride and compounds (as HF)
- nitrogen dioxides (NO_2)
- particulate matter (TSP, PM_{10} and $PM_{2.5}$)
- sulfur dioxide (SO_2)
- hydrogen chloride (HCl)
- polycyclic aromatic hydrocarbons (PAHs)
  - Benzo-a-pyrene
- volatile organic compounds (VOCs)
  - Benzene
  - Toluene
  - Xylenes
- mercury (Hg)
- formaldehyde
- acetaldehyde
- polychlorinated dioxins and furans (PCDDs/PCDFs)
- heavy metals
  - Arsenic (As)
  - Beryllium (Be)
  - Cadmium (Cd)
  - Chromium III [Cr(III)]
  - Chromium VI [Cr(VI)]
  - Copper (Cu)
  - Lead (Pb)
  - Nickel (Ni)
  - Antimony (Sb)
  - Selenium (se)
  - Zinc (Zn)
- odour.

4.2 Brisbane City Plan 2014

The assessment has been undertaken with reference to the relevant air quality objectives and performance requirements applicable to the proposed development. The key planning instruments are the Brisbane City Plan 2014 – Industry Code, which specifies both acceptable outcomes and performance outcomes for managing air quality impacts from development. PO1 of the Industry code states:

Development:

a. *Avoids or minimises air emissions;*

b. Complies with the following criteria in a sensitive zone, and at a sensitive use in a rural zone:

i. Air quality (planning) criteria in Table 9.3.12.3.B

ii. The odour criteria in Table 9.3.12.3.C

The criteria referred to in the Industry Code are provided in the Air Quality Planning Scheme Policy (AQPSP) within the Brisbane City Plan 2014. **Table 4.1** summarises the relevant pollutant and toxic substance criteria presented in *Table 9.3.12.3.B* and **Table 4.2** presents the odour criteria presented in *Table 9.3.12.3.C* of the Brisbane City Plan 2014.

Table 4.1: Brisbane City Plan 2014 Air Quality Criteria

Pollutant	Health Outcome Protected	Averaging Period	Criteria (µg/m³)
CO	Health and wellbeing	8 hours	11,000
NO_2	Health and wellbeing	1 hour, 99th Percentile	250
		Annual	62
TSP	Health and wellbeing	Annual	90
PM_{10}	Health and wellbeing	24 hours	50
		Annual	25
$PM_{2.5}$	Health and wellbeing	24 hours	25
		Annual	8
SO_2	Health and wellbeing	1 hour, 99th Percentile	570
		24 hours	230
		Annual	57
HCl	Health and wellbeing	1 hour, 99th Percentile	140
Benzo-a-pyrene (as marker for PAH)	Health and wellbeing	Annual	0.3 ng/m³
Benzene	Health and wellbeing	1 hour, 99th Percentile	29
		Annual	10
Toluene	Odour	1 hour, 99th Percentile	958
	Health and wellbeing	24 hours	4,100
		Annual	410
Xylenes	Health and wellbeing	24 hours	1,200
		Annual	950
Mercury organic	Health and wellbeing	1 hour, 99th Percentile	0.18
Formaldehyde	Protecting aesthetic environment	1 hour, 99th Percentile	96
	Health and wellbeing	24 hours	54
Acetaldehyde	Odour	1 hour, 99th Percentile	42
PCDDs/PCDFs	IARC Group 1 carcinogen (known human carcinogen)	1 hour, 99th Percentile	2×10^{-5}
Arsenic and compounds	IARC Group 1 carcinogen (known human carcinogen)	1 hour, 99th Percentile	0.09

Pollutant	Health Outcome Protected	Averaging Period	Criteria (µg/m³)
	Health and wellbeing	Annual	6 ng/m³
Beryllium and compounds	IARC Group 1 carcinogen (known human carcinogen)	1 hour, 99th Percentile	0.004
Cadmium and compounds	Health and wellbeing	Annual	5 ng/m³
Chromium III	Health and wellbeing	1 hour, 99th Percentile	9
Chromium VI	IARC Group 1 carcinogen (known human carcinogen)	1 hour, 99th Percentile	0.09
Copper fumes	Health and wellbeing	1 hour, 99th Percentile	3.7
Lead and compounds	Health and wellbeing	Annual	0.5
Nickel and compounds	Health and wellbeing	Annual	0.02
Antimony and compounds	Health and wellbeing	1 hour, 99th Percentile	9
Zinc chloride fumes	Health and wellbeing	1 hour, 99th Percentile	18

Table 4.2: Brisbane City Plan 2014 Odour Criteria

Pollutant	Averaging time	Criteria (OU)
Odour for ground-level and wake-affected plumes from short stacks	1 hour, 99.5th Percentile	2.5

4.3 NSW Impact Assessment Criteria

The NSW Environment Protection Authority (EPA) Impact Assessment Criteria (IAC) (NSW EPA, 2022) has been adopted for hydrogen fluoride as criteria is provided by the Brisbane City Plan 2014. **Table 4.3** summarises the IAC relevant to this assessment.

NSW EPA outlines relevant toxic air pollutant criteria for application at and beyond the boundary of the facility. These criteria have been conservatively adopted for sensitive receptor criteria to align with the Brisbane City Council impact assessment guidelines. The criteria identified for general land use have been adopted as no nearby areas are identified as specialised land use, which includes all areas with vegetation sensitive to fluoride, such as grapevines and stone fruits.

Table 4.3: NSW EPA Impact Assessment Criteria for Relevant Pollutants and Toxic Substances

Pollutant	Averaging period	Concentration (µg/m³)
Hydrogen fluoride	24 hours	2.9
	7 days	1.7
	30 days	0.84
	90 days	0.5

4.4 Ontario's Ambient Air Quality Criteria

Selenium has been identified as a heavy metal pollutant that may be emitted from the proposed development operations. However, the Brisbane City Plan 2014 and NSW EPA IAC do not outline an ambient air criterion. Therefore, the Ontario Ambient Air Quality Criteria (AAQC) for selenium of 10 µg/m³ for a 24-hour averaging period has been adopted for this assessment.

4.5 Summary of Relevant Pollutant Concentration Criteria

Table 4.4 presents a summary of the relevant air quality criteria adopted in this assessment.

Table 4.4: Adopted Air Quality Criteria

Pollutant	Averaging Period	Criteria (µg/m³)
CO	8 hours	11,000
Hydrogen fluoride	24 hours	2.9
	7 days	1.7
	30 days	0.84
	90 days	0.5
NO_2	1 hour, 99th Percentile	250
	Annual	62
TSP	Annual	90
PM_{10}	24 hours	50
	Annual	25
$PM_{2.5}$	24 hours	25
	Annual	8
SO_2	1 hour, 99th Percentile	570
	24 hours	230
	Annual	57
HCl	1 hour, 99th Percentile	140
Benzo-a-pyrene (as marker for PAHs)	Annual	0.3 ng/m³
Benzene	1 hour, 99th Percentile	29
	Annual	10
Toluene	1 hour, 99th Percentile	958
	24 hours	4,100
	Annual	410
Xylenes	24 hours	1,200
	Annual	950
Mercury organic	1 hour, 99th Percentile	0.18
Formaldehyde	1 hour, 99th Percentile	96
	24 hours	54
Acetaldehyde	1 hour, 99th Percentile	42
PCDDs/PCDFs	1 hour, 99th Percentile	2×10^{-5}
Arsenic and compounds	1 hour, 99th Percentile	0.09
	Annual	6 ng/m³
Beryllium and compounds	1 hour, 99th Percentile	0.004
Cadmium and compounds	Annual	5 ng/m³
Chromium III	1 hour, 99th Percentile	9

Pollutant	Averaging Period	Criteria (µg/m³)
Chromium VI	1 hour, 99th Percentile	0.09
Copper fumes	1 hour, 99th Percentile	3.7
Lead and compounds	Annual	0.5
Nickel and compounds	Annual	0.02
Antimony and compounds	1 hour, 99th Percentile	9
Selenium	24 hour	10
Zinc chloride fumes	1 hour, 99th Percentile	18
Odour	1 hour, 99.5th Percentile	2.5 OU

5. BACKGROUND AIR QUALITY

5.1 Representative Monitoring Data

The existing air quality in the project area is influenced by a combination of local traffic emissions and nearby industrial activities.

Air quality data from the Queensland Government air quality monitoring network has been used to develop representative background levels for the assessment.

The Department of Environment, Science, Tourism and innovation (DETSI) operates air monitoring stations in Queensland. Existing background air quality concentrations have been obtained according to the AQPSP with 70th percentile short-term averaging period concentrations and highest annual average concentrations for pollutants with annual averaging periods. Historical reports of DETSI data do not provide 70th percentile concentrations, so it is necessary to analyse raw data.

The nearest location to the site with publicly available data considered representative of the proposed development site is the Cannon Hill monitoring station operated by DETSI. This monitoring station is located 1.5 kilometres southeast of the site and in an area of similar land use. NO_X and particulate matter (TSP, PM_{10} and $PM_{2.5}$) background concentrations have been obtained from Cannon Hill DETSI station.

As Cannon Hill station does not monitor SO_2, data was sourced from Wynnum monitoring station located within a similar land use area of industrial and residential uses. Similarly, as CO is not monitored at the Cannon Hill station, data was sources from the Woolloongabba monitoring station. Data for the period 2020 to 2024 was used for the analysis.

For VOCs (benzene, toluene and xylenes) and formaldehyde, data was sourced from the Springwood monitoring station, which is the only site in Southeast Queensland with monitoring for these VOC species. Data was available up to 2020, and therefore, the period 2016 to 2020 was used for analysis.

The adopted background concentrations obtained from DETSI monitoring stations are presented in **Table 5.1.**

Table 5.1: Ambient Pollutant Concentrations from DETSI Monitoring Stations

Pollutant	Ambient Concentration (µg/m³)	Averaging Period	Monitoring Station
CO	285.5	8 hour (2021)	Woolloongabba
NO_X	16.41	1 hour (2024)	Cannon Hill
	13.81	Annual (2024)	
TSP	26.98	Annual (2020)	
PM_{10}	19.11	24 hours (2023)	
	17.28	Annual (2023)	
$PM_{2.5}$	7.22	24 hours (2023)	
	6.98	Annual (2023)	
SO_2	5.71	1 hour (2023)	Wynnum
	5.71	24 hours (2023)	
	4.93	Annual (2023)	
Formaldehyde	10.9	1 hour (2016)	Springwood
	11.2	24 hours (2016)	
Benzene	6.5	1 hour (2017)	
	5.5	Annual (2017)	

Pollutant	Ambient Concentration (μg/m³)	Averaging Period	Monitoring Station
Toluene	23	1 hour (2016)	
	22.4	24 hours (2016)	
	17.8	Annual (2016)	
Xylenes	41.7	24 hours (2020)	
	41.4	Annual (2020)	

5.2 DERM Runcorn Monitoring

Heavy metals, aldehydes and other pollutants were monitored from September 2009 to March 2010 near the Bradken Resources Foundry at Runcorn (Department of Environment and Resource Management (DERM), 2010). Arsenic, cadmium and aldehyde levels were found to be consistent with background. Other heavy metals increased when the wind blew from the foundry.

Sampling was completed at three sites. The proportion of time wind was flowing from the foundry was less at Bonemill Road and Selsey Street during metals sampling and Bonemill Road during aldehyde sampling. The data summarised in **Table 5.2** is the median concentrations monitored across the three sites.

Table 5.2: Summary of DERM Runcorn Monitoring Results

Pollutant	Ambient Concentration (μg/m³)
Mercury	<0.0003
Arsenic	0.001
Cadmium	7×10^{-5}
Chromium	0.002
Copper	0.005
Lead	0.002
Nickel	0.002
Zinc	0.02

5.3 Summary

The adopted background concentrations are presented in **Table 5.3.** No background concentration data is available for HF, HCl, PCDDs/PCDFs, benzo-a-pyrene, acetaldehyde, beryllium or selenium. It is assumed that background concentration for these pollutants is negligible. Odour concentration is considered cumulative only if the ambient and incremental odours are of the same properties. Based on desktop review, no surrounding industries have been identified as having potentially compounding odorous emissions. It is therefore assumed that background odour concentration is negligible.

Table 5.3: Adopted Background Concentrations

Pollutant	Averaging Period	Background Concentration (μg/m³)
CO	8 hours	285.5
Hydrogen fluoride	24 hours	-
	7 days	-
	30 days	-
	90 days	-

Pollutant	Averaging Period	Background Concentration (µg/m³)
NO_2	1 hour	16.41
	Annual	13.81
TSP	Annual	26.98
PM_{10}	24 hours	19.11
	Annual	17.28
$PM_{2.5}$	24 hours	7.22
	Annual	6.98
SO_2	1 hour	5.71
	24 hours	5.71
	Annual	4.93
HCl	1 hour	-
Benzo-a-pyrene (as marker for PAHs)	Annual	-
Benzene	1 hour	6.5
	Annual	5.5
Toluene	1 hour	23
	24 hours	22.4
	Annual	17.8
Xylenes	24 hours	41.7
	Annual	41.4
Mercury organic	1 hour	0.0003
Formaldehyde	1 hour	10.9
	24 hours	11.2
Acetaldehyde	1 hour	-
PCDDs/PCDFs	1 hour	-
Arsenic and compounds	1 hour	0.001
	Annual	0.001
Beryllium and compounds	1 hour	-
Cadmium and compounds	Annual	7×10^{-5}
Chromium III	1 hour	0.002
Chromium VI	1 hour	0.002
Copper fumes	1 hour	0.005
Lead and compounds	Annual	0.002
Nickel and compounds	Annual	0.002
Antimony and compounds	1 hour	-
Selenium	24 hour	-
Zinc chloride fumes	1 hour	0.02
Odour	1 hour	-

6. METEOROLOGICAL MODELLING

6.1 Overview

Atmospheric dispersion modelling involves the mathematical simulation of the dispersion of air contaminants in the environment. The modelling utilises a range of information to estimate the dispersion of pollutants released from a source, including:

- Meteorological data for surface and upper air winds, temperature and pressure profiles, as well as humidity, rainfall, cloud cover and ceiling height information;
- Emissions parameters, including source location and height, source dimensions and physical parameters (e.g., diameter and flow rate) along with pollutant mass emission rates;
- Terrain elevations and land use both at the source and throughout the surrounding region;
- Sensitive receptor locations and heights.

For the purpose of the assessment, meteorological modelling has been undertaken using CALMET to predict localised meteorological conditions. A TAPM run was conducted to generate the required prognostic input data for CALMET. Surface data from Cannon Hill DETSI station was also included in the CALMET run.

The meteorological data derived from these models have been used as an input for the CALPUFF dispersion modelling.

The following sections provide details of the meteorological modelling.

6.2 Model Year Selection

The nearest available weather stations are Brisbane BoM station and Cannon Hill DETSI station, located 5.3 and 1.5 kilometres from the site, respectively (see **Figure 6.1**). Due to the closeness of Cannon Hill DETSI station, there is high representativeness for site-specific meteorological conditions. To account for varied terrain and to increase the robustness of the analysis, data from the Brisbane BoM station has also been included.

Meteorological data from the Brisbane BoM station from 2021 to 2025 and from the Cannon Hill DETSI station for 2020 to 2024 were reviewed to identify a representative year for modelling. **Table 6.1** and **Table 6.2** show the percentage distribution of wind conditions across different wind speed categories. **Figure 6.2** and **Figure 6.3** present wind roses for each individual year and the period average.

Wind conditions at the Brisbane BoM weather station exhibit low annual variability in wind direction and consistently low average wind speeds, ranging from 1.5 to 1.6 m/s. Calm conditions were relatively low throughout the 2021 – 2025 period, occurring between 11.4 to 16.6% of the year. Conditions with low (0.5 – 1.5 m/s) or moderate (1.5 – 5 m/s) were dominant, with low wind speeds occurring between 38.8 to 41.9% and moderate wind speeds occurring between 46.4 to 49.4% of the year. Conditions with high wind speeds (> 5 m/s) were infrequent, occurring, on average, less than 1% of the time.

Wind conditions at Cannon Hill DETSI station indicate slightly higher average wind speeds compared with Brisbane BoM station, ranging from 1.6 to 1.9 m/s. Calm conditions occurred less frequently, between 8.4 to 11.4%, while high wind speeds were more frequent, occurring between 0.5 to 1.5% of the year. Similarly to Brisbane BoM station, Cannon Hill annual wind conditions were dominated by low (28.9 to 34.15%) to moderate (49.3 to 61.3%) wind speeds.

The data indicates that 2023 is broadly consistent with the long-term averages for both stations. The year shows typical distributions of wind conditions. The slightly higher proportion of winds from the northeast provide a conservative basis for modelling, as these winds have the greatest impact on nearby sensitive receptors.

Based on these observations, 2023 has been selected as the representative model year for this assessment.

Figure 6.1: Distance between Site Location and Weather Stations

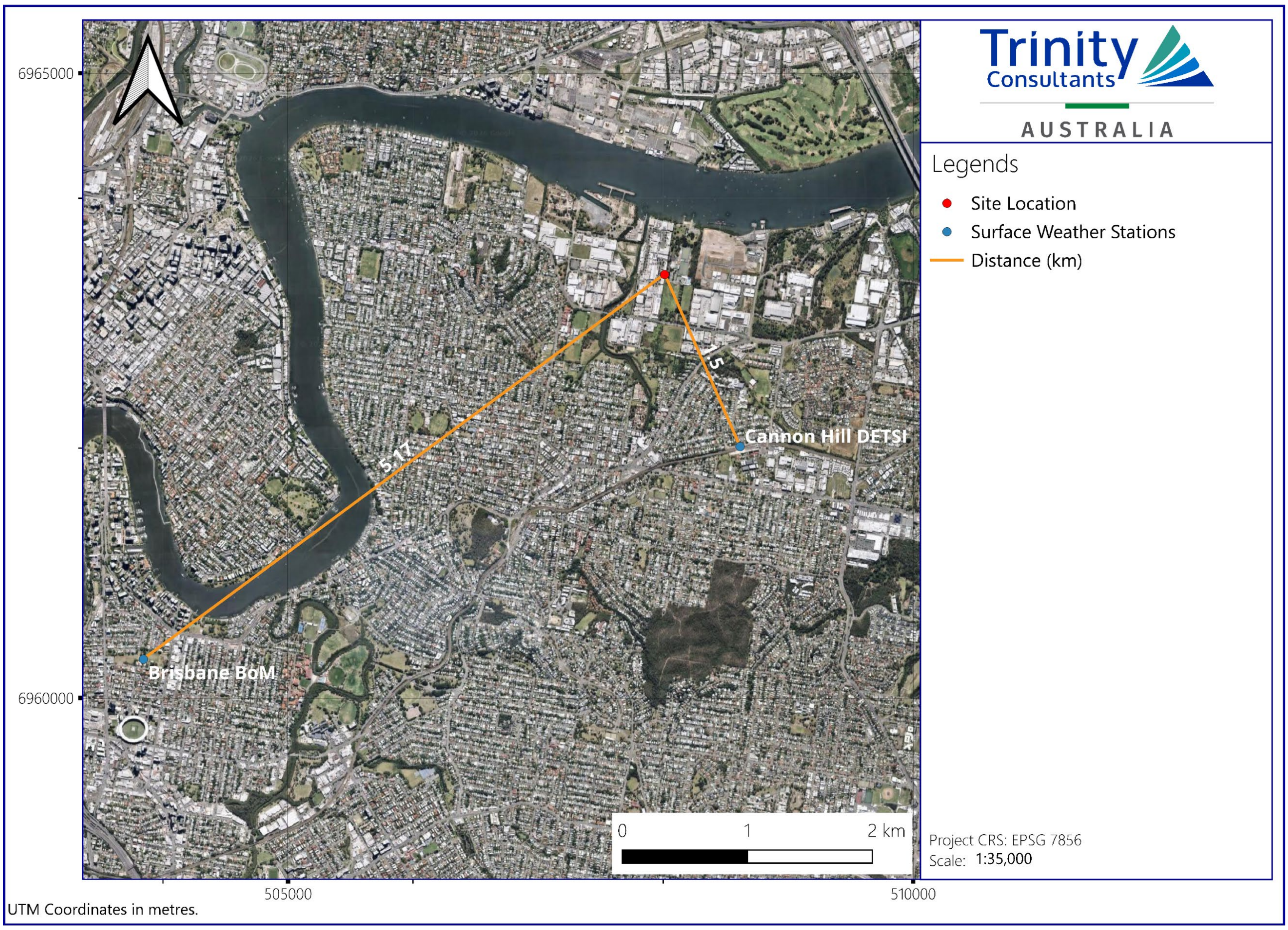


Table 6.1: Percentage of Wind Conditions in Each Wind Speed Category at Brisbane BoM Station

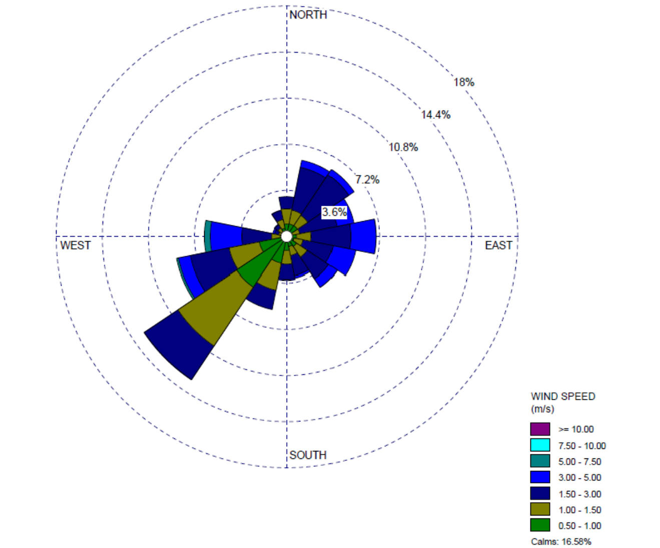
Year	Proportion Calm (%)	Average Wind Speed (m/s)	0.5 – 1.5 m/s (%)	1.5 – 5 m/s (%)	> 5 m/s (%)	NE Winds
2021	16.6	1.5	39.0	43.4	0.7	11.6
2022	11.4	1.6	38.8	49.4	0.3	9.8
2023	12.8	1.5	41.7	45.3	0.2	14.9
2024	12.7	1.5	41.9	45.2	0.1	12.8
2025	12.5	1.6	39.5	46.8	0.6	13.1
Average	**13.2**	**1.5**	**40.2**	**46.0**	**0.4**	**12.4**

Table 6.2: Percentage of Wind Conditions in Each Wind Speed Category at Cannon Hill DETSI Station

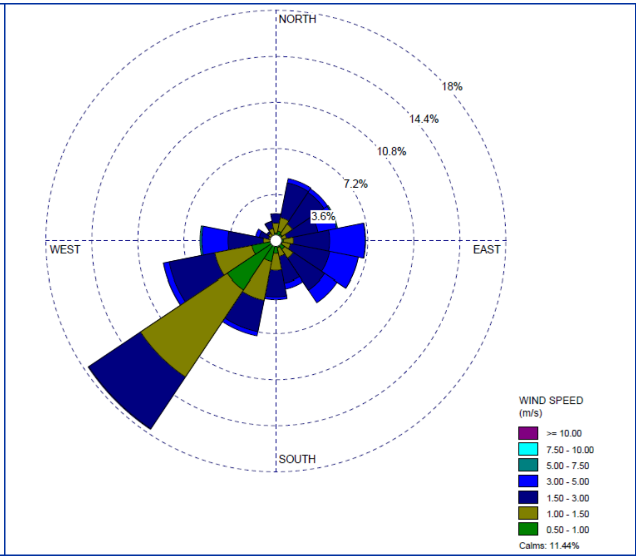
Year	Proportion Calm (%)	Average Wind Speed (m/s)	0.5 – 1.5 m/s (%)	1.5 – 5 m/s (%)	> 5 m/s (%)	NE Winds
2020	14.0	1.6	33.2	49.3	0.6	16.8
2021	10.4	1.9	30.8	54.9	1.5	13.0
2022	8.4	1.9	28.9	61.3	0.9	10.2
2023	11.4	1.8	32.6	55.2	0.7	16.4

Year	Proportion Calm (%)	Average Wind Speed (m/s)	0.5 – 1.5 m/s (%)	1.5 – 5 m/s (%)	> 5 m/s (%)	NE Winds
2024	9.8	1.8	34.1	55.2	0.5	13.6
Average	**10.8**	**1.8**	**31.9**	**55.2**	**0.8**	**14.0**

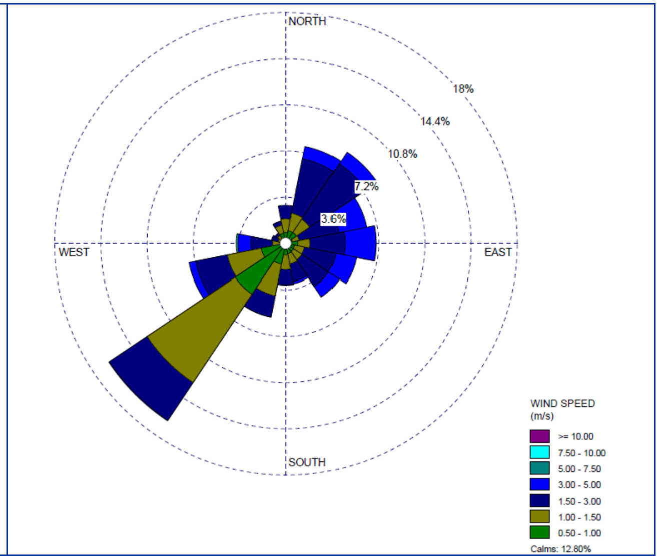
Figure 6.2: Wind Roses at Brisbane BoM Station



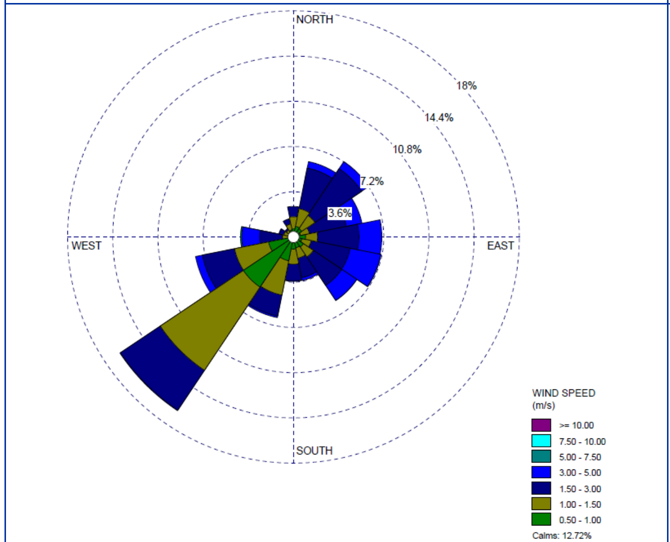
2021



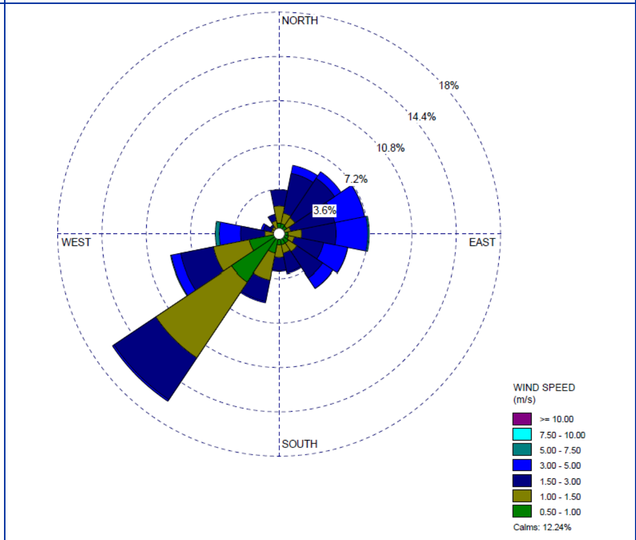
2022



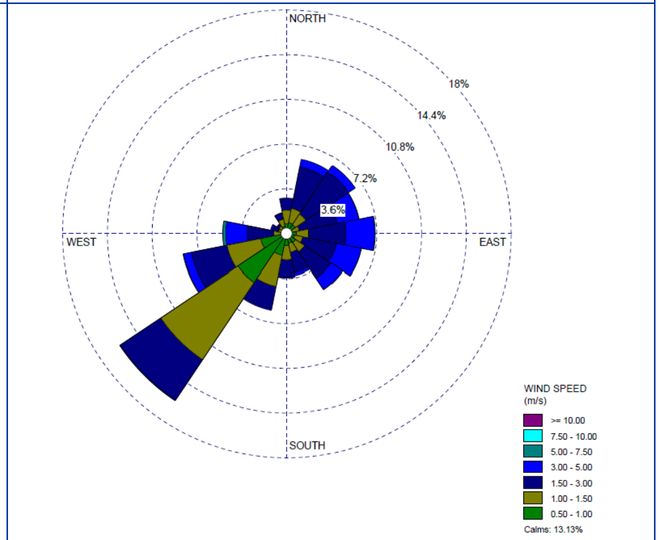
2023



2024

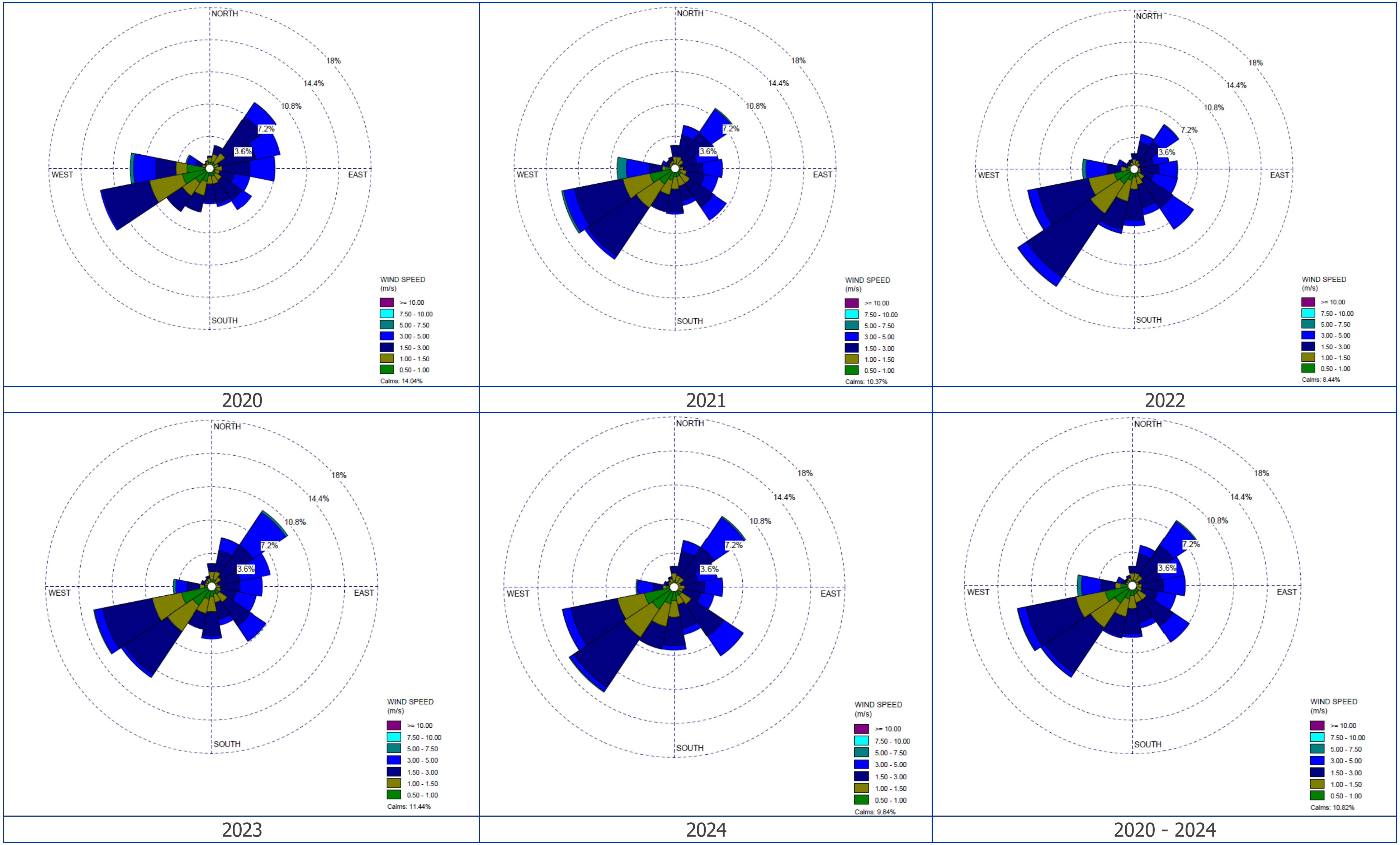


2025



2021 - 2025

Figure 6.3: Wind Roses at Cannon Hill DETSI Station



6.3 TAPM Meteorological Modelling

6.3.1 TAPM Fundamentals

The meteorological component of The Air Pollution Model (TAPM) was used to provide wind fields over the region.

The databases required to run TAPM are provided by CSIRO and include global and Australian terrain height data, vegetation and soil type datasets, sea surface temperature datasets and synoptic scale meteorological datasets.

The Australian terrain data is in the form of 9-second grid spacing (approximately 0.3 kilometres) and is based on data available from Geosciences Australia. Australian vegetation and soil type data is on a longitude/latitude grid at 3-minute grid spacing (approximately 5 kilometres) and is public domain data provided by CSIRO Wildlife and Ecology.

The synoptic scale meteorological dataset used is a six-hourly synoptic scale analysis on a longitude/latitude grid at 0.75 or 1.0-degree grid spacing (approximately 75 kilometres or 100 kilometres). The database is derived from the US NCEP reanalysis synoptic product.

TAPM dynamically fits the gridded data for the selected region to finer grids taking into account terrain, surface type and surface moisture conditions. It produces detailed fields of hourly estimated temperature, winds, pressure, turbulence, cloud cover, and humidity at various levels in the atmosphere as well as surface solar radiation and rainfall.

6.3.2 TAPM Configuration

TAPM was set up using four nested 24 x 25 grids centred on latitude 27º27.5′ south, longitude 153º5′ east.

The four nested grids were as follows:

- 750 km x 750 km with 30 km resolution
- 250 km x 250 km with 10 km resolution
- 75 km x 75 km with 3 km resolution
- 25 km x 25 km with 1 km resolution

Thirty (30) vertical levels were used with lower-level steps at 10, 25, 50, 750 and 100 metres up to 8 kilometres in altitude. This is greater than the normal number of vertical layers in order to provide a better resolution of vertical layers. Boundary conditions on the outer grid were derived from the synoptic analysis. Non-hydrostatic pressures were ignored due to the gentle terrain and moderate resolution.

6.4 CALMET

6.4.1 Overview

As discussed in the previous section, a 3-dimensional prognostic dataset derived from the TAPM model was input to CALMET to predict meteorological conditions at the project site and surrounding area. The following sections provide an overview of the data utilised in the CALMET modelling, along with details of some of the key parameters selected to establish calculation limits within CALMET.

6.4.2 CALMET Modelling Configuration

The CALMET configuration used is consistent with NSW OEH guidance (TRC,2011). The model was run over the full year based on a 3-dimensional grid produced using the CALTAPM utility program to convert TAPM data to MM5 format suitable for CALMET to read.

Observations from Cannon Hill DETSI station were incorporated into the model to increase the accuracy of model predicted wind speeds and direction.

The CALMET grid was configured with a 100-metre spacing and 100 by 100 grid points for the domain. Twelve vertical layers were modelled with cell face heights of 0, 20, 40, 80, 160, 300, 450, 650, 900, 1200, 1700, 2300, and 3200 metres. This is greater than the normal number of vertical layers to provide better resolution of vertical layers.

Mixing height calculation parameters were set to default values except the Coriolis parameter which was set to -6.71 x 10^{-5} as calculated from the Coriolis parameter equation:

$$f = 2\,\Omega\,\sin(\phi)\text{, where:}$$

- F is the Coriolis parameter;
- Ω is the Earth's rotation rate (2π/86400 or 7.29x10-5 rad·s-1);
- ϕ is the latitude which in this case is -27.46°.

Temperature prediction parameters were set to default. Divergence minimisation was used. Slope flow effects were included.

CALMET was run in hybrid mode (NOOBS = 1) using TAPM prognostic data and surface observations from the DETSI Cannon Hill meteorological station. R1 and R1MAX values of 10 and 20 kilometres were used for the observational data.

The output from CALMET was a 3-dimensional grid of wind-field data for incorporation into CALPUFF.

6.4.3 Terrain and Land Use Data

Terrain data for the area surrounding the development was obtained from the digital Elevation model (DEM) 5 Metre Grid of Australia derived from the LiDAR model, which represents a national 5-metre (bare earth) DEM that has been derived from some 236 individual LiDAR surveys between 2001 and 2015. Data for a 10 x 10 km area has been extracted for use in the modelling.

The TERRAD value in CALMET is used to determine the radius of influence for terrain features within the model domain. The TERRAD value has been calculated based on the rule 'ridge-to-ridge divided by 2, rounded up' recommended by the NSW Office of Environment and Heritage (TRC, 2011). Based on an average ridge to ridge distance, a TERRAD value of 2 kilometres has been adopted.

Land use data was also created based on the Queensland Government Land Use Dataset and satellite imagery and incorporated into the CALMET model. Where land use categories do not correspond with the CALMET land use input file categories, satellite imagery has been reviewed to determine the most appropriate land use category.

Figure 6.4 and **Figure 6.5** present the modelled terrain and land use in CALMET.

Figure 6.4: Modelled Terrain

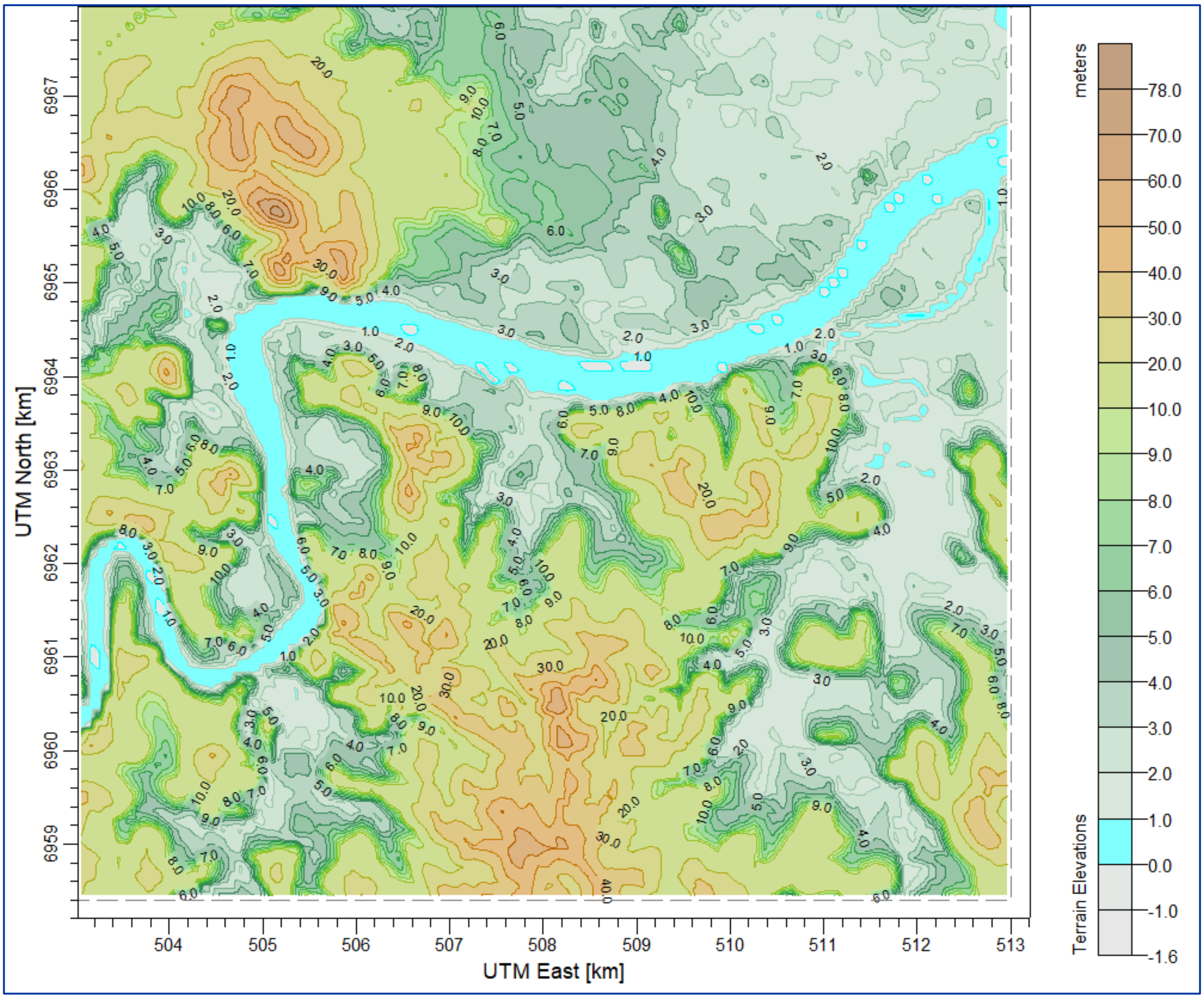
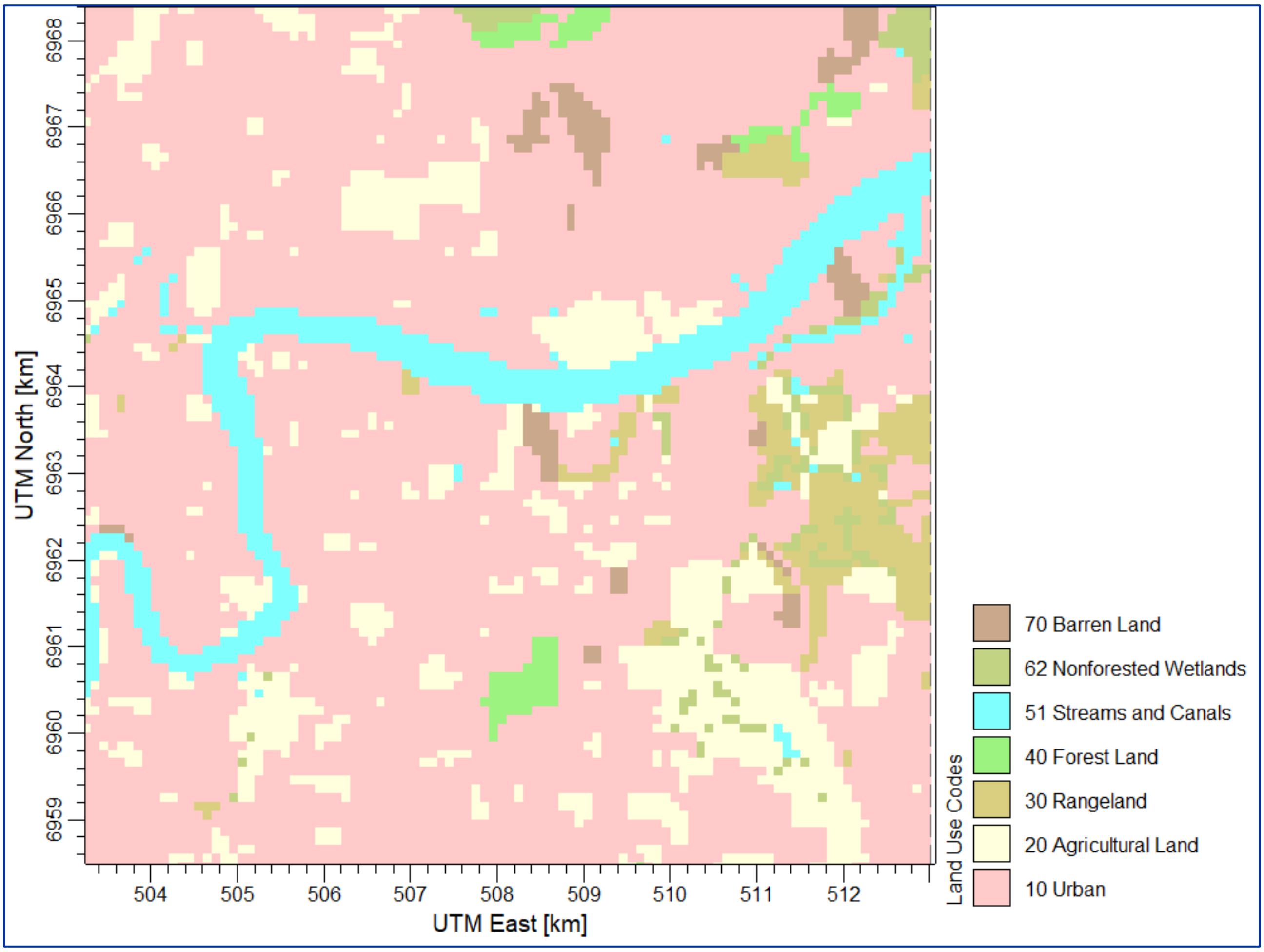


Figure 6.5: Modelled Land Use



6.5 Meteorological Predictions

6.5.1 Wind Predictions

The frequency distribution of wind direction and speed as predicted by CALMET are shown in **Table 6.3** and illustrated as a wind rose in **Figure 6.6.** The wind rose for the subject is consistent with the measured wind rose at Cannon Hill DETSI station, with predominant winds from the southwest.

The inclusion of surface data results in model predictions consistent with those observed at Cannon Hill monitoring station. However, the model predicts slightly higher calm conditions (12.4%) at the site.

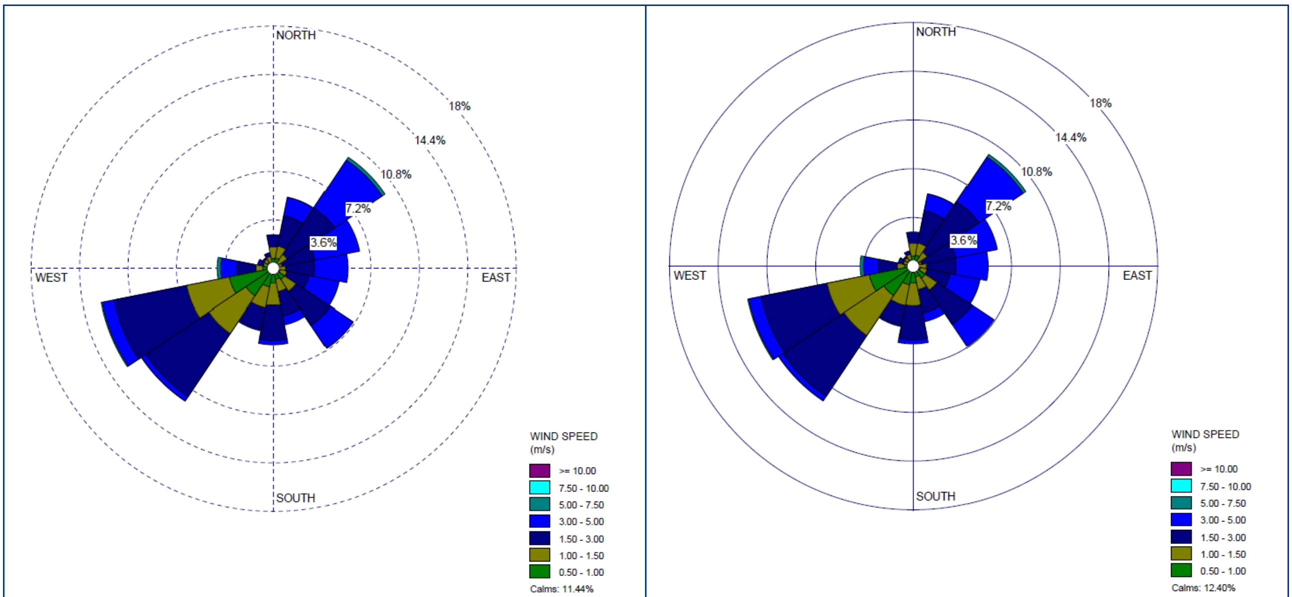
Overall, despite minor differences in wind speed distribution, CALMET captures the dominant wind behaviour for the area and is suitable for use in this assessment.

Table 6.3: Frequency Distribution of Wind Speed (m/s) and Direction Predicted by CALMET at the Subject Site

Direction	Frequency Distribution (%)								Total (%)
-	0 – 0.5 (m/s)	0.5 – 1.0 (m/s)	1.0 – 1.5 (m/s)	1.5 – 3.0 (m/s)	3.0 – 5.0 (m/s)	5.0 – 7.5 (m/s)	7.5 – 10 (m/s)	> 10 (m/s)	-
Calm	12.4	-	-	-	-	-	-	-	12.4
N	-	0.8	0.9	0.8	<0.1	<0.1	<0.1	<0.1	2.5

Direction	Frequency Distribution (%)								Total (%)
-	0 – 0.5 (m/s)	0.5 – 1.0 (m/s)	1.0 – 1.5 (m/s)	1.5 – 3.0 (m/s)	3.0 – 5.0 (m/s)	5.0 – 7.5 (m/s)	7.5 – 10 (m/s)	> 10 (m/s)	-
NNE	-	0.8	0.9	2.4	1.3	<0.1	<0.1	<0.1	5.4
NE	-	0.5	0.8	4.5	3.9	0.2	<0.1	<0.1	9.9
ENE	-	0.3	0.3	2.6	3.1	<0.1	<0.1	<0.1	6.3
E	-	0.4	0.6	2.2	2.3	<0.1	<0.1	<0.1	5.5
ESE	-	0.5	0.5	1.7	2.2	<0.1	<0.1	<0.1	5.0
SE	-	1.1	1.1	3.0	1.9	<0.1	<0.1	<0.1	7.1
SSE	-	0.8	1.0	1.8	0.6	<0.1	<0.1	<0.1	4.2
S	-	1.2	1.7	2.5	0.3	<0.1	<0.1	<0.1	5.7
SSW	-	1.4	1.5	1.5	0.1	<0.1	<0.1	<0.1	4.5
SW	-	2.6	3.5	5.4	0.4	<0.1	<0.1	<0.1	11.9
WSW	-	3.3	3.2	5.0	0.9	0.1	<0.1	<0.1	12.4
W	-	0.7	0.5	1.4	1.1	0.3	<0.1	<0.1	3.9
WNW	-	0.4	0.3	0.2	0.2	<0.1	<0.1	<0.1	1.1
NW	-	0.5	0.3	0.1	<0.1	<0.1	<0.1	<0.1	0.9
NNW	-	0.5	0.4	0.3	<0.1	<0.1	<0.1	<0.1	1.2
Total %	**12.4**	**15.7**	**17.4**	**35.5**	**18.3**	**0.6**	**<0.1**	**<0.1**	**100**

Figure 6.6: Measured Wind Rose at the DETSI Station and Predicted Wind Rose at the Subject Site

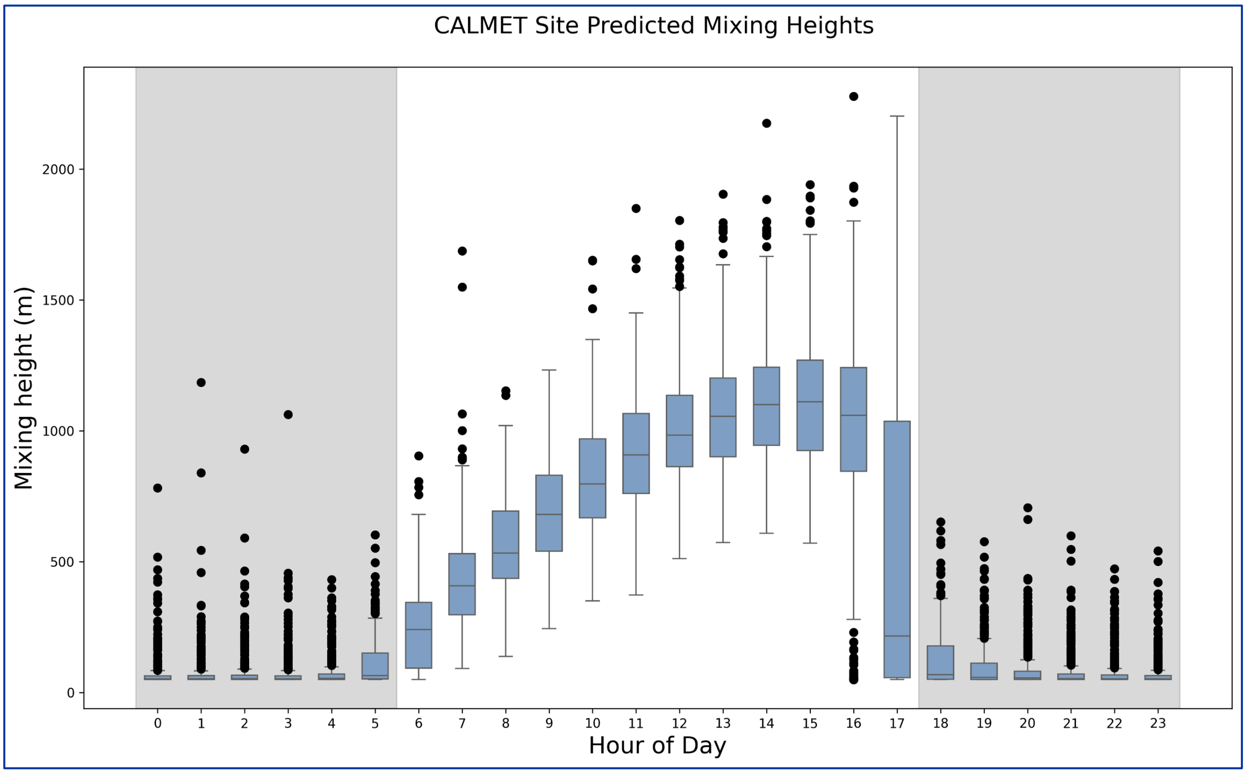


Measured wind rose at the Cannon Hill DETSI Station	CALMET predicted wind rose at the site

6.5.2 Mixing Heights

Figure 6.7 shows the variation in mixing height throughout the day. In the morning, the mixing height rises gradually, reaching an average of approximately 1.1 kilometres by the afternoon, then rapidly reforming at ground level again at nightfall.

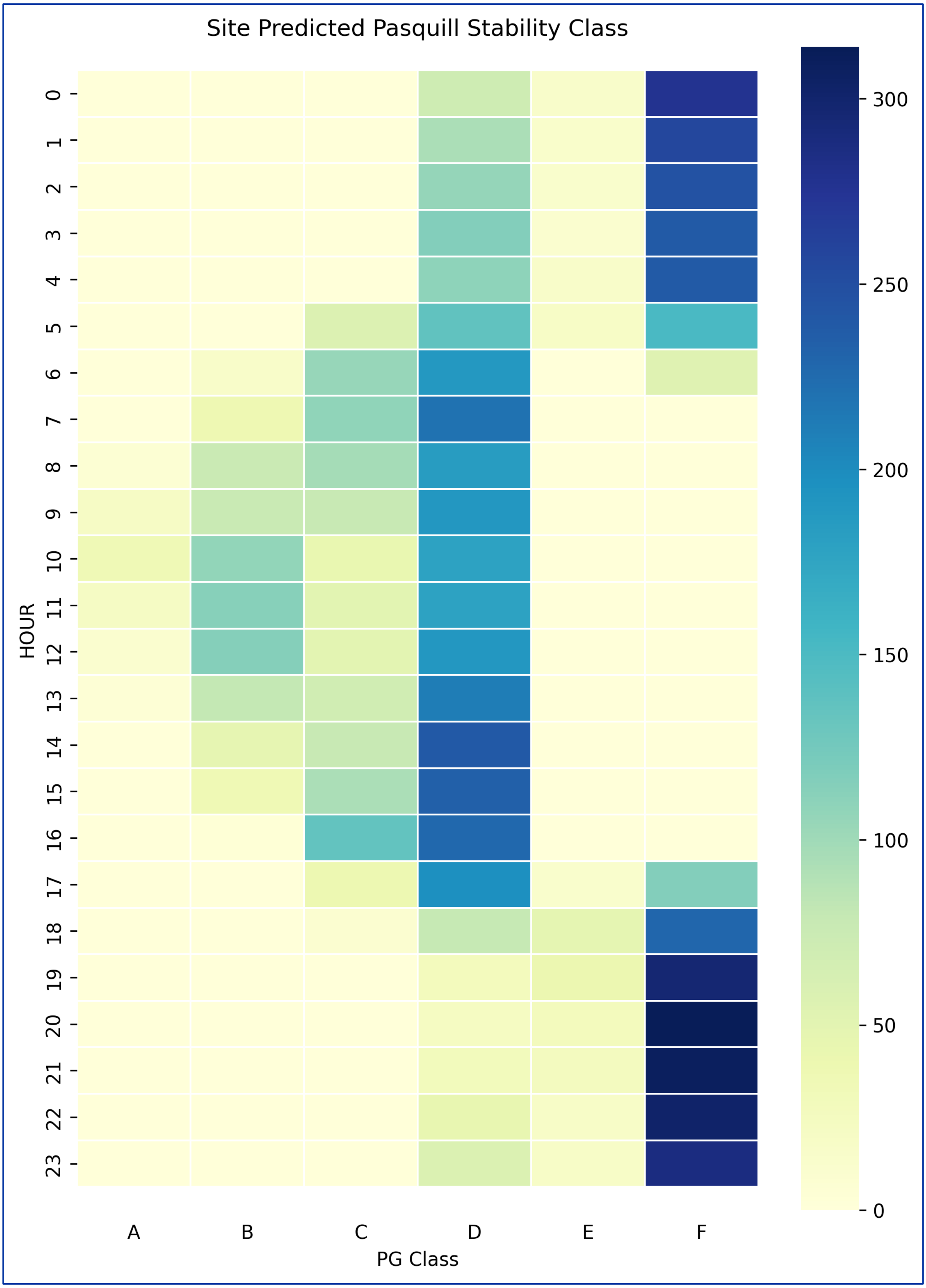
Figure 6.7: Prediction of Mixing Height from CALMET



6.5.3 Stability Class

Figure 6.8 shows the frequency of stability classes throughout the day. Daytime conditions are either neutral or unstable, while nighttime conditions are stable or neutral.

Figure 6.8: Diurnal Frequency of stability Classes



7. EMISSION INVENTORY

7.1 Source Parameters

The Information Request provided by the Brisbane City Council on 10 March 2026 states:

Given the separation distance to sensitive receptors, a sensitivity analysis of key emission parameters (e.g., maximum/minimum exhaust velocity, stack temperature) is required.

Therefore, source parameters, and the resulting emission rates, have been modelled at both a minimum and maximum emission parameter scenarios. These are referred to as Scenario 1 and Scenario 2, respectively.

The cremator stack has been modelled as a point source (see **Figure 7.1**), with relevant release parameters for both Scenario 1 and 2 detailed in **Table 7.1**.The exhaust temperature in Scenario 1 has been modelled as the minimum temperature of the secondary chamber, while for Scenario 2 it has been set to the maximum operating temperature of the secondary chamber.

Pollutant emissions were conservatively modelled at a constant rate throughout the proposed operational schedule of the facility. To reduce the model run time, a singular pollutant was modelled at a 1 g/s emission rate. The appropriate calculated emission rates presented in **Table 7.4** were then applied to the corresponding CALPOST outputs to determine the predicted pollutant concentrations at receptors.

Figure 7.1: Modelled Source Location

Table 7.1: Modelled Stack Parameters

Parameter	Unit	Value	
		Scenario 1	Scenario 2
X and Y Coordinates	m	508,016.1 6,963,390.9	
Height	m	9	
Diameter	m	0.33	
Exit velocity	m/s	5	15
Exit temperature	K	1123.15	1573.15
Flow rate	m^3/s	0.43	1.28

7.2 Emission Rates

As described in **Section 2.3**, the YDF-100 incinerator is the main source of air pollutants for the site operations. Emission rates have been calculated based on the manufacturer supplied emission data and release parameters. Supplier emission concentrations do not cover a comprehensive list of pollutants; therefore, the following considerations were made in deriving the relevant emission rates:

- It is assumed that the supplier specified dust concentration is equivalent to TSP. No additional data was provided regarding TSP:PM_{10}:$PM_{2.5}$ ratio. Therefore, the specified dust concentration was assumed to be entirely $PM_{2.5}$. As a result, TSP, PM_{10} and $PM_{2.5}$ emission rates are constant.
- Emission rates for heavy metals were estimated using the supplier specified heavy metal group concentration and ratios calculated using the National Pollutant Inventory (NPI) emission estimation manual for crematoria (DSEWPC, 2011) emission factors for each specific metal.
- Emission rates for pollutants identified in the NPI emission manual that did not have manufacturer supplied emissions concentrations were calculated based on NPI emission factors and operation activity supplied by the client.
- Limited data is available for expected odour levels from the facility. Available data includes measurements from the flue gas of a human crematorium (Hong Kong Productivity Council, 2004) and from a pet crematorium in Brisbane (Assured Environmental, 2019). These were compared to determine an appropriate emission rate. Based on the measured levels at the two facilities, the higher odour concentration taken from the pet crematorium in Brisbane of 567 ou.m^3/s was conservatively adopted for use in the assessment. This value is considered representative, as the measurements were undertaken at a pet crematorium during the approximately 45-minute cremation of medium- to large-sized animals, consistent with the proposed Pet Haven Crematorium operations.

7.2.1 Manufacturer Data

Pet Haven Crematorium provided manufacturer emission concentrations (see **Section 2.3**) for the YDF-100 incinerator. Test conditions, testing standards and fuel type of these supplied concentrations are unknown and, as such, conservative approaches have been taken where appropriate. The provided emission concentrations have been converted to emission rates based on the corresponding flow rates for Scenario 1 and Scenario 2. **Table 7.2** shows the modelled emission rates for pollutants with manufacturer supplied emission concentrations.

Table 7.2: Modelled Emission Rates from Manufacturer Supplied Emission Concentrations

Pollutant	Emission Rate (g/s)	
	Scenario 1	Scenario 2
CO	3.1E-02	9.3E-02
HF	2.5E-03	7.6E-03
NO_2	6.5E-02	1.9E-01
TSP	3.7E-02	1.1E-01
PM_{10}	3.7E-02	1.1E-01
$PM_{2.5}$	3.7E-02	1.1E-01
SO_2	1.7E-02	5.1E-02
HCl	3.7E-02	1.1E-01
Mercury	1.9E-05	5.8E-05
Arsenic	1.1E-05	3.4E-05
Cadmium	3.8E-06	1.2E-05
Chromium III	2.8E-05	8.3E-05
Chromium VI	1.2E-06	3.7E-06
Copper	2.5E-05	7.5E-05
Lead	2.0E-04	6.1E-04
Nickel	1.5E-05	4.4E-05
Antimony	2.8E-05	8.3E-05

7.2.2 NPI Emission Factors

Estimation of emissions from the YDF-100 incinerator that did not have emission concentration data supplied by the manufacturer were derived using emission factors presented in the NPI Emission Estimation Technique Manual for Crematoria (DCCEEW, 2023). While the incinerator is proposed to have an included multi-stage filtration unit, calculated emission rates have been conservatively determined based on NPI emission factors for uncontrolled crematorium.

NPI emission factors are provided as kg pollutant per cremation (kg/cremation). Therefore, emission rates have been derived for the proposed operation of 3 cycles per day. Active emissions are expected for 45 minutes per cycle while the cremation process takes place. However, CALPUFF dispersion modelling does not allow for 45-minute emission increments, so emissions rates have been calculated assuming 60-minute emission period. As NPI emission factors are presented per cremation, the derived emission rates for Scenarios 1 and 2 remain constant.

Table 7.3 presents the emission factors used in the assessment and the modelled emission rates.

Table 7.3: Modelled Emission Rates from NPI Emission Factors

Pollutant	Emission Factor (kg/cremation)	Emission Rate (g/s)
Benzo-a-pyrene	2.6E-05	7.2E-06
Benzene	0.1 (as total VOCs)	2.8E-02
Toluene	0.1 (as total VOCs)	2.8E-02
Xylenes	0.1 (as total VOCs)	2.8E-02
Formaldehyde	1.5E-05	4.3E-06

Pollutant	Emission Factor (kg/cremation)	Emission Rate (g/s)
Acetaldehyde	5.9E-05	1.6E-05
PCDDs/PCDFs	4.9E-09	1.4E-09
Beryllium	6.2E-07	1.7E-07
Selenium	2.0E-05	5.5E-06
Zinc	1.6E-04	4.4E-05

7.2.3 Summary of Emissions Inventory

The YDF-100 incinerator emission rates for both Scenario 1 and Scenario 2 are summarised in **Table 7.4.**

Table 7.4: Modelled Emission Rates

Pollutant	Emission Rate (g/s)	
	Scenario 1	Scenario 2
CO	3.1E-02	9.3E-02
HF	2.5E-03	7.6E-03
NO_2	6.5E-02	1.9E-01
TSP	3.7E-02	1.1E-01
PM_{10}	3.7E-02	1.1E-01
$PM_{2.5}$	3.7E-02	1.1E-01
SO_2	1.7E-02	5.1E-02
HCl	3.7E-02	1.1E-01
Benzo-a-pyrene	7.2E-06	7.2E-06
Benzene	2.8E-02	2.8E-02
Toluene	2.8E-02	2.8E-02
Xylenes	2.8E-02	2.8E-02
Mercury	1.9E-05	5.8E-05
Formaldehyde	1.6E-05	1.6E-05
Acetaldehyde	1.4E-09	1.4E-09
PCDDs/PCDFs	1.7E-07	1.7E-07
Arsenic	1.1E-05	3.4E-05
Beryllium	1.7E-07	1.7E-07
Cadmium	3.8E-06	1.2E-05
Chromium III	2.8E-05	8.3E-05
Chromium VI	1.2E-06	3.7E-06
Copper	2.5E-05	7.5E-05
Lead	2.0E-04	6.1E-04
Nickel	1.5E-05	4.4E-05
Antimony	2.8E-05	8.3E-05
Selenium	2.0E-05	5.5E-06
Zinc	1.6E-04	4.4E-05

7.3 Building Downwash

Building downwash has been modelled using the BPIP Prime processor. The height and location of the modelled buildings is shown in **Figure 7.2**.

Figure 7.2: Location of Modelled Buildings

8. DISPERSION MODELLING METHOD

8.1 Overview

A mathematical model is used to stimulate the dispersion of pollutants after they are emitted into air. It is accepted by regulatory agencies that this type of modelling has associated uncertainties. These are normally addressed by using statistics over long stimulation times and deriving emission rates based on published emission factors or data representing high emission conditions.

CALPUFF (version 7.2.1) was chosen as the appropriate method for this assessment. The predictions undertaken for this assessment are based on the following method:

- Input meteorology was generated using TAPM, which was run over a full representative year (2023) to capture seasonal variability.
- The TAPM-derived meteorological data were refined using CALMET and observational data from DETSI Cannon Hill station.
- To optimise model processing time, CALPUFF was used to predict concentrations for a representative pollutant with an emission rate of 1 g/s, with results subsequently scaled according to the relevant pollutant-specific emission rates.

8.2 CALPUFF Configuration

The 3-dimensional wind fields from CALMET were entered into CALPUFF for the full year (2023). CALPUFF was run over a computational grid the same size as the meteorological grid (10 kilometres x 10 kilometres) with 100 metre grid spacing.

Wind speed profile was set to the Industrial Source Complex (ISC) Urban-1 exponents. Transitional plume rise and partial penetration of boundary layers were included.

The emissions were modelled as puffs and puff splitting was turned off.

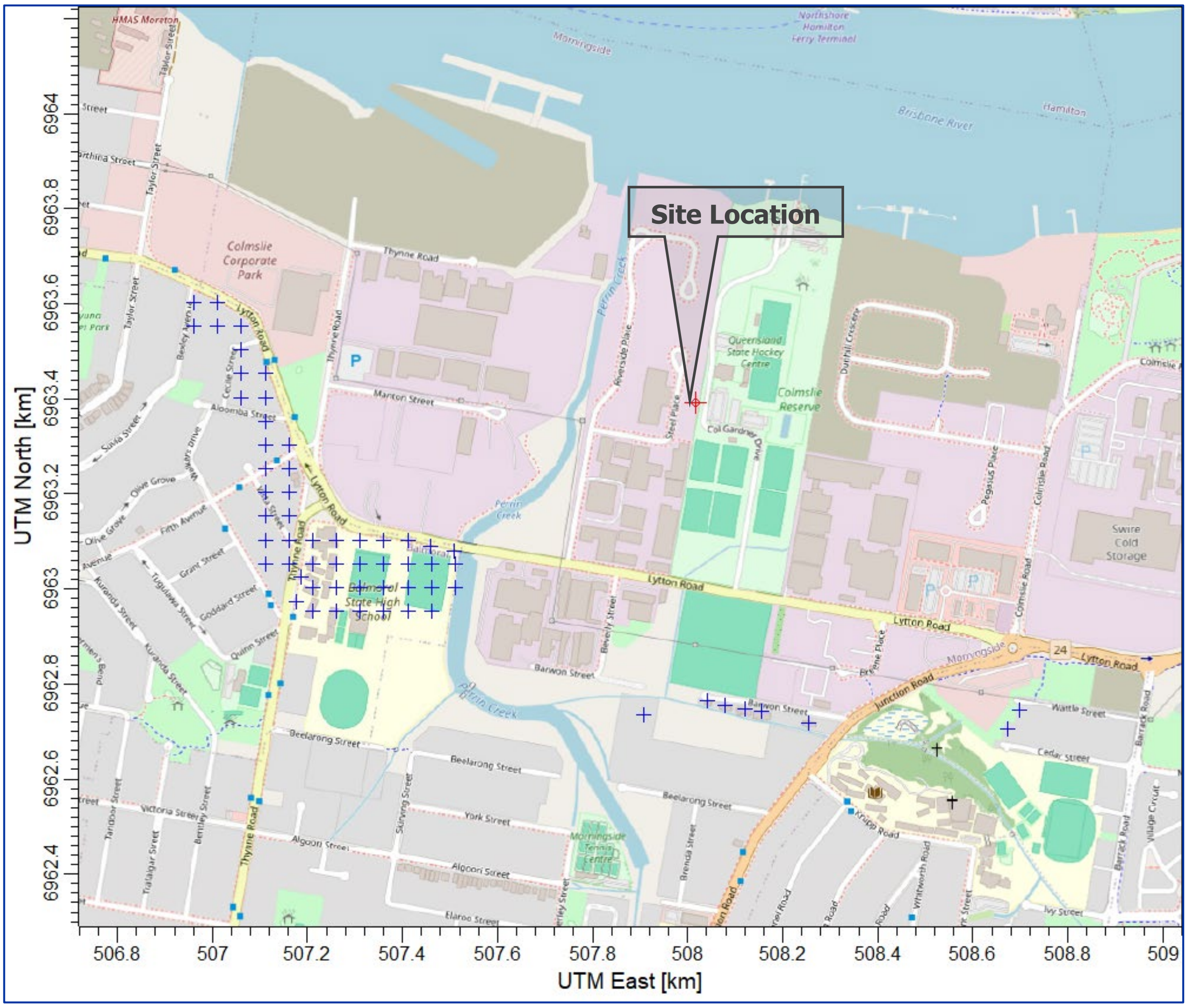
Dispersion coefficients were derived by the model using turbulence computed from micrometeorology. The Heffter curve was used to compute time-dependent dispersion beyond 550-metres. The partial plume adjustment method was used to allow winds to approach hills as terrain increases.

The minimum turbulence velocity, sigma v, was set to 0.2 m/s over land.

Figure 8.1 shows the modelled source and sensitive receptors for the proposed project.

Receptors were placed at 1.5 metres above ground to assess pollutant concentrations at ground level (typical breathing height). Receptor locations include the nearby school and residential houses (to the southeast and east).

Figure 8.1: Modelled Point Source and Sensitive Receptors



8.3 CALPOST

Post-processing of modelled emissions was undertaken using the CALPOST package, which provides detailed analysis of the pollutant predictions generated by the CALPUFF system. CALPOST can report predicted concentrations for a range of averaging periods from 1 hour to 1 year.

CALPOST outputs were multiplied by the relevant emission rates to determine the predicted pollutant concentrations at receptor locations.

9. DISPERSION MODELLING RESULTS

The maximum predicted incremental and cumulative pollutant concentrations at sensitive receptors are presented in **Table 9.1** and **Table 9.2** for Scenarios 1 and 2, respectively. The cumulative concentrations predicted at all assessed receptors comply with the relevant air quality and odour criteria for all pollutants assessed, thus achieving compliance with PO1(b) and PO1(c) of the Industry Code. It is noted that, at most receptors, the cumulative predicted concentrations are largely driven by background levels.

Given the substantial compliance margins and low cumulative concentrations predicted for all other pollutants and averaging periods, ground-level concentration plots are presented only for the worst-case pollutants under both short- and long-term averaging conditions for the worst-case scenario. **Figure 9.1** and **Figure 9.2** present the concentration plots for 24-hour average PM_{10} and annual average $PM_{2.5}$ for Scenario 2.

PO1(a) requires the development to avoid or minimise air emissions. This is achieved through the implementation of good combustion practices, adherence to manufacturer-specified operating conditions, routine maintenance, and the use of a multi-stage filtration system (as discussed in **Section 2.3**).

Table 9.1: Predicted Pollutant Concentrations for Scenario 1

Pollutant	Averaging period	Maximum Predicted Incremental Concentrations (µg/m³)	Background Concentration (µg/m³)	Maximum Predicted Cumulative Concentration (µg/m³)	Criteria (µg/m³)
CO	8 hours	0.3	285.5	285.8	11,000
HF	24 hours	8.2E-03	-	8.2E-03	2.9
	7 days	1.5E-03	-	1.5E-03	1.7
	30 days	9.0E-04	-	9.0E-04	0.84
	90 days	6.1E-04	-	6.1E-04	0.5
NO_X	1 hour	0.6	16.41	17.0	250
	Annual	7.6E-03	13.81	13.8	61
TSP	Annual	4.4E-03	26.98	27.0	90
PM_{10}	24 hours	0.1	19.11	19.2	50
	Annual	4.4E-03	17.28	17.3	25
$PM_{2.5}$	24 hours	0.1	7.22	7.3	25
	Annual	4.4E-03	6.98	7.0	8
SO_2	1 hour	0.2	5.71	8.9	570
	24 hours	5.5E-02	5.71	5.8	230
	Annual	2.0E-03	4.93	4.9	57
HCl	1 hour	0.3	-	0.3	140
Benzo-a-pyrene	Annual	8.5E-07	-	8.5E-04 ng/m3	0.3 ng/m3
Benzene	1 hour	0.3	6.6	6.9	29
	Annual	3.3E-03	5.5	5.5	10
Toluene	1 hour	0.3	23	23.3	958
	24 hours	9.2E-02	22.4	22.5	4,100

Pollutant	Averaging period	Maximum Predicted Incremental Concentrations (µg/m³)	Background Concentration (µg/m³)	Maximum Predicted Cumulative Concentration (µg/m³)	Criteria (µg/m³)
	Annual	3.3E-03	17.8	17.8	410
Xylenes	24 hours	9.2E-02	41.7	41.8	1,200
	Annual	3.3E-03	41.4	41.4	950
Mercury	1 hour	1.8E-04	< 0.0003	4.8E-04	0.18
Formaldehyde	1 hour	4.1E-05	10.9	10.9	96
	24 hours	1.4E-05	11.2	11.2	54
Acetaldehyde	1 hour	1.6E-04	-	1.6E-04	42
PCDDs/PCDFs	1 hour	1.3E-08	-	1.3E-08	2.0E-06
Arsenic	1 hour	1.1E-04	0.001	1.1E-03	0.09
	Annual	1.4E-03 ng/m3	0.001	1.0 ng/m3	6 ng/m3
Beryllium	1 hour	1.6E-06	-	1.6E-06	0.004
Cadmium	Annual	4.5E-04 ng/m3	7.0E-05	7.0E-02 ng/m3	5 ng/m3
Chromium III	1 hour	2.6E-04	0.002	2.3E-03	9
Chromium VI	1 hour	1.2E-05	0.002	2.0E-03	0.09
Copper	1 hour	2.4E-04	0.005	5.2E-03	3.7
Lead	Annual	2.4E-05	0.002	2.0E-03	0.5
Nickel	Annual	1.7E-06	0.002	2.0E-03	0.02
Antimony	1 hour	2.6E-04	-	2.6E-04	9
Selenium	24 hours	1.8E-05	-	1.8E-05	10
Zinc	1 hour	4.2E-04	0.02	2.0E-02	18
Odour	1 hour	3.0E-03 ou	-	3.0E-03 OU	0.5 ou

Table 9.2: Predicted Pollutant Concentrations for Scenario 2

Pollutant	Averaging period	Maximum Predicted Incremental Concentrations (µg/m³)	Background Concentration (µg/m³)	Maximum Predicted Cumulative Concentration (µg/m³)	Criteria (µg/m³)
CO	8 hours	0.3	285.5	285.8	11,000
HF	24 hours	8.3E-03	-	8.3E-03	2.9
	7 days	4.6E-03	-	4.6E-03	1.7
	30 days	2.6E-03	-	2.6E-03	0.84
	90 days	1.7E-03	-	1.7E-03	0.5
NO_X	1 hour	1.9	16.41	18.3	250
	Annual	2.1E-02	13.81	13.8	61
TSP	Annual	1.2E-02	26.98	27.0	90
PM_{10}	24 hours	0.1	19.11	19.2	50
	Annual	1.2E-02	17.28	17.3	25
$PM_{2.5}$	24 hours	0.1	7.22	7.3	25
	Annual	1.1E-02	6.98	7.0	8
SO_2	1 hour	0.5	5.71	6.2	570
	24 hours	5.6E-02	5.71	5.8	230
	Annual	5.5E-03	4.93	4.9	57
HCl	1 hour	1.0	-	1.0	140
Benzo-a-pyrene	Annual	7.8E-04 ng/m3	-	7.8E-04 ng/m3	0.3 ng/m3
Benzene	1 hour	0.3	6.6	6.9	29
	Annual	3.1E-03	5.5	5.5	10
Toluene	1 hour	0.3	23	23.3	958
	24 hours	3.1E-02	22.4	22.4	4,100
	Annual	3.1E-03	17.8	17.8	410

Pollutant	Averaging period	Maximum Predicted Incremental Concentrations (µg/m³)	Background Concentration (µg/m³)	Maximum Predicted Cumulative Concentration (µg/m³)	Criteria (µg/m³)
Xylenes	24 hours	3.1E-02	41.7	41.7	1,200
	Annual	3.1E-03	41.4	41.4	950
Mercury	1 hour	5.5E-04	< 0.0003	8.5E-04	0.18
Formaldehyde	1 hour	4.1E-05	10.9	10.9	96
	24 hours	4.7E-06	11.2	11.2	54
Acetaldehyde	1 hour	1.6E-04	-	1.6E-04	42
PCDDs/PCDFs	1 hour	1.3E-08	-	1.3E-08	2.0E-06
Arsenic	1 hour	3.3E-04	0.001	1.3E-03	0.09
	Annual	3.7E-03 ng/m3	0.001	1.0 ng/m3	6 ng/m3
Beryllium	1 hour	1.7E-06	-	1.7E-06	0.004
Cadmium	Annual	1.2E-03 ng/m3	7.0E-05	7.1E-02 ng/m3	5 ng/m3
Chromium III	1 hour	7.9E-04	0.002	2.8E-03	9
Chromium VI	1 hour	3.6E-05	0.002	2.0E-03	0.09
Copper	1 hour	7.2E-05	0.005	5.7E-03	3.7
Lead	Annual	6.6E-05	0.002	2.1E-03	0.5
Nickel	Annual	4.7E-06	0.002	2.0E-03	0.02
Antimony	1 hour	8.0E-04	-	8.0E-04	9
Selenium	24 hours	6.1E-06	-	6.1E-06	10
Zinc	1 hour	4.3E-04	0.02	2.0E-02	18
Odour	1 hour	3.0E-03 OU	-	3.0E-03 OU	0.5

Figure 9.1: Scenario 2 Predicted Cumulative 24-hour PM_{10} Concentration

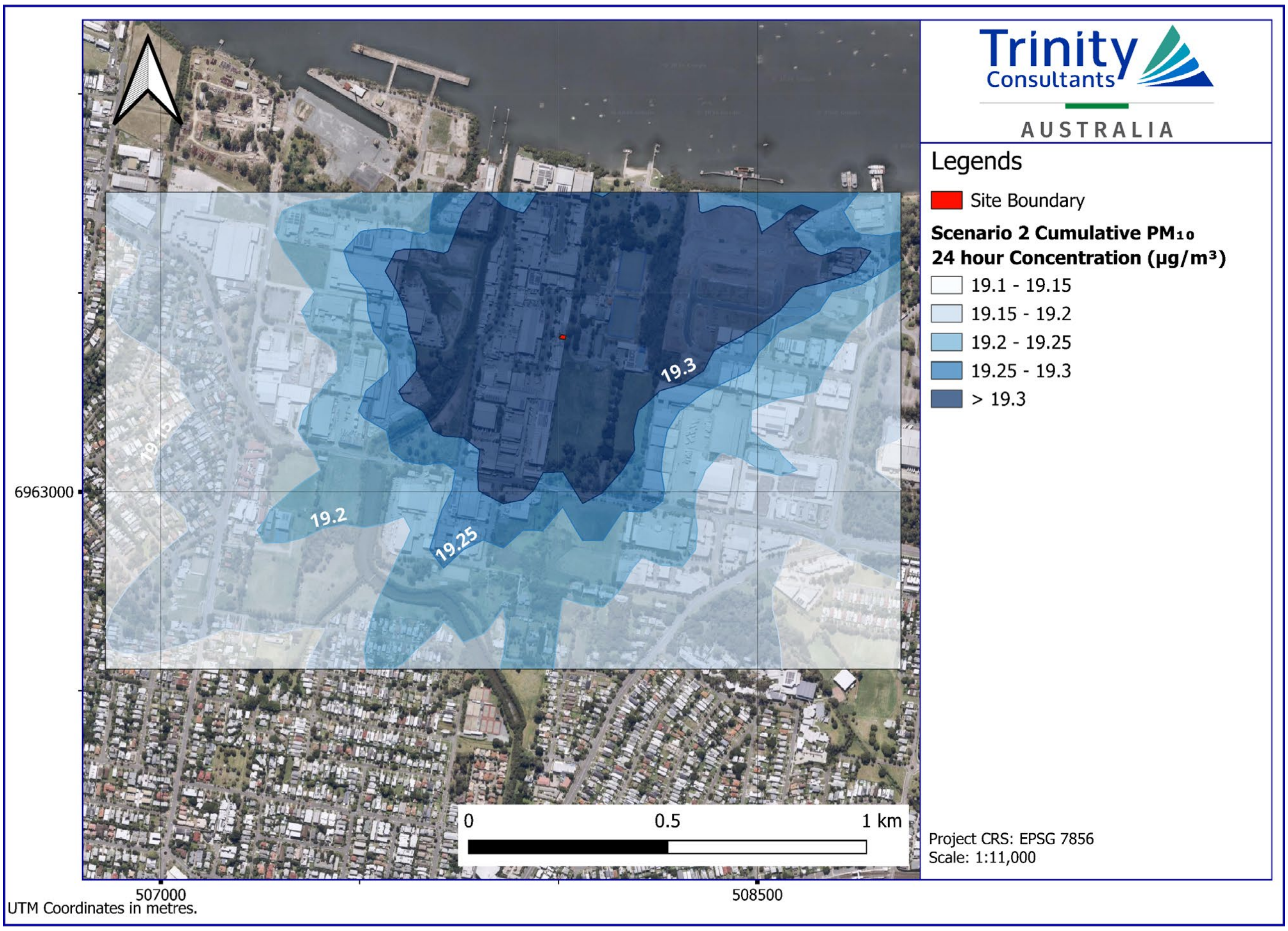
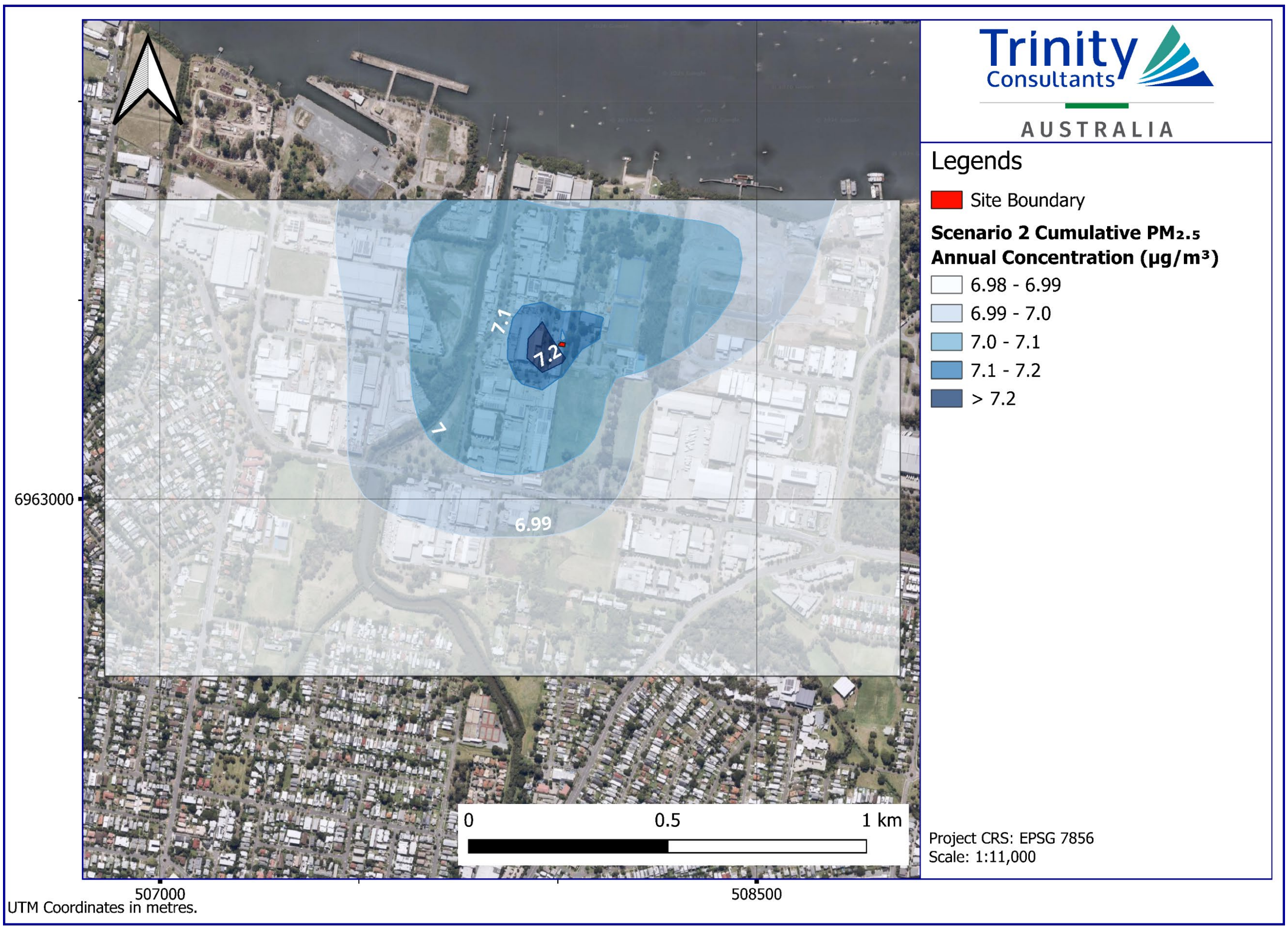


Figure 9.2: Scenario 2 Predicted Cumulative Annual $PM_{2.5}$ Concentration



10. CONCLUSION

An air quality assessment has been conducted for the proposed pet crematorium to be located at 3/41 Steel Street, Morningside. The results of the assessment are summarised as follows:

- The main source of emissions is the YDF-100 incinerator, which vents combustion emissions through a stack.
- The development minimises air emissions through the implementation of good combustion practices, adherence to manufacturer-specified operating conditions, routine maintenance, and the use of a multi-stage filtration system, thus achieving compliance with PO1(a) of the Industry Code.
- The cumulative concentrations predicted at all assessed receptors comply with the relevant air quality and odour criteria for all pollutants assessed, thus achieving compliance with PO1(b) and PO1(c) of the Industry Code.

Overall, the proposed pet crematorium is predicted to comply with the relevant air quality criteria, with associated impacts expected to be low.

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APPENDIX A GLOSSARY

Parameter or Term	Description
BoM	Bureau of Meteorology
BPIP	Building Profile Input Program
CALMET	Diagnostic meteorological model included in the CALPUFF Modelling System
CALPUFF	Gaussian puff dispersion model included in the CALPUFF Modelling System
CALTAPM	Utility used to convert TAPM output files into a format readable by CALMET
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Development Approval
DEM	Digital Elevation Model
EP Act	Environmental Protection Act 1994
ISC	Industrial Source Complex
m/s	Metres per second
m^3	Cubic Metre
NSW OEH	New South Wales Office of Environment and Heritage
NSW EPA	New South Wales Environment Protection Authority
OU	Odour units, the number of dilutions of the odour to reach the odour intensity at which a panel of qualified people can just detect it. Refer to AS4323.3 for a scientific definition.
$PM_{2.5}$	Particulates suspended in air with aerodynamic diameter less than 2.5 microns
PM_{10}	Particulates suspended in air with aerodynamic diameter less than 10 microns
R1	Relative weight given to an observation site in the CALMET model. It is the radius where the Step 1 wind field and the surface observations are weighted equally.
TAPM	The Air Pollution Model developed by CSIRO
Terrad	Radius of influence of terrain features in the CALMET model
VOC	Volatile organic compound

Trinity Consultants Australia

BRISBANE

A: Level 3, 43 Peel Street
South Brisbane, QLD 4101
T: +61 7 3255 3355
E: brisbane@trinityconsultants.com

GLADSTONE (Vision Environment)

A: Unit 3, 165 Auckland Street
PO Box 1267
Gladstone, QLD 4680
T: +61 7 4972 7530
E: office@visionenvironment.com.au

SYDNEY

A: Upper Ground, 55 Brisbane Street
Surry Hills, NSW 2010
T: +61 2 7255 4077
E: sydney@trinityconsultants.com

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