AIR QUALITY ASSESSMENT

131 ST VINCENT STREET, ULLADULLA

Olivander Capital

9 July 2024

Job Number 23071615

Prepared by

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Air Quality Assessment
131 St Vincent Street, Ulladulla

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1 INTRODUCTION

Todoroski Air Sciences has prepared this report for Olivander Capital and the Fleming Group. It presents an assessment of the potential air quality impacts associated with the proposed mixed-use residential and commercial development at 131 St Vincent Street, Ulladulla, New South Wales (NSW) (hereafter referred to as the Project).

The Project involves rezoning the site from E4 General Industrial to MU1 Mixed Use under the Shoalhaven Local Environment Plan 2014 to allow for a development comprising of residences, commercial operations, affordable housing and a childcare centre. This report investigates the potential for air quality impacts to arise at the Project site due to air emission sources.

This air quality impact assessment has been prepared in general accordance with the NSW Environment Protection Authority (EPA) document *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA, 2022**).

To assess the potential air quality impacts associated with the Project, this report incorporates the following aspects:

- A background and description of the Project;
- A review of the existing meteorological and air quality conditions of the Project site;
- A description of the dispersion modelling approach and emission estimation used to assess potential air quality impacts;
- Presentation of the predicted results and a discussion of the potential air quality impacts; and,
- Suggested air quality mitigation measures.

2 PROJECT BACKGROUND

2.1 Local setting

The Project site is located at 131 St Vincent Street, Ulladulla, on the corner of St Vincent Street and Parson Street. The site is currently situated on the edge of an industrial zone comprising of various commercial and industrial operations. A residential area adjoins the site to the north and a productivity support area (which includes a mixture of commercial and warehousing activities) to the east. The Princes Highway is located approximately 0.2 kilometres (km) to the east of the site.

Figure 2-1 presents the Project setting with reference to the current land use zones surrounding the Project.

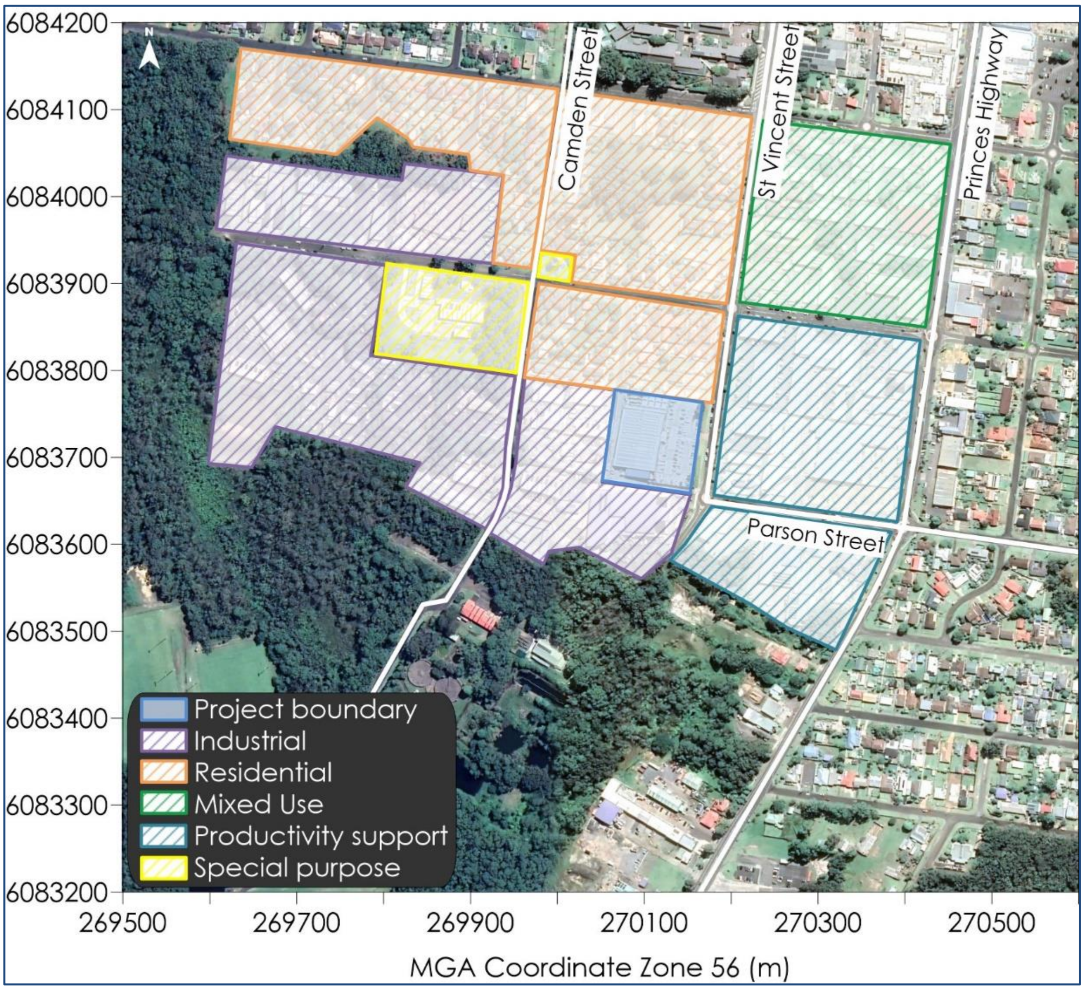


Figure 2-1: Project location

Figure 2-2 presents a representative three-dimensional visualisation of the terrain features surrounding the Project location. The local topography is relatively flat at the site and undulating the surrounding area with increasing elevations moving west of the site. The Tasman Sea is located to the east of the Project site.

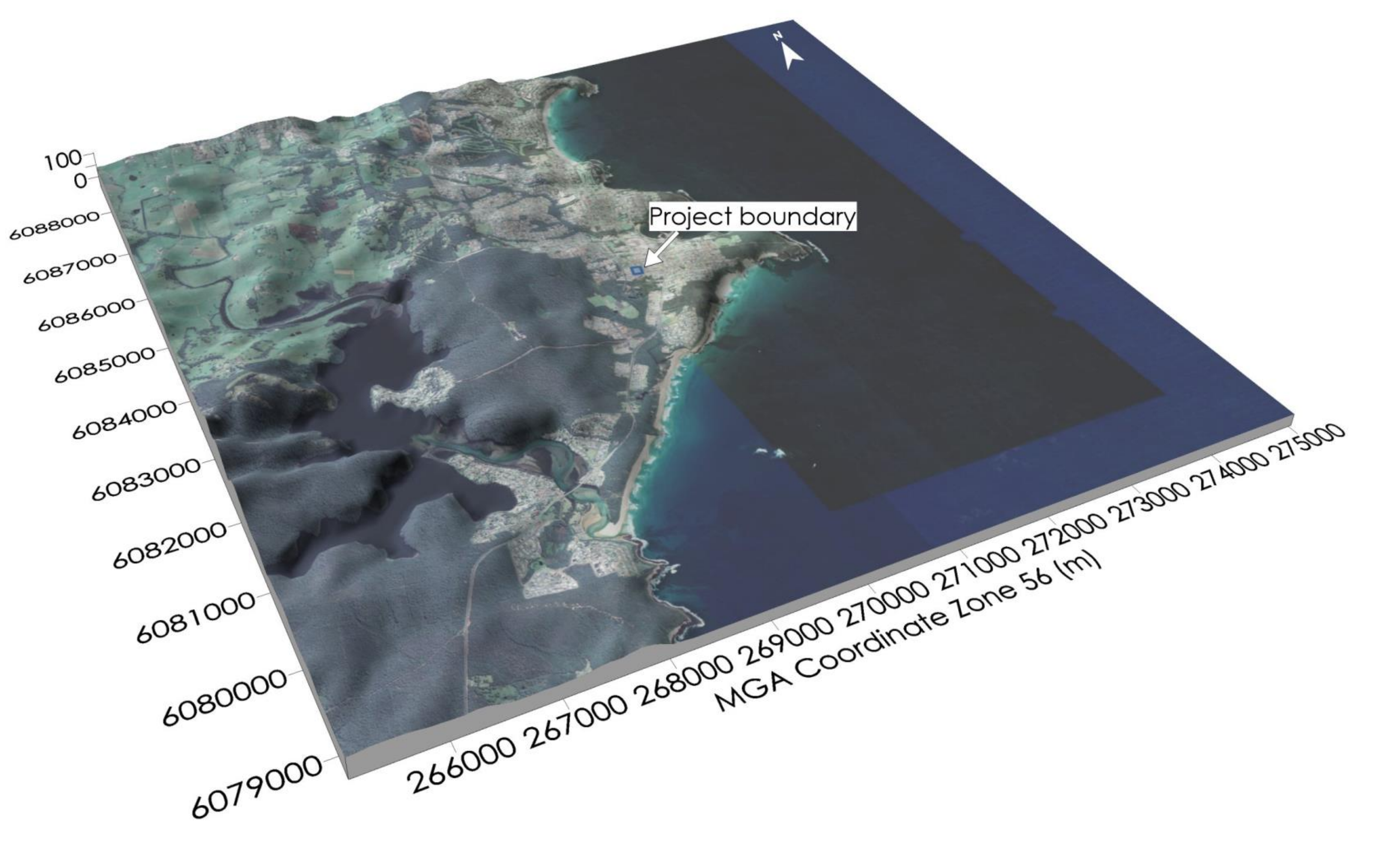


Figure 2-2: Representative visualisation of the local topography surrounding the Project

2.2 Project description

The Project seeks to rezone the site, formally known as Lot 26 DP759018, from E4 General Industrial to MU1 Mixed Use to allow for the development of a mixed-use residential and commercial precinct. The precinct will include a 4-tower development ranging up to five stories, with the inclusion of a perimeter road to increase the setback of the development from the adjacent concrete batching plant. The tower does not feature opening windows fronting the industrial uses.

Figure 2-3 presents an indicative layout of the Project site.

The focus of this report is to consider the potential for air quality impacts due to nearby air emission sources to result in any adverse impacts upon residences at the Project site.

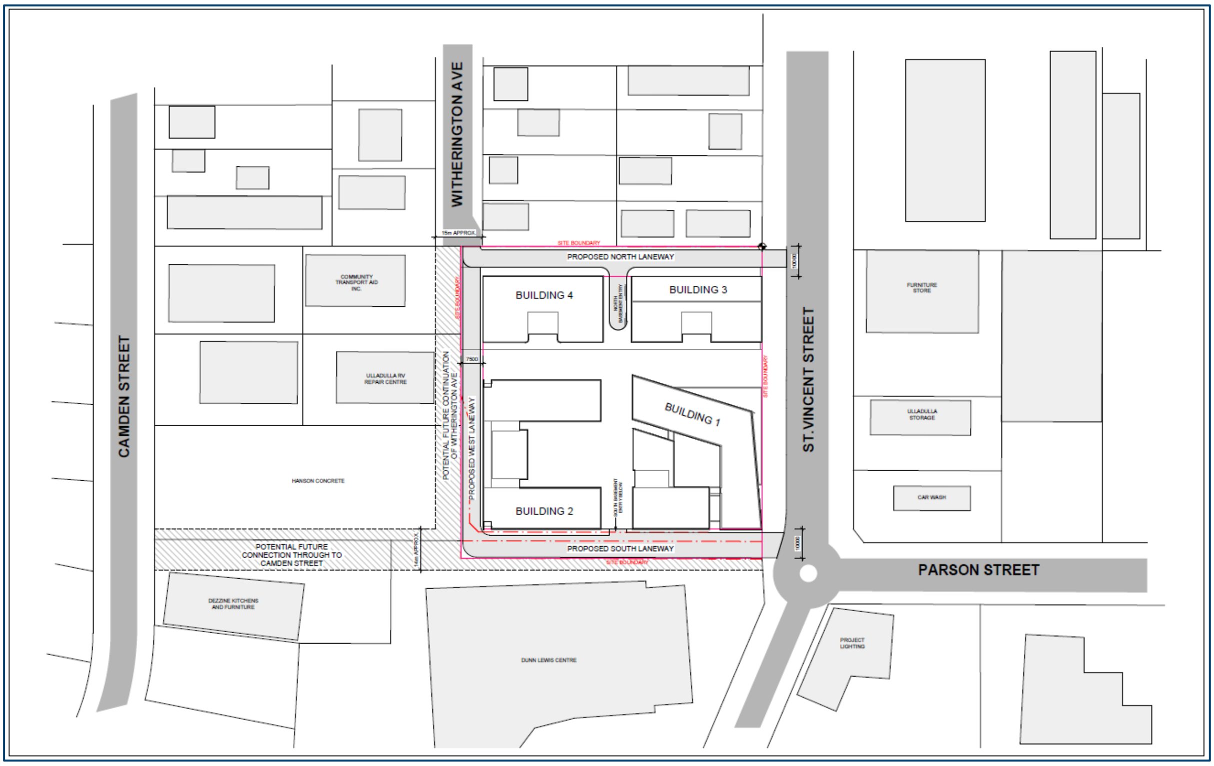


Figure 2-3: Indicative layout of the Project

3 AIR QUALITY CRITERIA

3.1 Particulate matter

Particulate matter consists of dust particles of varying size and composition. Air quality goals refer to measures of the total mass of all particles suspended in air defined as the Total Suspended Particulate matter (TSP). The upper size range for TSP is nominally taken to be 30 micrometres (µm) as in practice particles larger than 30 to 50µm will settle out of the atmosphere too quickly to be regarded as air pollutants.

Two sub-classes of TSP are also included in the air quality goals, namely PM_{10}, particulate matter with equivalent aerodynamic diameters of 10µm or less, and $PM_{2.5}$, particulate matter with equivalent aerodynamic diameters of 2.5µm or less.

Particulate matter, typically in the upper size range, that settles from the atmosphere and deposits on surfaces is characterised as deposited dust. The deposition of dust on surfaces may be considered a nuisance and can adversely affect the amenity of an area by soiling property in the vicinity.

3.2 Other pollutants

NO_2 is reddish-brown in colour (at high concentrations) with a characteristic odour and can irritate the lungs and lower resistance to respiratory infections such as influenza. NO_2 belongs to a family of reactive gases called nitrogen oxides (NO_X). These gases form when fuel is burned at high temperatures, mainly from motor vehicles, power generators and industrial boilers (**USEPA**, **2011**). It is important to note that when formed, NO_2 is generally a small fraction of the total NO_X generated.

Sulfur dioxide (SO_2) is a colourless, toxic gas with a pungent and irritating smell. It commonly arises in industrial emissions due to the sulphur content of the fuel. SO_2 can have impacts upon human health and the habitability of the environment for flora and fauna. SO_2 emissions are a precursor to acid rain, which can be an issue in the northern hemisphere; however it is not known to have any widespread impact in NSW, and is generally only associated with large industrial activities. Due to its potential to impact on human health, sulfur is actively removed from fuel to prevent the release and formation of SO_2. The sulfur content of Australian diesel is controlled to a low level by national fuel standards.

CO is a colourless, odourless and tasteless gas generated from the incomplete combustion of fuels when carbon molecules are only partially oxidised. It can reduce the capacity of blood to transport oxygen in humans resulting in symptoms of headache, nausea and fatigue.

3.3 NSW EPA impact assessment criteria

Table 3-1 summarises the key air quality goals that are relevant to the assessment as outlined in the NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA, 2022**).

The air quality goals for total impact relate to the total pollutant burden in the air and not just the contribution from the Project. Consideration of background pollutant levels needs to be made when using these goals to assess potential impacts.

Table 3-1: NSW EPA air quality impact assessment criteria

Pollutant	Averaging Period	Criterion	Assessment location
TSP	Annual	90 µg/m³	Receptor
PM_{10}	Annual	25 µg/m³	Receptor
	24 hour	50 µg/m³	Receptor
$PM_{2.5}$	Annual	8 µg/m³	Receptor
	24 hour	25 µg/m³	Receptor
Deposited dust	Annual	2 g/m²/month	Receptor
		4 g/m²/month	Receptor
Sulfur dioxide (SO_2)	24-hour	57 µg/m³	Receptor
	1-hour	286 µg/m³	Receptor
Nitrogen dioxide (NO_2)	Annual	31 µg/m³	Receptor
	1-hour	164 µg/m³	Receptor
Carbon monoxide (CO)	8-hour	10 mg/m³	Receptor
	1-hour	30 mg/m³	Receptor
	15-minute	100 mg/m³	Receptor

Source: **NSW EPA, 2022**
µg/m³ = micrograms per cubic metre
g/m²/month = grams per square metre per month

4 EXISTING ENVIRONMENT

This section describes the existing environment including the climate and ambient air quality in the area surrounding the Project.

4.1 Local climate

Long-term climatic data from the Bureau of Meteorology weather station at Ulladulla Automatic Weather Station (AWS) (Site No. 069138) were analysed to characterise the local climate in the proximity of the Project site. The Ulladulla AWS is located approximately 1.2km east of the Project.

Table 4-1 and **Figure 4-1** present a summary of data from Ulladulla AWS collected over an approximate 16 to 32-year period for the various meteorological parameters.

The data indicate that January is the hottest month with a mean maximum temperature of 24.3 degrees Celsius (°C), July is the coldest month with mean minimum temperatures of 8.9°C.

Rainfall is highest during the first half of the year, with an average annual rainfall of 1163.2 millimetres (mm) over 95.3 days. The data show March is the wettest month with an average rainfall of 138.0mm over 9.6 days and December is the driest month with an average rainfall of 73.4mm over 8.7 days.

Relative humidity levels exhibit little variability over the year and seasonal fluctuations. Mean 9am relative humidity levels range from 60% in August to 80% in February. Mean 3pm humidity levels vary from 56% in August to 73% in February.

Wind speeds have a greater spread between the 9am and 3pm conditions during the warmer months of the year compared to the cooler months. The mean 9am wind speeds range from 12.3 kilometres per hour (km/h) in March to 14.9km/h in November. The mean 3pm wind speeds vary from 16.3km/h in June and July to 21.2km/h in November.

Table 4-1: Monthly climate statistics summary – Ulladulla AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Temperature													
Mean max. temp. (°C)	24.3	24.2	23.3	21.5	19.2	16.9	16.5	17.3	19.2	20.7	21.6	23.0	20.6
Mean min. temp. (°C)	17.6	17.7	16.5	14.1	11.9	9.9	8.9	9.2	10.9	12.5	14.2	16.0	13.3
Rainfall													
Rainfall (mm)	92.9	127.3	138.0	99.5	97.6	115.0	85.9	73.5	75.3	92.0	95.0	73.4	1163.2
No. of rain days (≥1mm)	9.6	9.6	9.6	8.4	6.5	7.6	5.9	5.0	7.4	8.3	8.7	8.7	95.3
9am conditions													
Mean temp. (°C)	20.5	20.5	19.6	18.1	15.6	13.2	12.5	13.6	15.5	17.1	17.6	19.4	16.9
Mean R.H. (%)	77.0	80.0	76.0	69.0	68.0	67.0	63.0	60.0	63.0	66.0	73.0	74.0	70.0
Mean W.S. (km/h)	13.7	13.7	12.3	12.9	12.4	13.6	13.3	13.5	14.6	14.5	14.9	14.2	13.6
3pm conditions													
Mean temp. (°C)	22.5	22.9	22.1	19.9	17.7	15.6	15.0	15.9	17.2	18.5	19.5	21.2	19.0
Mean R.H. (%)	71.0	73.0	70.0	67.0	64.0	62.0	59.0	56.0	60.0	63.0	67.0	71.0	65.0
Mean W.S. (km/h)	19.8	19.3	18.4	17.8	16.4	16.3	16.3	18.1	19.2	20.1	21.2	20.1	18.6

Source: **Bureau of Meteorology, 2023**

RH = Relative Humidity, WS = Wind speed

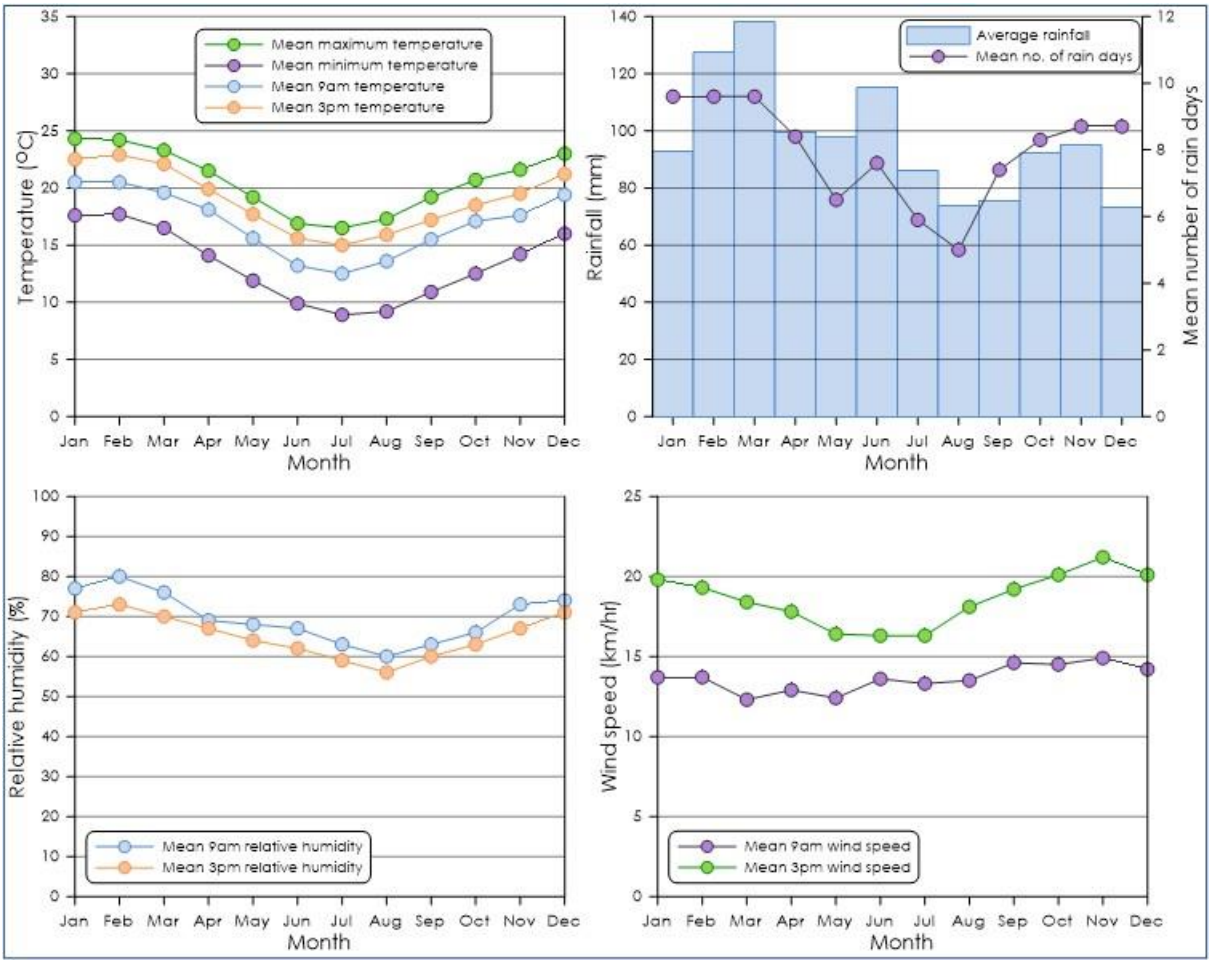


Figure 4-1: Monthly climate statistics summary – Ulladulla AWS

4.2 Local meteorological conditions

Annual and seasonal windroses generated from data from Ulladulla AWS during 2021 are presented in **Figure 4-2**.

The 2021 calendar year was selected as the meteorological year for the dispersion modelling based on analysis of trends in meteorological data recorded for the area as outlined in **Appendix A**.

On an annual basis, the most dominant winds are from the north. Winds in summer predominately occur from the south-southeast and north. In autumn, a high proportion of winds occur along an axis from the southwest to the west-northwest, and the north. In winter, winds from the west-northwest and north are most prevalent. The spring windrose follows a similar distribution to the annual windrose, with the most dominant winds occurring from the north.

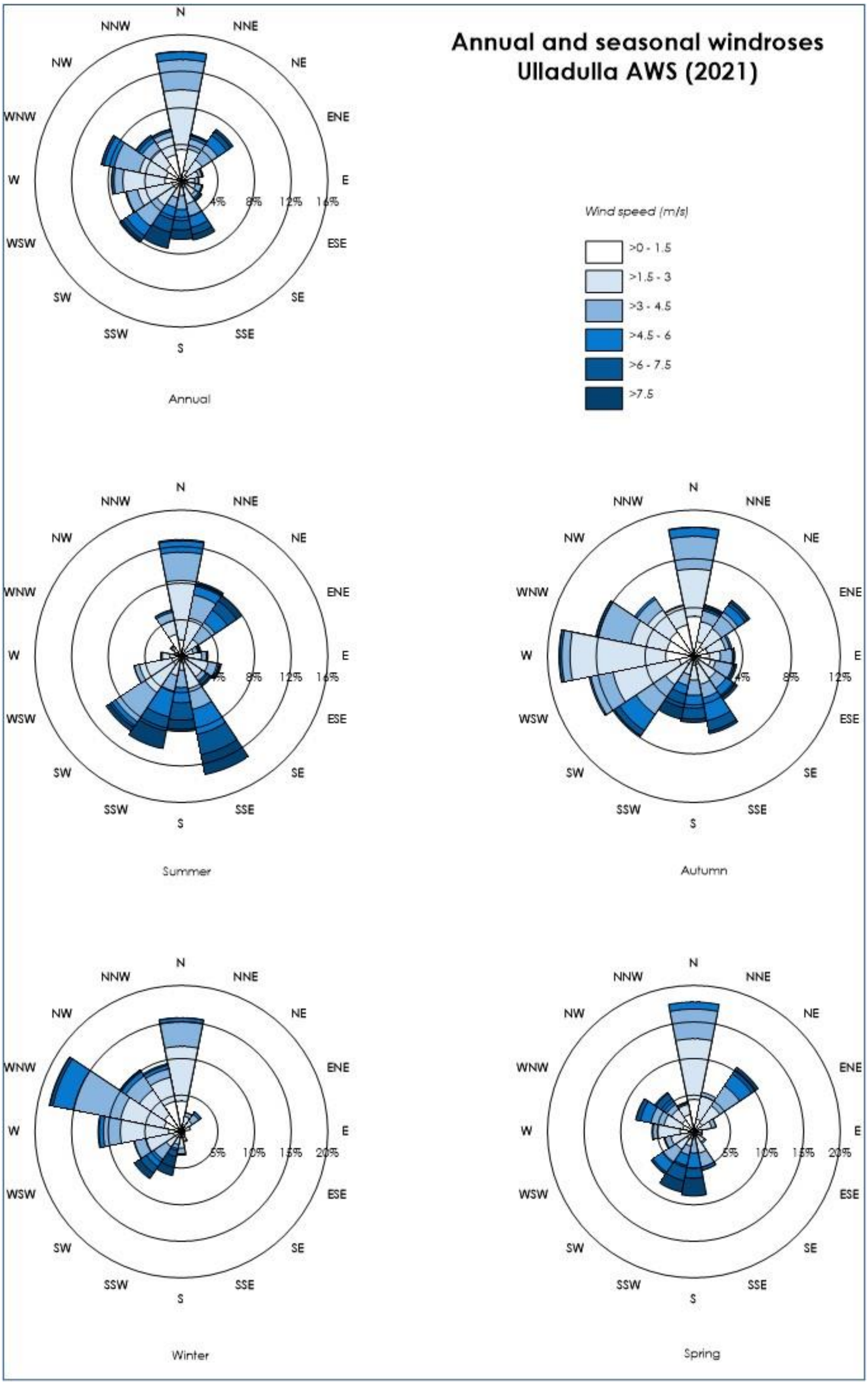


Figure 4-2: Annual and seasonal windroses for Ulladulla AWS (2021)

4.3 Local air quality monitoring

The main sources of air pollutants in the area surrounding the Project include emissions from local anthropogenic activities (such as motor vehicle exhaust and domestic wood heaters), and industrial and commercial activities.

Available data from the nearest air quality monitor operated by the NSW Department of Planning and Environment (DPE) at Albion Park South was used to quantify the existing background level for assessed pollutants at the Project site. As the air quality monitor at Albion Park South does not monitor CO, data from the next nearest monitoring station at Wollongong has been used to characterise the existing background level of CO at the Project site. The air quality monitors at Albion Park South and Wollongong are located approximately 91km and 111km north-northeast of the Project site, respectively.

To confirm the suitability of these monitors for characterising the existing background levels at the site, an air quality monitoring campaign at the Project site was conducted from 21 August 2023 to 10 September 2023. Ambient air quality data collected during the monitoring campaign was compared with the Albion Park South and Wollongong monitoring data for the contemporaneous period. The results of the comparison are presented in **Section 4.3.6** and indicate that the campaign monitoring data align reasonably well with the measured data from Albion Park South and Wollongong, thereby confirming its suitability for representing indicative background pollutant concentrations for the Project site.

4.3.1 PM_{10} monitoring

A summary of available 24-hour average PM_{10} concentrations for the Albion Park South monitoring station from 2016 to 2022 is presented in **Figure 4-3** and **Table 4-2**. These data include levels measured during all extraordinary event days. Extraordinary event days are characterised as those days influenced by exceptional events such as bushfires, dust storms and hazard reduction burns.

A review of **Table 4-2** indicates that the annual average PM_{10} concentrations for the DPE monitoring stations were below the relevant criterion of 25µg/m^3 for all years. The maximum 24-hour average PM_{10} concentrations were found to exceed the relevant criterion of 50µg/m^3 on occasion throughout the review period in 2018, 2019 and 2020.

Elevated PM_{10} concentrations in 2018 can be attributed to a 4-day dust storm event and hazard reduction burning (**NSW DPIE, 2020**). The significant increase in the frequency of exceedances of the 24-hour average PM_{10} criterion in the 2019/ 2020 summer, is predominately due to smoke associated with the widespread bushfires occurring at this time (**NSW DPIE, 2021**) (refer to **Figure 4-3**).

Table 4-2: Summary of PM_{10} levels from Albion Park South (µg/m³)

Year	Annual average	Criterion
2016	14.9	25
2017	15.3	25
2018	17.8	25
2019	19.5	25
2020	17.1	25
2021	13.1	25
2022	10.9	25
Year	**Maximum 24-hour average**	**Criterion**
2016	43.1	50
2017	44.6	50
2018	**94.4**	50
2019	**104.3**	50
2020	**153.3**	50
2021	39.4	50
2022	29.9	50

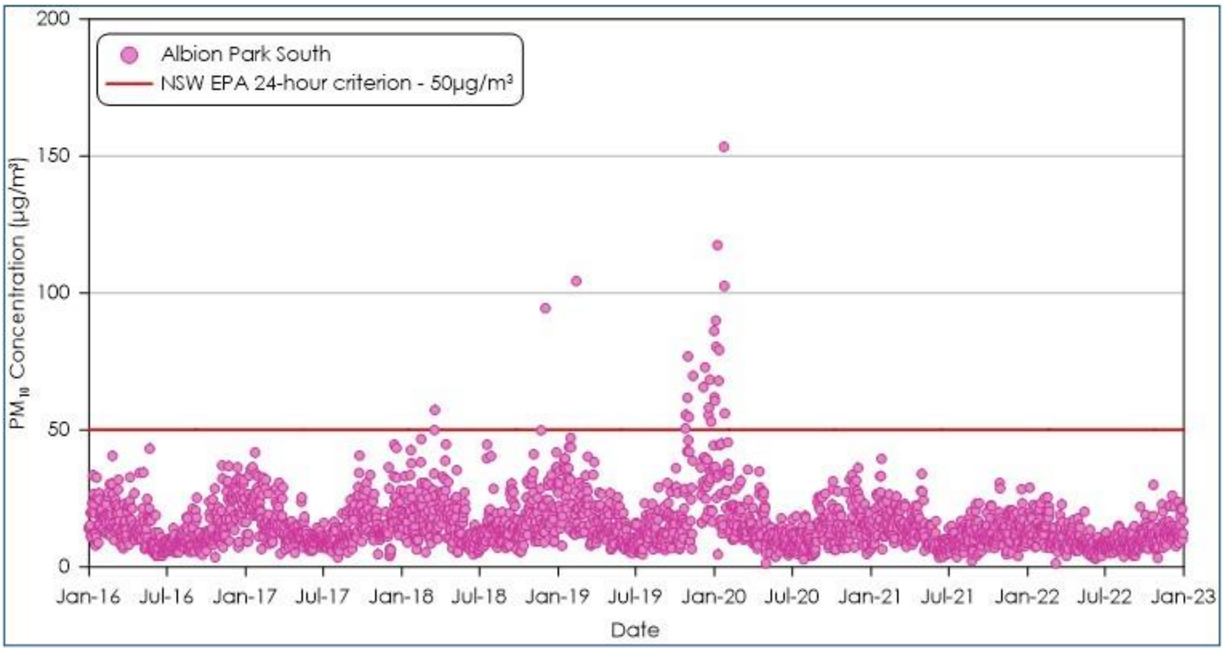


Figure 4-3: 24-hour average PM_{10} concentrations

4.3.2 $PM_{2.5}$ monitoring

A summary of the available data from 2016 to 2022 for the Albion Park South monitoring station is presented in **Table 4-3**. Recorded 24-hour average $PM_{2.5}$ concentrations are presented in **Figure 4-4**.

Table 4-3 indicates that the annual average $PM_{2.5}$ concentrations for the Albion Park South monitoring station were below the relevant criterion of 8µg/m³ for all years except in 2019. The maximum 24-hour average $PM_{2.5}$ concentrations were found to exceed the relevant criterion of 25µg/m³ on occasion throughout the review period in 2018, 2019 and 2020.

Elevated $PM_{2.5}$ concentrations can be attributed to the same extraordinary events that affected the PM_{10} data, in particular, the elevated levels during the 2019/ 2020 summer due to smoke associated with the widespread bushfires occurring at this time (refer to **Figure 4-4**).

Table 4-3: Summary of $PM_{2.5}$ levels from Albion Park South (µg/m³)

Year	Annual average	Criterion
2016	7.2	8
2017	6.6	8
2018	6.8	8
2019	**8.6**	8
2020	6.8	8
2021	4.8	8
2022	3.8	8
Year	**Maximum 24-hour average**	**Criterion**
2016	30.7	25
2017	19.3	25
2018	**29.4**	25
2019	**49.4**	25
2020	**96.3**	25
2021	23.3	25
2022	13.6	25

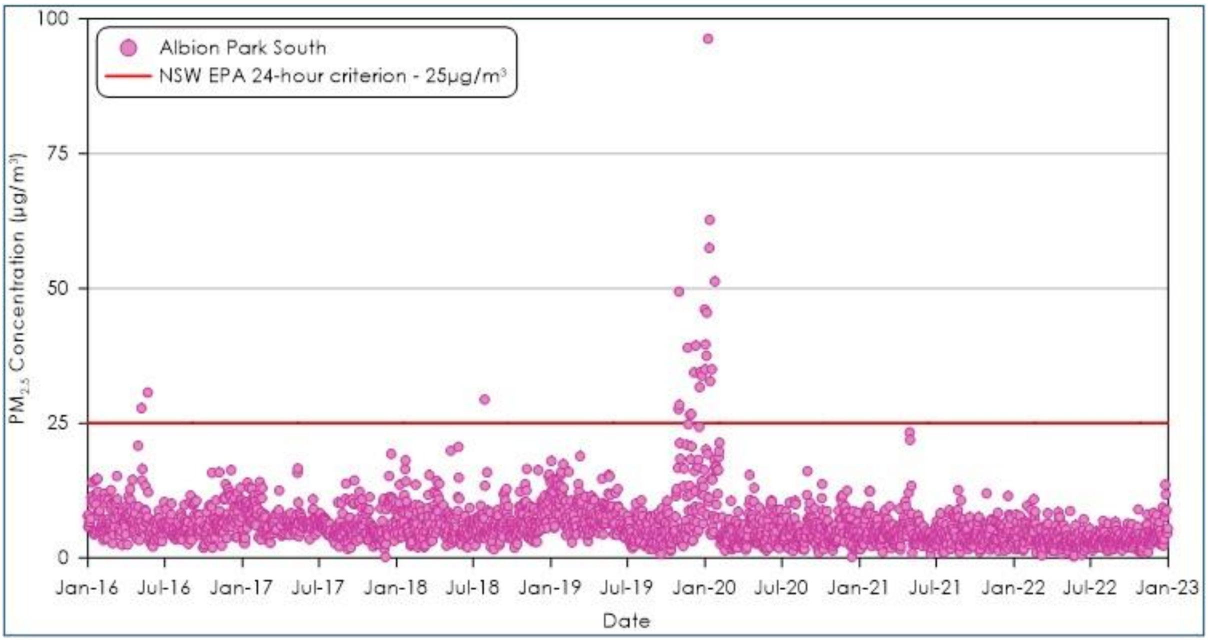


Figure 4-4: 24-hour average $PM_{2.5}$ concentrations

4.3.3 NO_2 monitoring

Table 4-4 presents a summary of the annual average NO_2 concentrations for the Albion Park South monitoring station from 2016 to 2022. A review of **Table 4-4** indicates that the annual average NO_2 concentrations for the Albion Park South monitor were below the relevant criterion of 31µg/m^3 for all years.

Table 4-4: Summary of NO_2 levels from Albion Park South (µg/m³)

Year	Annual average	Criterion
2016	8.2	31
2017	8.2	31
2018	8.2	31
2019	8.2	31
2020	6.2	31
2021	4.1	31
2022	6.2	31

Figure 4-5 presents the maximum daily 1-hour average NO_2 concentrations recorded at the Albion Park South monitoring station from 2016 to 2022. The monitoring data reviewed indicate that there were no exceedances of the relevant 1-hour average goal of 164µg/m^3 at the monitor during this period. The data in **Figure 4-5** indicate that levels of NO_2 are relatively low compared to the criterion level.

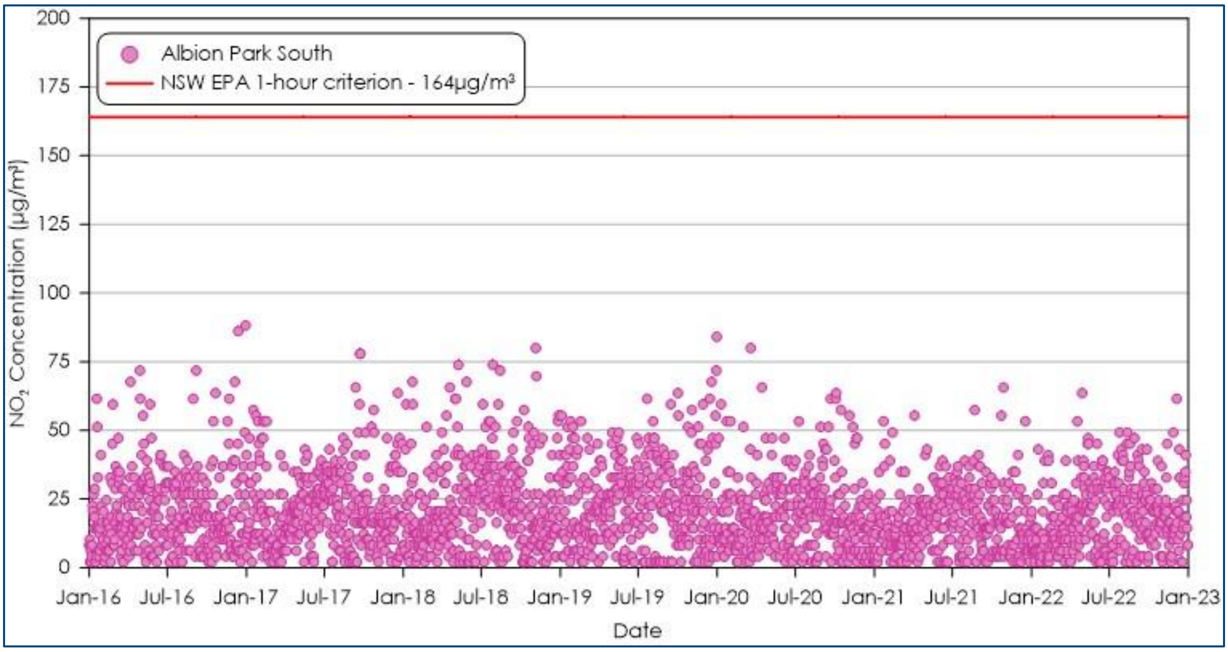


Figure 4-5: Maximum daily 1-hour average NO_2 concentrations

4.3.4 SO_2 monitoring

Figure 4-6 and **Figure 4-7** present the maximum daily 1-hour average and maximum 24-hour average SO_2 concentrations recorded the Albion Park South monitoring site between 2016 and 2022. The data show that the measured levels of SO_2 were well below the relevant criterions of 286µg/m^3 and 57µg/m^3 respectively.

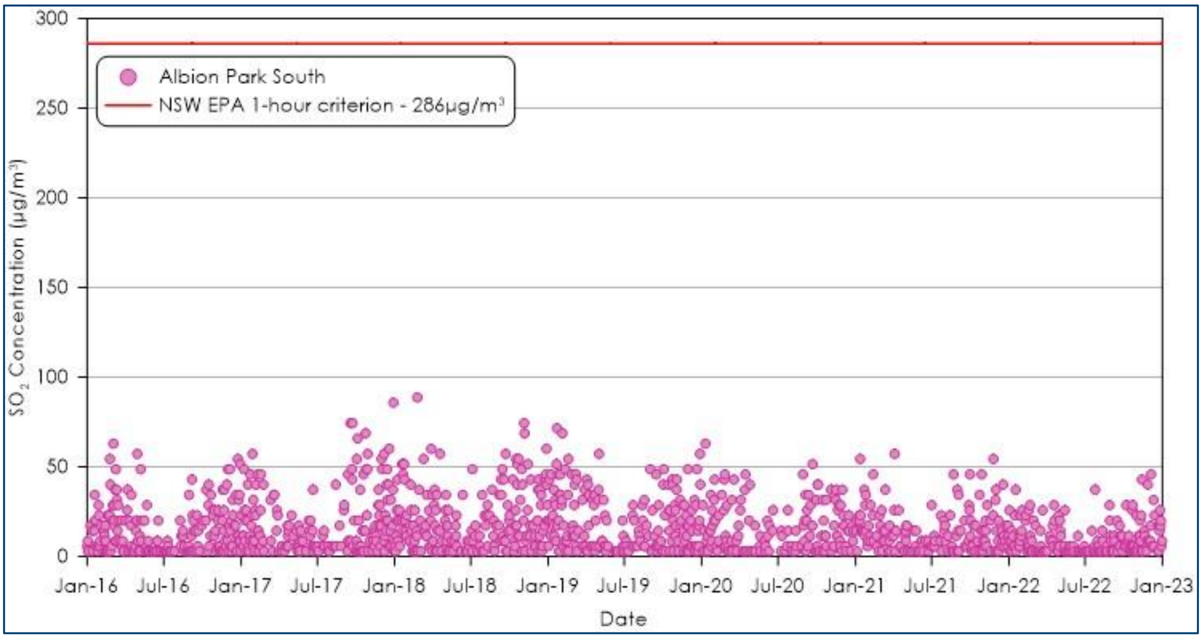


Figure 4-6: Maximum daily 1-hour average SO_2 concentrations

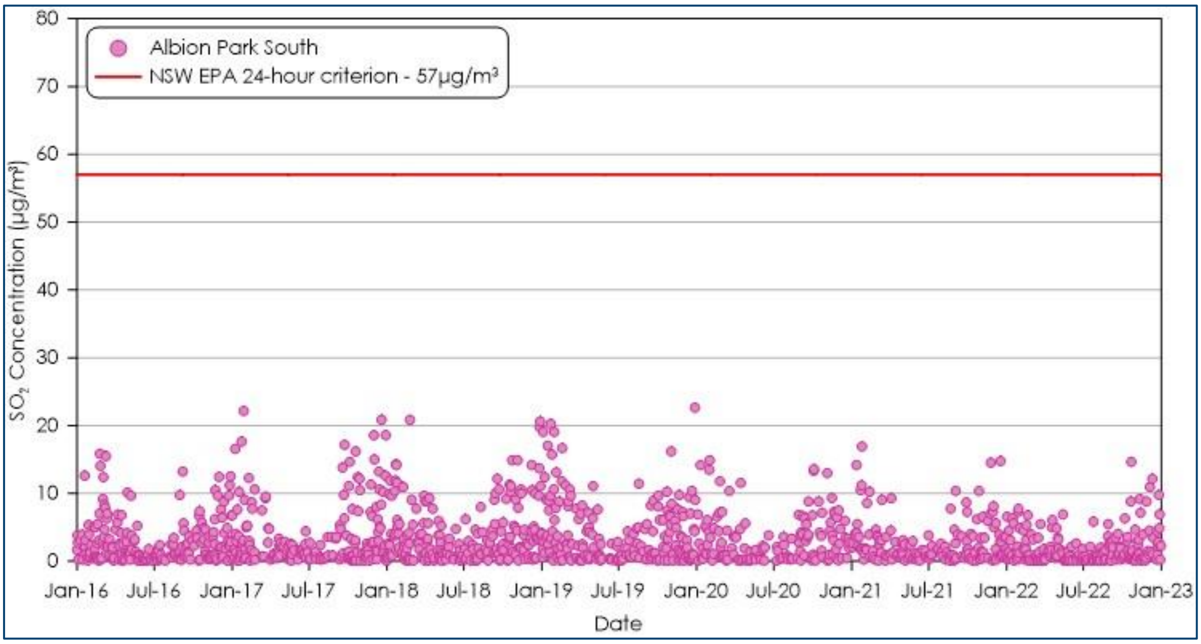


Figure 4-7: 24-hour average SO_2 concentrations

4.3.5 CO monitoring

Figure 4-8 presents the rolling 8-hour average CO monitoring data from the Wollongong monitoring station from 2016 to 2022. The data show that CO levels were well below the relevant criterion of 10mg/m^3 for all years during the review period. Elevated levels shown in **Figure 4-8** can be attributed to the large-scale bushfires affecting NSW during the 2019/ 2020 summer.

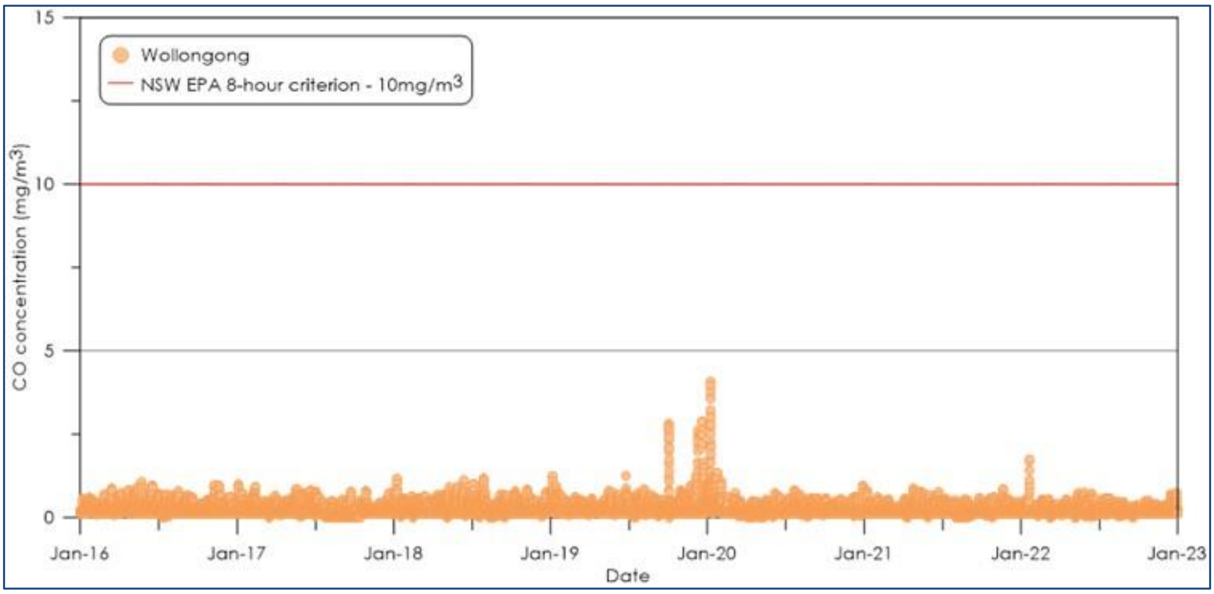


Figure 4-8: Rolling 8-hour average CO concentrations

4.3.6 Campaign air quality monitoring

An ambient air quality monitoring campaign to assist with the characterisation of background air quality levels at the Project was conducted from 21 August 2023 to 10 September 2023.

The ambient air quality monitoring campaign included continuous monitoring of $PM_{2.5}$, PM_{10}, SO_2, NO_2 and CO and the measured levels are compared with the nearest DPE air quality monitors at Albion Park South and Wollongong for the campaign period.

The location of the air monitor relative to the Project site is shown in **Figure 4-9**.

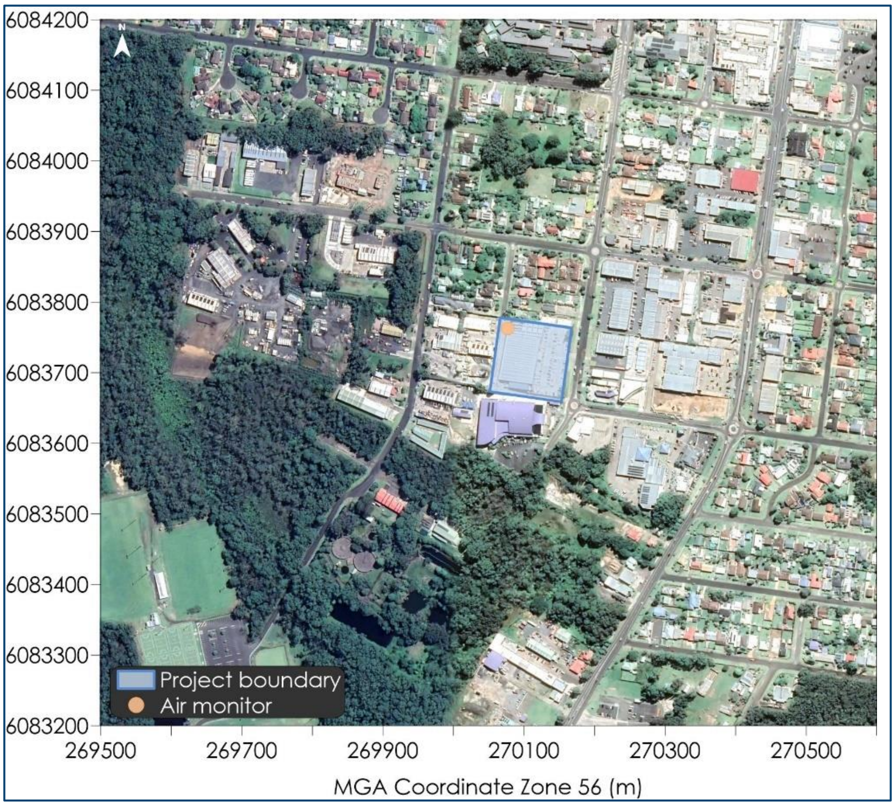


Figure 4-9: Location of air monitor

Figure 4-10 presents a comparison of the recorded 24-hour average PM_{10} concentrations for the air monitor and the Albion Park South monitor. The 24-hour average PM_{10} concentrations recorded at the air monitor were below the relevant NSW EPA criterion of 50µg/m^3 and compare reasonably well with the measured concentrations at the Albion Park South monitor.

Figure 4-11 presents a comparison of the recorded 24-hour average $PM_{2.5}$ concentrations for the air monitor and the Albion Park South monitor. Similar to the PM_{10} concentrations, the 24-hour average $PM_{2.5}$ concentrations recorded at the air monitor were below the relevant NSW EPA criterion of 25µg/m^3 and compare reasonably well with the measured concentrations at the Albion Park South monitor.

Figure 4-12 presents a comparison of the recorded daily maximum 1-hour average SO_2 concentrations for the air monitor and the Albion Park South monitor. The air monitor indicates slightly higher SO_2 concentrations compared to the Albion Park South monitor, this is likely due to the different monitoring methodologies as there are no identifiable sources of SO_2 located near the air monitor. The 1-hour average SO_2 concentrations recorded at the air monitor were well below the relevant NSW EPA criterion of 286μg/m^3.

Figure 4-13 presents a comparison of the recorded daily maximum 1-hour average NO_2 concentrations for the air monitor and the Albion Park South monitor. The 1-hour average NO_2 concentrations recorded at the air monitor were below the relevant NSW EPA criterion of 164μg/m^3 and compare reasonably well with the measured concentrations at the Albion Park South monitor.

Figure 4-14 presents a comparison of the recorded daily maximum 1-hour average CO concentrations from the air monitor and the Wollongong monitor. The 1-hour average CO concentrations recorded at the air monitor were below the relevant NSW EPA criterion of 30mg/m^3 and compare reasonably well with the measured concentrations at the Wollongong monitor.

Overall, the air monitor indicates that the Albion Park South and Wollongong sites provide a reasonable indication of the background air quality levels at the Project site.

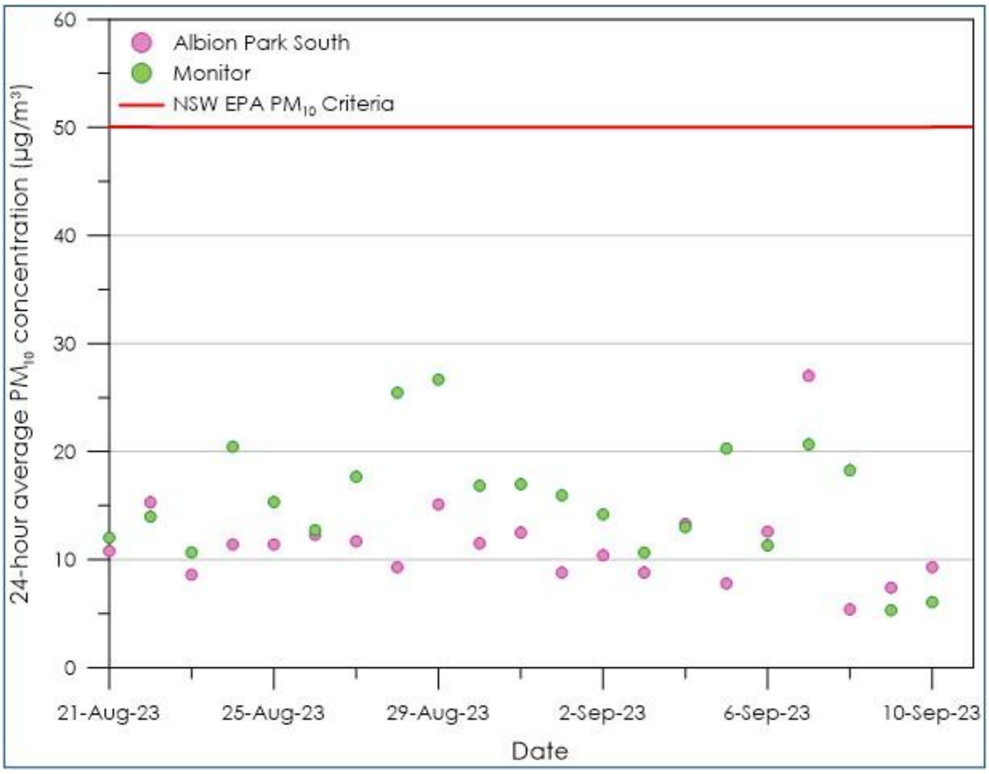


Figure 4-10: Comparison of 24-hour average PM_{10} concentrations during monitoring campaign

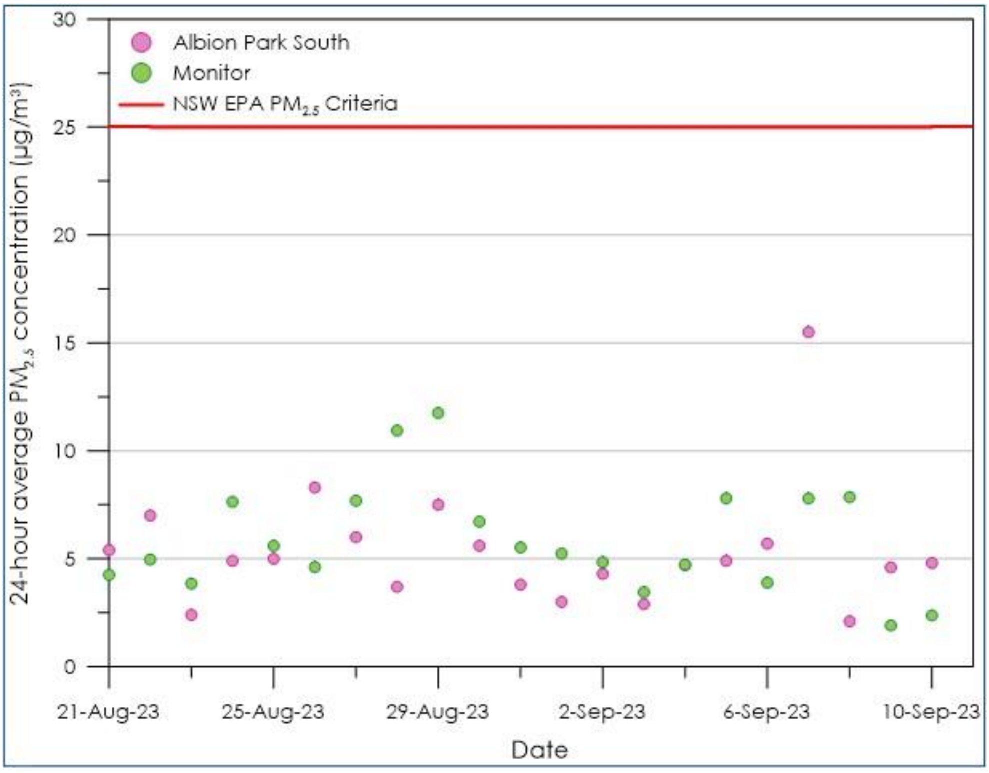


Figure 4-11: Comparison of 24-hour average $PM_{2.5}$ concentrations during monitoring campaign

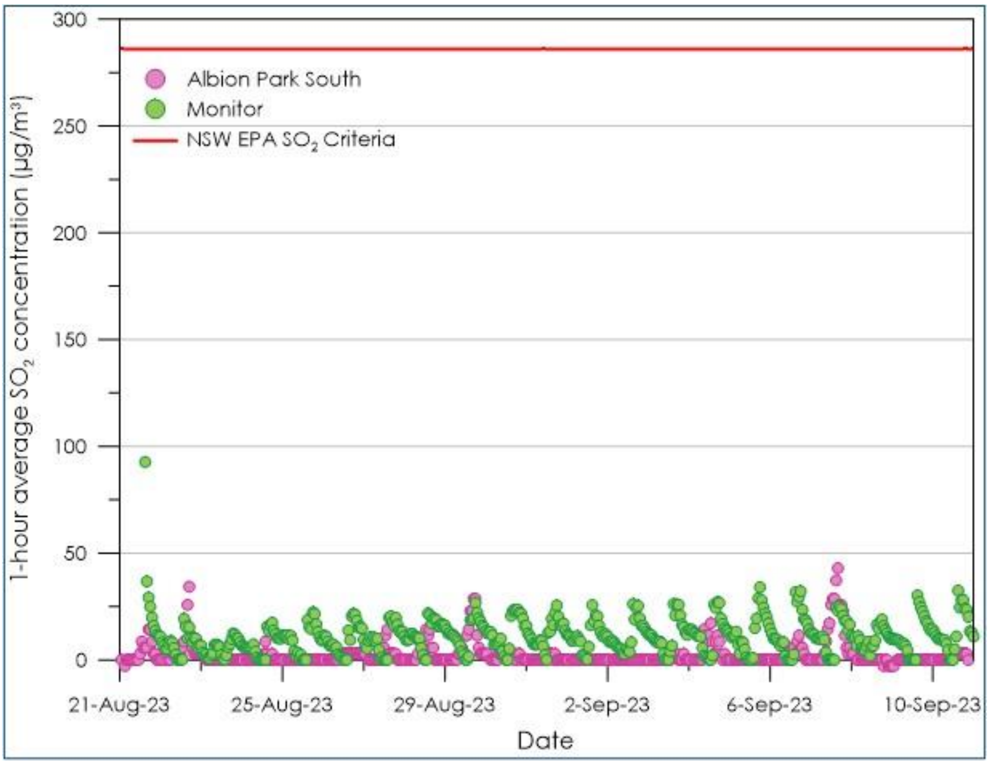


Figure 4-12: Comparison of daily maximum 1-hour average SO_2 concentrations during monitoring campaign

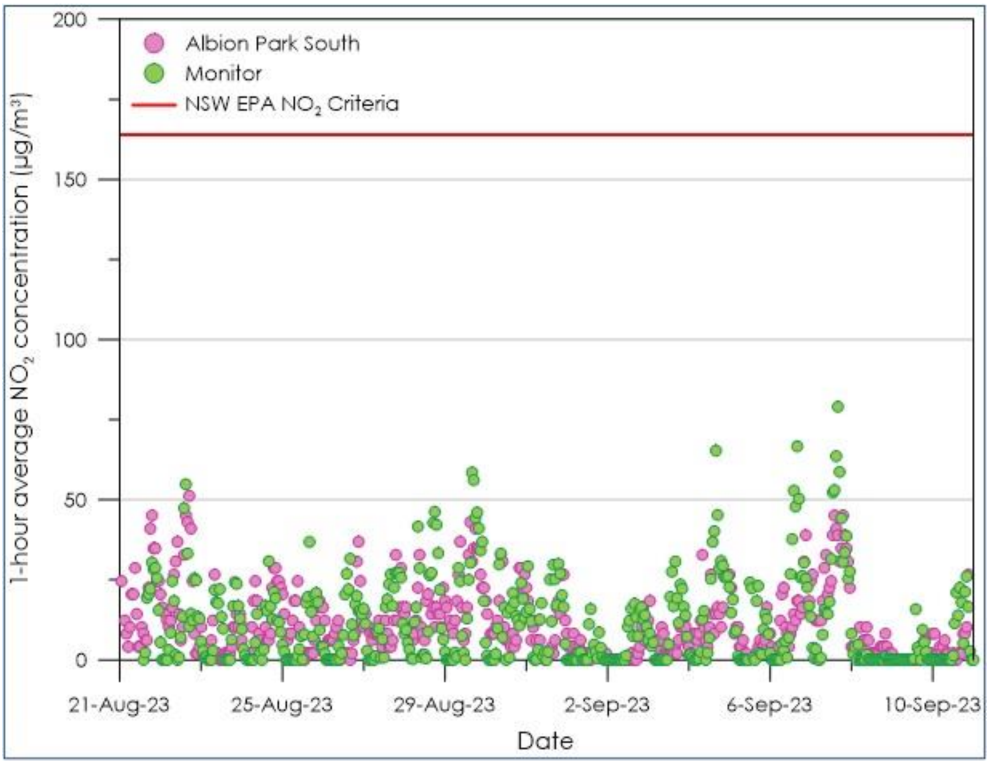


Figure 4-13: Comparison of daily maximum 1-hour average NO_2 concentrations during monitoring campaign

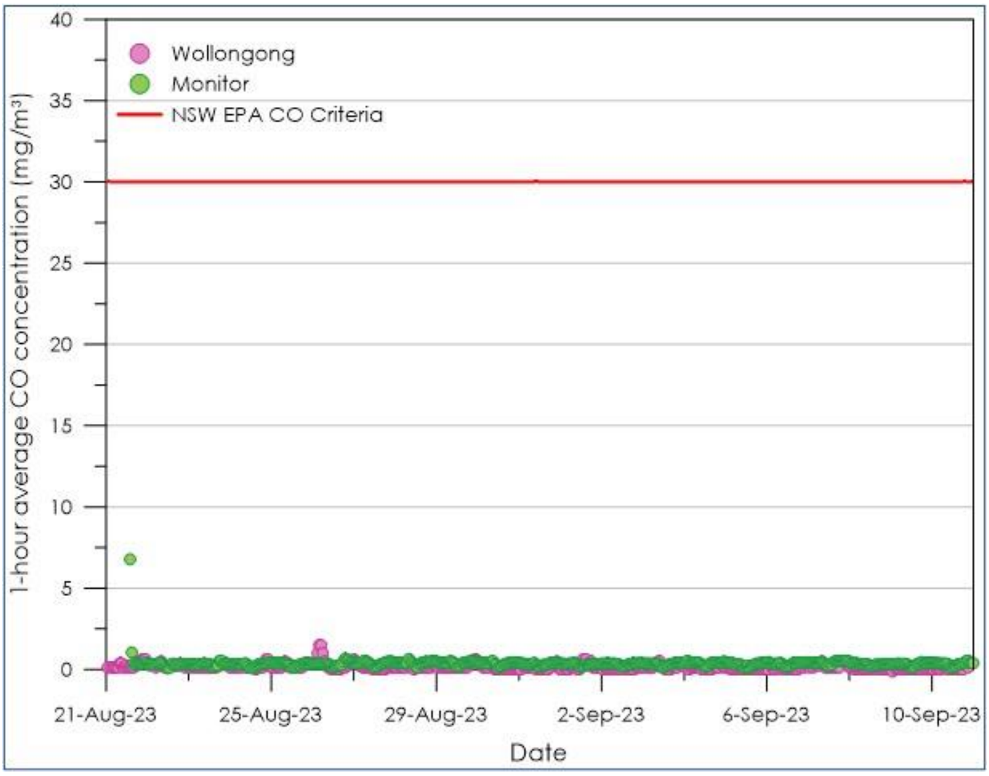


Figure 4-14: Comparison of daily maximum 1-hour average CO concentrations during monitoring campaign

4.3.7 Estimated background dust levels

The background air quality levels from the Albion Park South monitor were used to represent the background levels for the Project.

The 2021 calendar period corresponds to the period of meteorological modelling based on an analysis of long-term data trends in meteorological data as outlined in **Appendix A** and were used to represent the background levels for the Project.

In the absence of available data, estimates of the annual average background TSP and deposited dust concentrations can be determined from a relationship between PM_{10}, TSP and deposited dust concentrations and the measured PM_{10} levels. This relationship assumes that an annual average PM_{10} concentration of 25µg/m^3 corresponds to a TSP concentration of 90µg/m^3 and a dust deposition value of 4g/m^2/month. This assumption is based on the NSW EPA air quality impact criteria. Applying this relationship with the measured annual average PM_{10} concentration of 13.1µg/m^3 indicates an approximate annual average TSP concentration and deposition value of 47.2µg/m^3 and 2.1g/m^2/month, respectively.

Table 4-5 presents a summary of the background pollutant concentrations applied in this assessment.

Table 4-5: Adopted background pollutant concentrations

Pollutant	Background level	Units
24-hour average $PM_{2.5}$	Daily varying	µg/m^3
Annual average $PM_{2.5}$	4.8	µg/m^3
24-hour average PM_{10}	Daily varying	µg/m^3
Annual average PM_{10}	13.1	µg/m^3
Annual average TSP	47.2	µg/m^3
Annual average deposited dust	2.1	g/m^2/month

5 DISPERSION MODELLING APPROACH

5.1 Introduction

The following sections are included to provide the reader with an understanding of the model and modelling approach applied for the assessment.

The model setup used is in general accordance with methods provided in the NSW EPA document *Generic Guidance and Optimum Model Setting for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia'* (**TRC**, **2011**).

5.2 Modelling methodology

Modelling was undertaken using a combination of The Air Pollution Model (TAPM) and the CALPUFF Modelling System.

TAPM is a prognostic air model used to simulate the upper air data for CALMET input. The meteorological component of TAPM is an incompressible, non-hydrostatic, primitive equation model with a terrain-following vertical coordinate for 3D simulations. The model predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analysis.

CALPUFF is an advanced air dispersion model which can deal with the effects of complex local terrain on the dispersion meteorology over the modelling domain in a three-dimensional, hourly varying time step. CALPUFF is an air dispersion model approved by NSW EPA for use in air quality impact assessments.

5.2.1 Meteorological modelling

TAPM was applied to the available data to generate a 3D upper air data file for use in CALMET. The centre of analysis for TAPM was 35deg19.6min south and 150deg26.9min east. The simulation involved an outer grid of 30km, with three nested grids of 10km, 3km and 1km with 35 vertical grid levels.

The CALMET domain was run on a 10 x 10km area with 0.1km grid resolution. The available meteorological data for the 2021 calendar year from Ulladulla AWS were included in this run.

Local land use and detailed topographical information was included in the simulation to produce realistic fine scale flow fields (such as terrain forced flows) in surrounding areas (**Figure 5-1**).

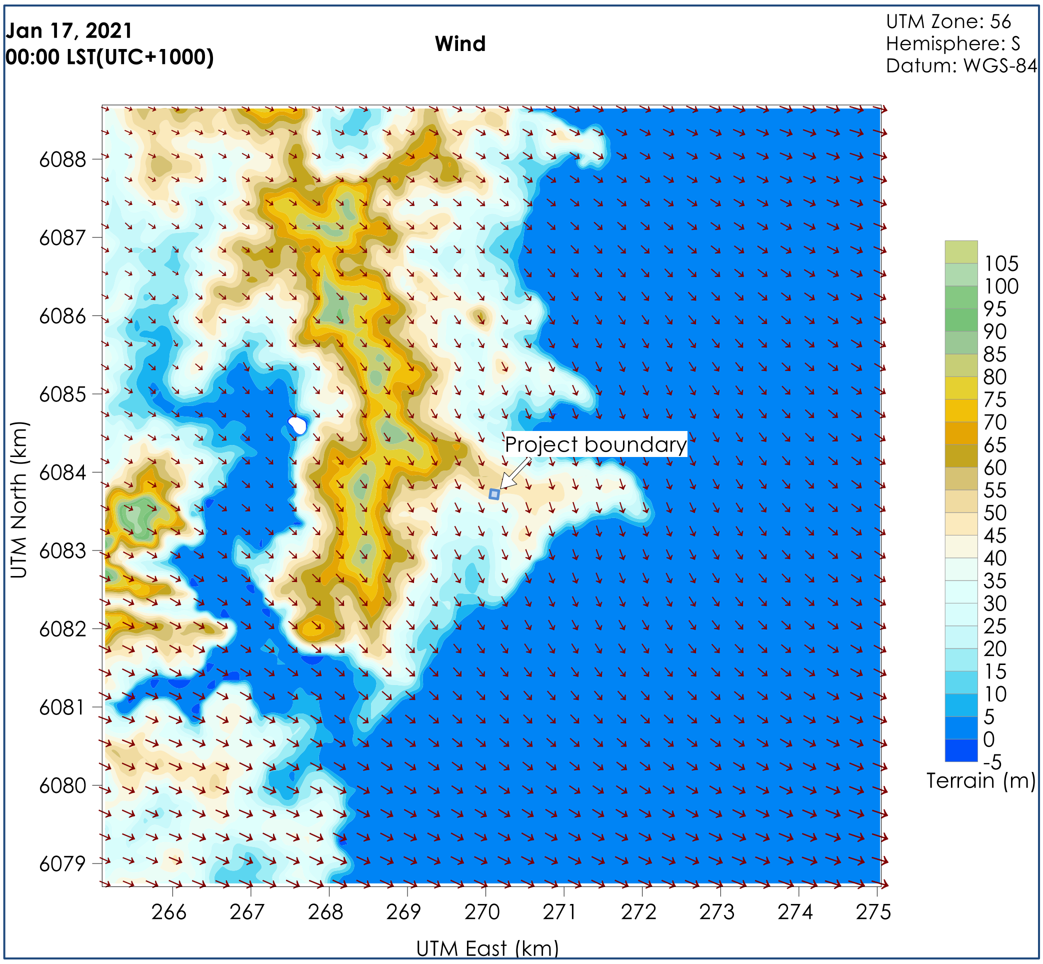


Figure 5-1: Representative snapshot of wind field for the Project

CALMET generated meteorological data were extracted from a point within the CALMET domain and are graphically represented in **Figure 5-2** and **Figure 5-3**.

Figure 5-2 presents the annual and seasonal windroses from the CALMET data. Overall, the windroses generated in the CALMET modelling reflect the expected wind distribution patterns of the area as determined based on the available measured data and the expected terrain effects on the prevailing winds. **Figure 5-3** includes graphs of the temperature, wind speed, mixing height and stability classification over the modelling period and show sensible trends considered to be representative of the area.

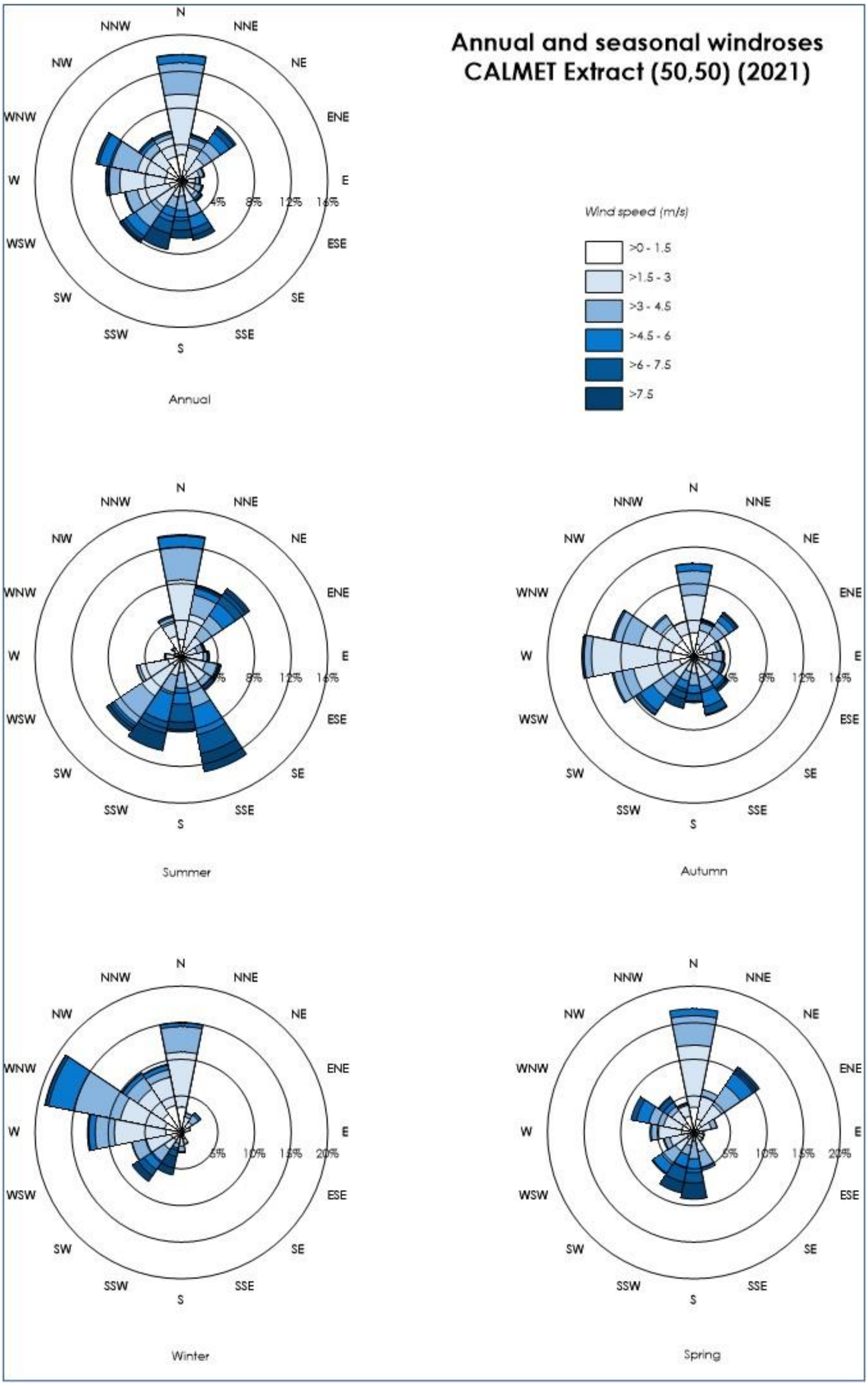


Figure 5-2: Annual and seasonal windroses from CALMET (5050)

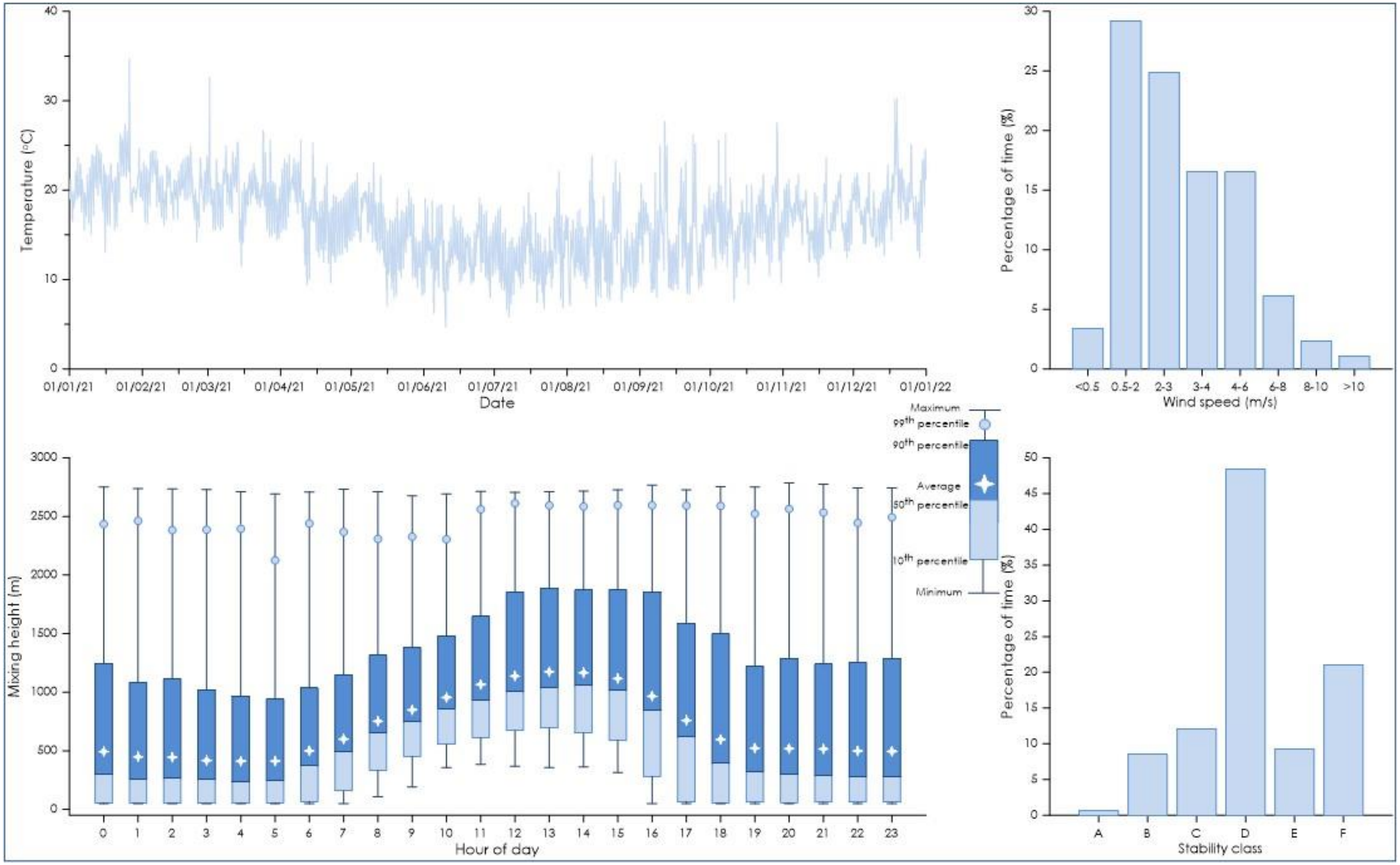


Figure 5-3: Meteorological analysis CALMET (5050)

5.3 Source identification

The focus of this report is to consider the potential for air quality impacts to occur upon the Project site and to determine whether this is likely to result in any adverse impacts. A desktop review was conducted to identify the main sources of potential air emissions in the local area which can adversely affect the Project site.

To the east of the site is predominantly commercial operations, which include a car wash, various retailers, a petrol station and a McDonald's drive-thru restaurant. Immediately adjacent to the south of the site is a community centre containing a ten-pin bowling club and several meeting rooms, and the Rotary Club of Milton Ulladulla. As mentioned, residential dwellings are located to the north and northwest and the majority of industrial operations are located to the west.

Operations with potential to generate air emissions located within an approximate 500m radius of the Project are outlined in **Table 5-1**. The location of each of these operations relative to the Project site is presented in **Figure 5-4**. For each of the identified operations an investigation was conducted to determine the potential for dust or odour to impact on the Project site.

Table 5-1: Potential air emission sources from nearby existing operations

Potential air emission source ID	Name	Type of operation	Type of air emission source	Approximate distance from Project (m)
1	Hansen Australia	Concrete batching	Dust	5
2	JNC	Welding and fabrication	Dust and air toxics	220
3	Dale Familo Excavations	Earthworks	Dust	70
4	McDonald's	Fast food	Odour	190
5	Ampol/BP	Petrol stations	Odour and air toxics	190
6	Ampol	Petrol Station	Odour and air toxics	280
7	Shoalhaven City Council/ Milton Rural Landcare	Depot & Nursey	Dust	230
8	Princes Highway	Road traffic	Dust and air toxics	235

Figure 5-4: Potential air emission sources from nearby existing operations

Potential air emission Source 1 is identified as a concrete batch plant and is located immediately adjacent to the Project site. Activities at the site would involve the transport and storage of raw materials for concrete production to the site, handling of materials onsite, concrete batching and the transport of concrete offsite once the process is complete. The batching plant, silo and storage bays are situated outdoors. Due to the close proximity of the concrete batch plant to the Project site and the nature of the process, there is potential for dust impacts to arise at the Project and have been considered in detail in this assessment.

Potential air emission Source 2 is identified as a welding and fabrication operation, located approximately 220m from the Project site. The welding and fabrication process can produce dust and various air toxic fumes. It is noted that the activities occur within a warehouse with the nearest residence to the site located approximately 90m to the east. Based on the likely scale of the operations and its current proximity to residences, it can be inferred that potential emissions of dust and/or air toxic fumes are minimal. Potential impacts on the Project site would be less than the existing residences and not result in any adverse impacts at the Project. Therefore, this source has not been considered further in this assessment.

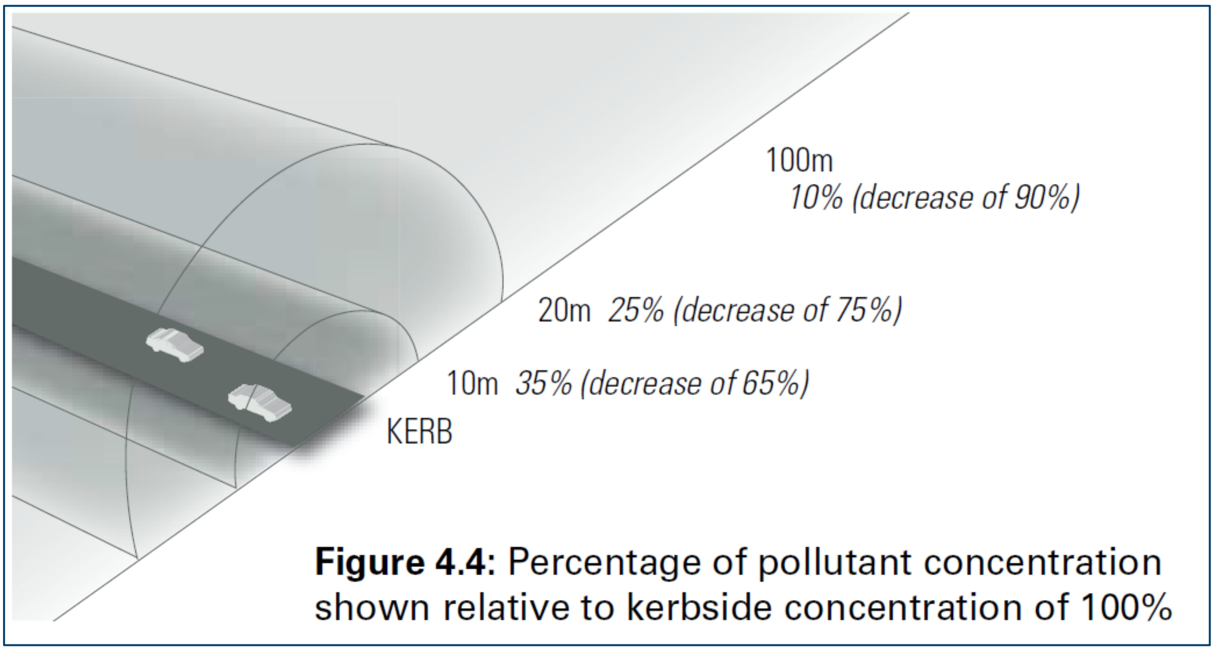
Potential air emission Source 3 is identified as an earthworks company located approximately 70m from the Project site. Landscaping products, such as soil, sand and rocks, are stored onsite in outdoor open bays before being transported offsite. There is potential for dust impacts to arise at the Project site due to the storage of product outside and has a potential cumulative impact with the concrete batching plant, therefore this site has been considered in this assessment.

Potential air emission Source 4 is identified as a McDonalds fast food restaurant and is located approximately 190m from the Project site. The operation of a fast food restaurant would generate some odours and typically be temporary or infrequent according to demand. The potential zone of influence of odour emissions from these operations is expected to be confined within their boundary or would not extend beyond approximately 50m from the source. This operation is located further than 50m from the Project, odour from these operations is unlikely to be detected at the Project site.

Potential air emission Sources 5 and 6 are identified as petrol stations and are located approximately 190m and 280m from the Project, respectively. The main air emissions of concern associated with petrol stations are in the form of Volatile Organic Compounds (VOCs), and the key pollutants of concern present in fuel vapours are benzene (health) and toluene (amenity / odour). The closest existing residential receptor to the three petrol stations is located approximately 8m from Source 6. As these operations are further than 100m from the Project site, and are currently operating adjacent to residences, emissions from these operations are unlikely to impact upon the Project, and therefore have not been considered further in this assessment.

Potential air emission Source 7 is identified as the Shoalhaven City Council/ Milton Rural Landcare Nursery and is located approximately 230m from the Project site. The site comprises of a depot and a wholesale plant nursery. The potential for dust generation from these activities would be low and with the separation distance to the Project site the potential for any impact is unlikely, therefore this has not been considered further in this assessment.

Potential air emission Source 8 is identified as the Princes Highway and has a separation distance of approximately 235m. The main air emissions associated with motor vehicles travelling on the Princes Highway that arise from exhaust and tyre/ break wear are $PM_{2.5}$ and NO_2. Potential air impacts from roadways are generally well understood and based on **Figure 5-5**, the concentration of motor vehicle emissions travelling on Princes Highway would decrease by 90% before reaching the Project site (as it is greater than 100m away). The air emissions associated with cars travelling along the Princes Highway is unlikely to impact upon the Project due to the large separation distance and therefore has not been considered further in this assessment.



Source: **NSW Department of Planning (2008)**

Figure 5-5: Percentage of pollutant concentration shown relative to kerbside concentration of 100%

5.4 Emission estimation

The dust generating activities with potential to impact the Project are associated with the concrete batching plant and earthworks company located nearby. These activities have been identified as the loading/unloading of material, vehicles travelling on-site, windblown dust generated from exposed and trafficable areas. The onsite vehicle and plant equipment also have the potential to generate particulate emissions from the diesel exhaust.

Dust emission estimates have been calculated by analysing the various types of dust generating activities taking place and utilising suitable emissions sourced from both locally developed and United States various types of activities taking Environmental Protection Agency (US EPA) developed documentation.

A summary of the estimated annual TSP, PM_{10} and $PM_{2.5}$ emissions for the air emission sources considered in this assessment are presented in **Table 5-2**. Detailed calculations of the dust emission estimates are provided in **Appendix B**.

Table 5-2: Summary of estimated dust emissions (kg/year)

Activity	TSP Emissions	PM_{10} emissions	$PM_{2.5}$ emissions
Concrete batching plant	1,090	625	348
Earthworks	724	438	236

5.5 Modelled receptor locations

To assess the potential impacts at the Project site a set of discrete receptors are applied. The receptor locations used to represent the Project site are presented in **Figure 5-6**.

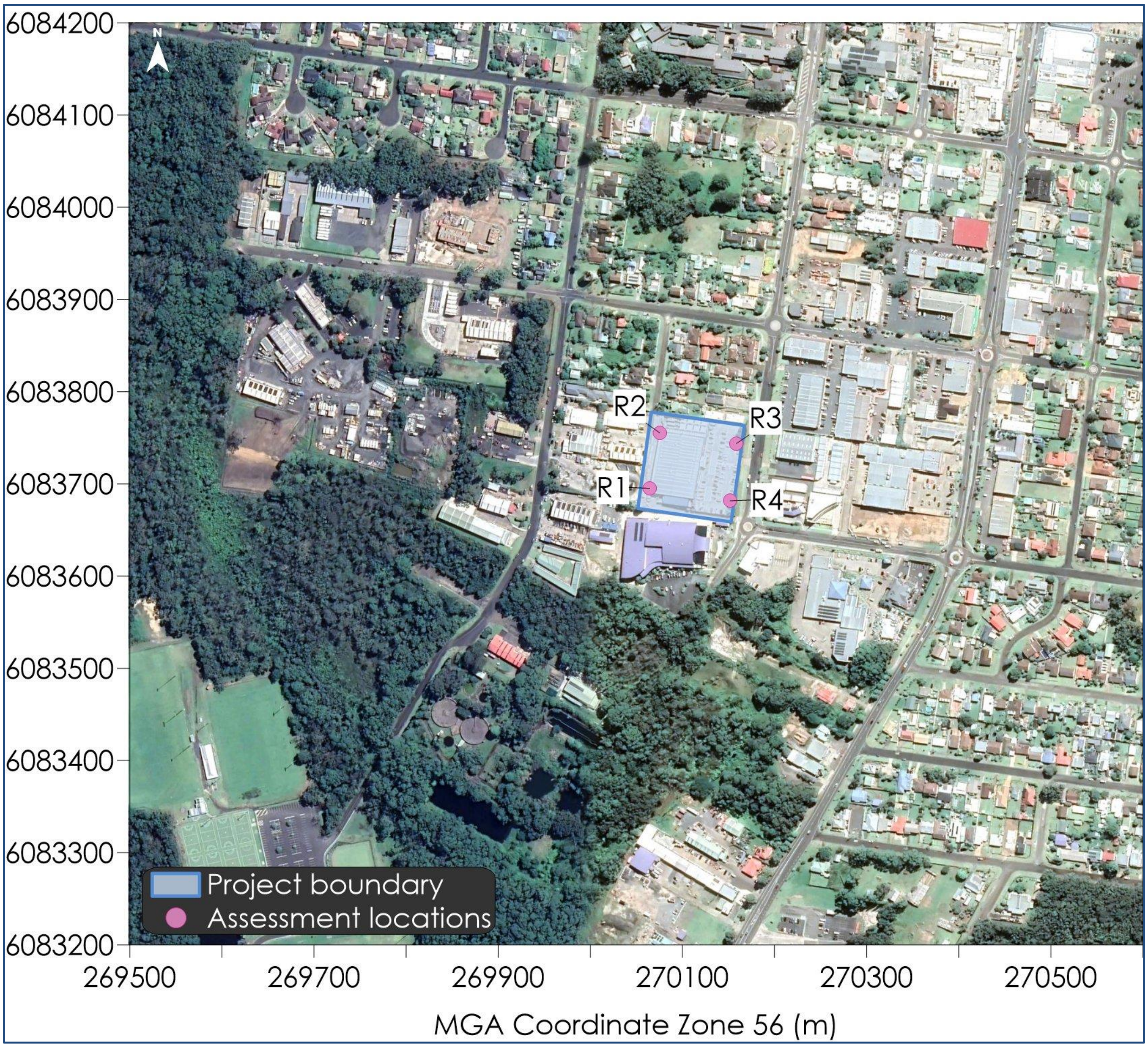


Figure 5-6: Receptor locations that represent the Project site

6 DISPERSION MODELLING RESULTS

The dispersion model predictions presented in this section include those for the concrete batching plant and the earthworks company. The results show the predicted:

- Maximum 24-hour average $PM_{2.5}$ and PM_{10} concentrations;
- Annual average $PM_{2.5}$, PM_{10} and TSP concentrations; and,
- Annual average dust (insoluble solids) deposition rates.

It is important to note that when assessing impacts per the maximum 24-hour average levels, these predictions are based on the highest predicted 24-hour average concentrations which were modelled at each point within the modelling domain for the worst day (i.e. a 24-hour period) during the one year long modelling period.

Associated isopleth diagrams of the dispersion modelling results are presented in **Appendix C**.

The total (cumulative) impact is defined as the operation of the concrete batching plant and earthworks company combined with the estimated ambient background levels in **Section 5.3.**

Table 6-1 presents the predicted incremental and cumulative particulate dispersion modelling results at each of the assessed receptor locations.

The predicted incremental results show that minimal impact would arise at the receptor locations due to the concrete batching plant and earthworks company. The predicted cumulative results indicate that the receptor locations are predicted to experience levels below the relevant criteria for each of the assessed dust metrics.

Table 6-1: Dust dispersion modelling results for sensitive receptors

Receptor ID	$PM_{2.5}$ (µg/m³)		PM_{10} (µg/m³)		TSP (µg/m³)	DD* (g/m²/mth)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)	DD* (g/m²/mth)
	Incremental						Cumulative			
	24-hr ave.	Ann. ave.	24-hr ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.	Ann. ave.
	Air quality impact criteria									
	-	-	-	-	-	2	8	25	90	4
R1	16.0	2.3	21.4	3.4	5.1	0.7	7.1	16.5	52.3	2.8
R2	9.6	0.8	11.8	1.2	1.9	0.4	5.6	14.3	49.1	2.5
R3	2.3	0.2	2.8	0.25	0.3	<0.1	5.0	13.3	47.5	2.1
R4	2.5	0.2	3.3	0.3	0.5	<0.1	5.0	13.4	47.7	2.2

*Deposited dust

6.1 Assessment of Cumulative 24-hour average $PM_{2.5}$ and PM_{10} Concentrations

The results for incremental 24-hour average $PM_{2.5}$ and PM_{10} concentrations indicate there are no predicted exceedances of the relevant criteria at the assessed receptors.

When assessing the cumulative 24-hour average impacts based on model predictions, an assessment of cumulative 24-hour average $PM_{2.5}$ and PM_{10} impacts was undertaken in accordance with Section 11.2 of the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA**, **2022**).

A "Level 1 assessment – Maximum impact" and a "Level 2 assessment - Contemporaneous impact and background approach" has been applied to assess the potential cumulative 24-hour average $PM_{2.5}$ and PM_{10} impacts.

In simple terms, the Level 1 assessment involves adding the maximum background level with the maximum predicted Project only level and the Level 2 assessment involves matching one year of ambient air quality monitoring data with the corresponding Project only level predicted using the same day's weather data to account for the spatial and temporal variation in background levels on a given day.

Table 6-2 provides a summary of the findings from the Level 1 and Level 2 assessments for the assessment locations.

The results in **Table 6-2** indicate that the Project does not increase the number of days above the 24-hour average criterion at the assessed receptors for $PM_{2.5}$ and PM_{10}.

Detailed tables of the contemporaneous assessment results are provided in **Appendix D**.

Table 6-2: NSW EPA contemporaneous assessment - maximum number of additional days above 24-hour average criterion

Receptor ID	$PM_{2.5}$	PM_{10}
R1	0	0
R2	0	0
R3	0	0
R4	0	0

Time series plot of the predicted cumulative 24-hour average $PM_{2.5}$ and PM_{10} concentrations for the Receptor R1 is presented in **Figure 6-1**.

The orange bars in the figures represent the contribution from the Project and the blue bars represent the applied background levels. It is clear from the figures that the Project has a small influence at the assessed receptor location and would be difficult to discern beyond the existing background level.

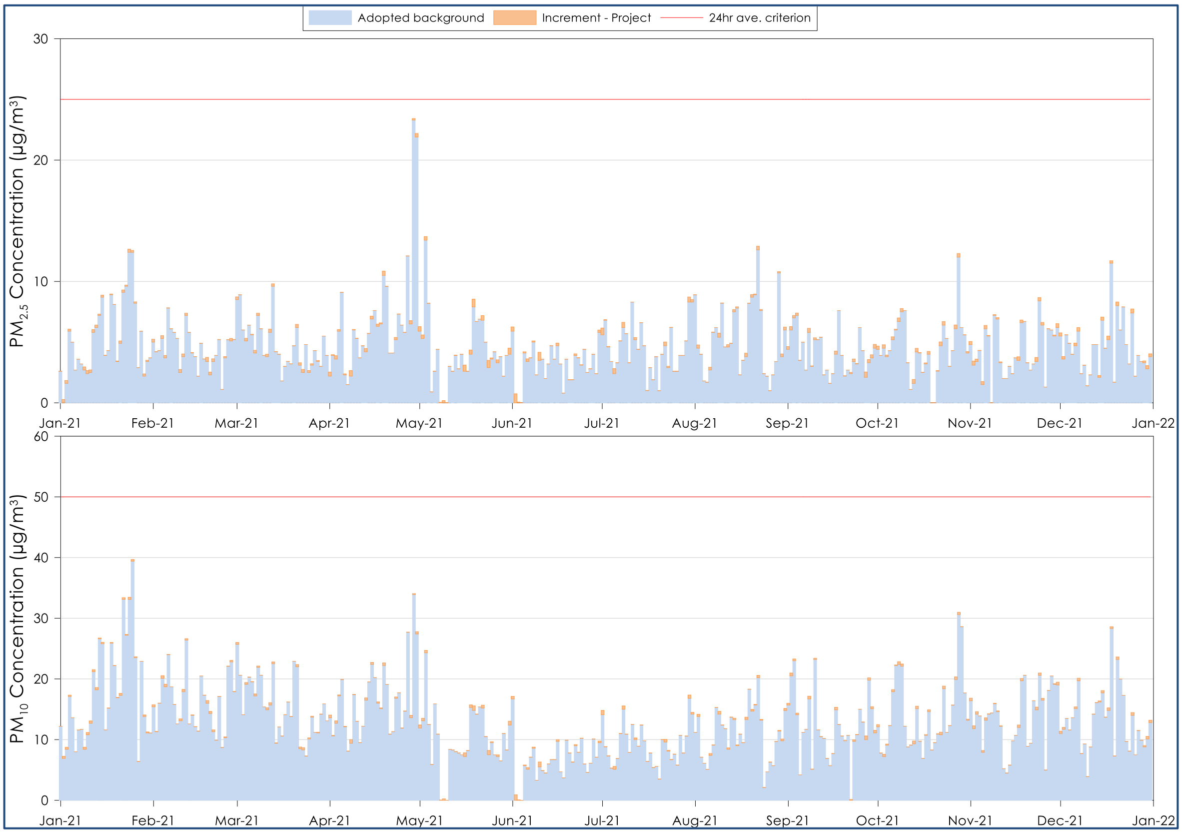


Figure 6-1: 24-hour cumulative $PM_{2.5}$ and PM_{10} concentrations – R1

7 RECOMMENDATIONS

The modelling predictions indicate the potential for air quality impacts on the Project site is unlikely due to the existing industrial operations. This is supported by the air quality monitoring campaign which finds a low influence from the surrounding industries as the ambient air quality levels are governed by regional influences.

Nevertheless, it is recommended that the Project consider a range of measures to generally mitigate air quality impacts.

- Plan for the least sensitive land uses to be located nearest to the industrial uses. Compatible land uses may include park reserves, car parks or access roads;
- Orientate buildings to provide adequate air flow around the building and design buildings to encourage air flow in a particular direction (e.g. away from outdoor living areas. (This can be aided by road orientation and block size and shapes). Avoid construction of dead-end courtyards or long narrow spaces perpendicular to the prevailing winds where air can lay dormant and stagnate, is to be encouraged;
- Build continuous dense landscaping (bunds and vegetation) to assist in air dispersion; and,
- Consider air conditioning and ventilation, and design buildings so living and workspaces such as bedrooms and offices do not face industrial sources. Large apartment buildings could have non-opening windows on the industrial side of the building and could duct cleaner air into the building from the far side, and out to the industrial side.

8 SUMMARY AND CONCLUSIONS

This report has assessed the potential for air quality impacts to arise the proposed residential and commercial development located at 131 St Vincent Street, Ulladulla.

It is predicted that all the assessed air pollutants generated by the operation of the concrete batching plant and earthworks company would comply with the applicable assessment criteria at the assessed receptors and therefore would not lead to any unacceptable level of environmental harm or significantly impact upon the amenity at the Project site.

Recommendations have been made to minimise the potential for air quality impacts on the Project site.

Overall, the assessment demonstrates that the rezoning of the site from E4 General Industrial to MU1 Mixed Use is appropriate in regard to air quality. The modelling indicates that residential and commercial land uses can operate without exceeding the applicable air quality criteria in this location.

9 REFERENCES

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"Development Near Rail Corridors and Busy Roads – Interim Guideline", NSW Department of Planning, 2008

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"Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales", New South Wales Environmental Protection Authority, September 2022

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"Compilation of Air Pollutant Emission Factors", AP-42, Fourth Edition United States Environmental Protection Agency, Office of Air and Radiation Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711.

US EPA (2011)

"Health Effects of Pollution", United States Environmental Protection Agency website. http://www.epa.gov/region07/air/quality/health.htm, 2011

Appendix A
Selection of Meteorological Year

Selection of meteorological year

A long-term analysis of the last seven years of available meteorological data from the nearest BoM weather station with suitable available data at Ulladulla AWS is presented in **Table A-1**.

The analysis of the seven years indicates that 2018 is closest to the average for wind speed, and 2021 is closest to the average for temperature and relative humidity. Overall, the 2021 year aligns most closely to the long-term average and is considered suitable for use in the assessment.

Table A-1: Long term analysis results for Ulladulla AWS

Year	Wind speed	Temperature	Relative humidity	Score
2016	0.7	0.6	3.2	4.5
2017	0.6	0.5	3.9	5.0
2018	0.5	0.6	4.2	5.3
2019	0.7	0.6	5.7	6.9
2020	0.6	0.4	3.8	4.8
2021	0.7	0.3	2.3	3.2
2022	0.6	0.4	4.1	5.0

Figure A-1 shows the frequency distributions for wind speed, wind direction, temperature and relative humidity for the 2021 year compared with the mean and range of the combined 2016 to 2022 data set. The 2021-year data appear to be well aligned with the mean data.

Therefore, based on this analysis it was determined that 2021 is generally representative of the long-term trends compared to other years and is thus suitable for the purpose of modelling.

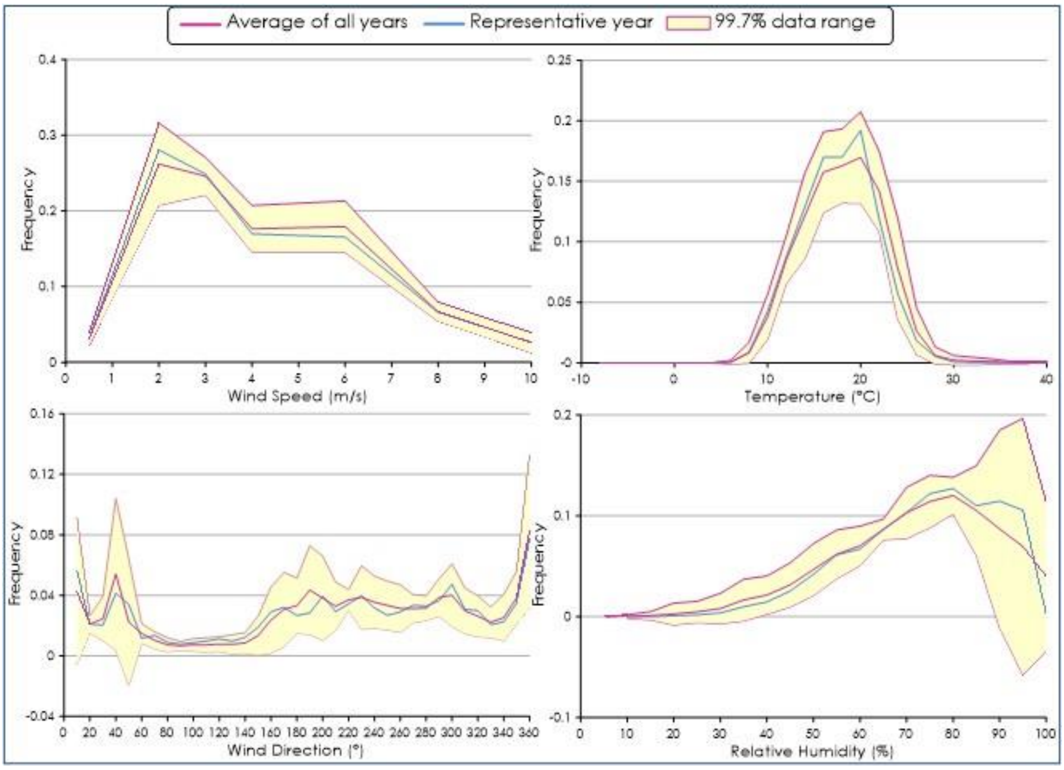

Figure A-1: Frequency distributions for wind speed, wind direction, temperature and relative humidity

Appendix B

Emission Calculations

Emission Calculation

The dust emissions from the Project have been estimated from the operational description of the proposed activities provided by the Proponent and have been combined with emission factor equations and utilising suitable emission and load factors which relate to the quantity of dust emitted from particular activities based on intensity, the prevailing meteorological conditions and composition of the material being handled.

Emission factors and associated controls have been sourced from the United States (US) EPA AP42 Emission Factors (**US EPA, 1985 and Updates**).

The emission factor equations used for each dust generating activity are outlined in **Table B-1** below. A detailed dust emission inventory for the modelled scenario is presented in **Table B-2**.

Table B-1: Emission factor equations

Activity	Emission factor equation		
	TSP	PM_{10}	$PM_{2.5}$
Loading / emplacing material	$EF = 0.74 \times 0.0016 \times \left(\frac{U}{2.2}^{1.3} / \frac{M}{2}^{1.4}\right) kg/tonne$	$EF = 0.35 \times 0.0016 \times \left(\frac{U}{2.2}^{1.3} / \frac{M}{2}^{1.4}\right) kg/tonne$	$EF = 0.053 \times 0.0016 \times \left(\frac{U}{2.2}^{1.3} / \frac{M}{2}^{1.4}\right) kg/tonne$
Hauling on sealed surfaces	$EF = 3.23 \times s.L.^{0.91} \times (1.1023 \times W)^{1.02} kg/VKT$	$EF = 0.62 \times s.L.^{0.91} \times (1.1023 \times W)^{1.02} kg/VKT$	$EF = 0.15 \times s.L.^{0.91} \times (1.1023 \times W)^{1.02} kg/VKT$
Shredding material	$EF = 0.0027\ kg/tonne$	$EF = 0.0012\ kg/tonne$	$EF = 0.0002\ kg/tonne$
Granulating material	$EF = 0.0125\ kg/tonne$	$EF = 0.0043\ kg/tonne$	$EF = 0.0003\ kg/tonne$
Exhaust	*EF = 99kg/yr x ((100-70)/100)*	*EF = 99kg/yr x ((100-70)/100)*	*EF = 96kg/yr x ((100-70)/100)*

EF = emission factor, U = wind speed (m/s), s.L. = silt loading (g/m^2), M = moisture content (%), W = average weight of vehicle (tonne), VKT = vehicle kilometres travelled (km)

Table B-2: Dust Emissions Inventory – Concrete batch plant

Activity	TSP (kg/yr)	PM10 (kg/yr)	PM2.5 (kg/yr)	Intensity	Units	TSP EF	PM10 EF	PM2.5 EF	Units	Var. 1	Units	Var. 2	Units	TSP Var.3	PM10 Var.3	PM2.5 Var.3	Units	Var.4	Units	Var. 5	Units
Delivering sand and aggregate material onsite (paved road)	60	12	3	60000	t/yr	0.001	0.0002	0.00005	kg/t	36	t/load	0.1	km/return	0.3	0.05	0.01	kg/VKT	2	S.L (g/m2	36	ave weight (t)
Unloading sand and aggregate materials to stockpile	37	17	3	60000	t/yr	0.001	0.0003	0.00004	kg/t	2	ave ws (v	5	M.C %								
FEL rehandle	37	17	3	60000	t/yr	0.001	0.0003	0.00004	kg/t	2	ave ws (v	5	M.C %								
Unloading sand and aggregate materials to hopper	37	17	3	60000	t/yr	0.001	0.0003	0.00004	kg/t	2	ave ws (v	5	M.C %								
Conveying aggregate/sand to storage silo	20	10	2	0.02	ha	850	425	64	kg/ha/year												
Delivering cement material onsite (paved road)	60	12	3	60000	t/yr	0.001	0.0002	0.00005	kg/t	27	t/load	0.1	km/return	0.2	0.04	0.01	kg/VKT	2	S.L (g/m2	27	ave weight (t)
Unloading cement to elevated storage silo (pneumatic)	30	10	2	60000	t/yr	0.001	0.0002	0.00004	kg/t												
Weigh hopper loading	37	17	3	60000	t/yr	0.001	0.0003	0.00004	kg/t	2	ave ws (v	5	M.C %								
Loading to agitator	37	17	3	60000	t/yr	0.001	0.0003	0.00004	kg/t	2	ave ws (v	5	M.C %								
Agitator concrete truck travelling onsite (paved road)	81	16	4	60000	t/yr	0.001	0.0003	0.00006	kg/t	16	t/load	0.2	km/return	0.1	0.02	0.01	kg/VKT	2	S.L (g/m2	16	ave weight (t)
Loading concrete washout	1	0	0	1500	t/yr	0.001	0.0003	0.00004	kg/t	2	ave ws (v	5	M.C %								
Transporting concrete washout offsite (paved road)	2	0	0	1500	t/yr	0.001	0.0003	0.00007	kg/t	27	t/load	0.4	km/return	0.1	0.02	0.01	kg/VKT	2	S.L (g/m2	16	ave weight (t)
Wind erosion	347	173	26	0	ha	850	425	64	kg/ha/year												
Diesel exhaust	305	305	296																		
Total TSP emissions (kg/yr)	**1090**	**625**	**348**																		

Table B-3: Dust Emissions Inventory – Earth works

Activity	TSP (kg/year)	PM10 (kg/year)	PM2.5 (kg/year)	Intensity	Units	TSP EF	PM10 EF	PM2.5 EF	Units	Var. 1	Units	Var. 2	Units	TSP Var.3	PM10 Var.3	PM2.5 Var.3	Units	Var. 4	Units	Var. 5	Units
Delivering material onsite (paved road)	41	8	2	15,000	t/yr	0.003	0.001	0.0001	kg/t	6.5	t/load	0	km/retur	0.2	0.04	0.01	kg/VKT	10	S.L (g/m2)	7	ave weight (t)
Unloading materials to stockpile	30	14	2	15,000	t/yr	0.002	0.001	0.0001	kg/t	1.71	ave ws (ws/2.2)^1.3 (m/s)	2	M.C %								
FEL rehandle	30	14	2	15,000	t/yr	0.002	0.001	0.0001	kg/t	1.71	ave ws (ws/2.2)^1.3 (m/s)	2	M.C %								
Loading material to truck	30	14	2	15,000	t/yr	0.002	0.001	0.0001	kg/t	1.71	ave ws (ws/2.2)^1.3 (m/s)	2	M.C %								
Transporting material offsite (paved road)	39	8	2	15,000	t/yr	0.003	0.001	0.0001	kg/t	6.5	t/load	0	km/retur	0.2	0.04	0.01	kg/VKT	10	S.L (g/m2)	7	ave weight (t)
Wind erosion	347	173	26	0	ha	850	425	64	kg/ha/year												
Diesel exhaust	206	206	200																		
Total TSP emissions (kg/yr)	**724**	**438**	**236**																		

Appendix C

Isopleth Diagrams

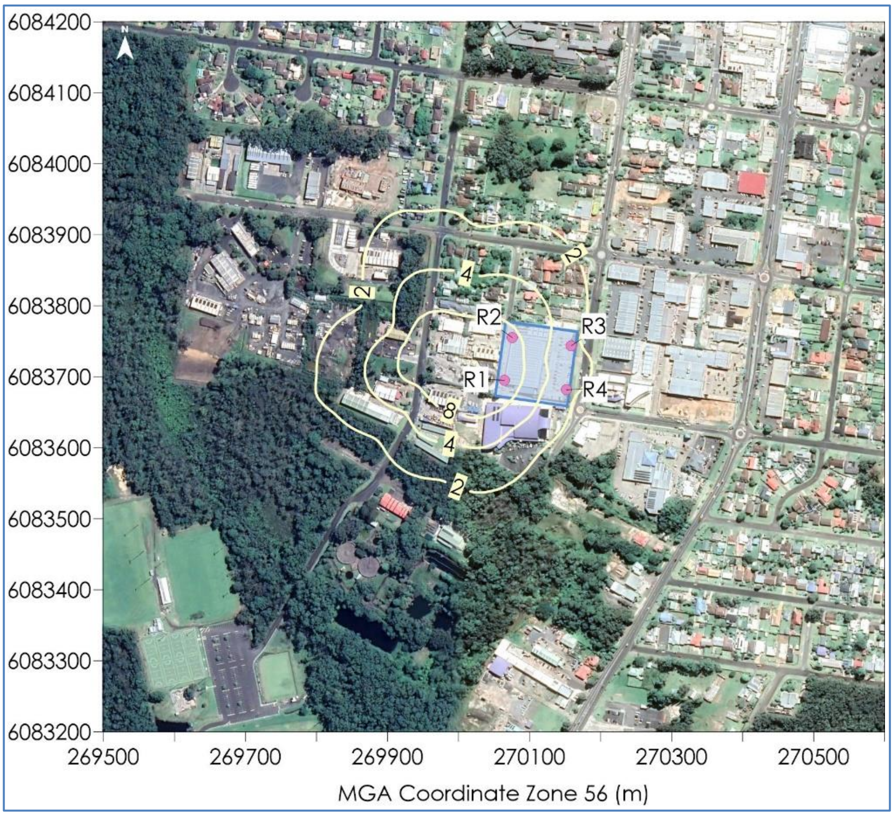

Figure C-1: Predicted incremental maximum 24-hour average $PM_{2.5}$ concentrations (µg/m³)

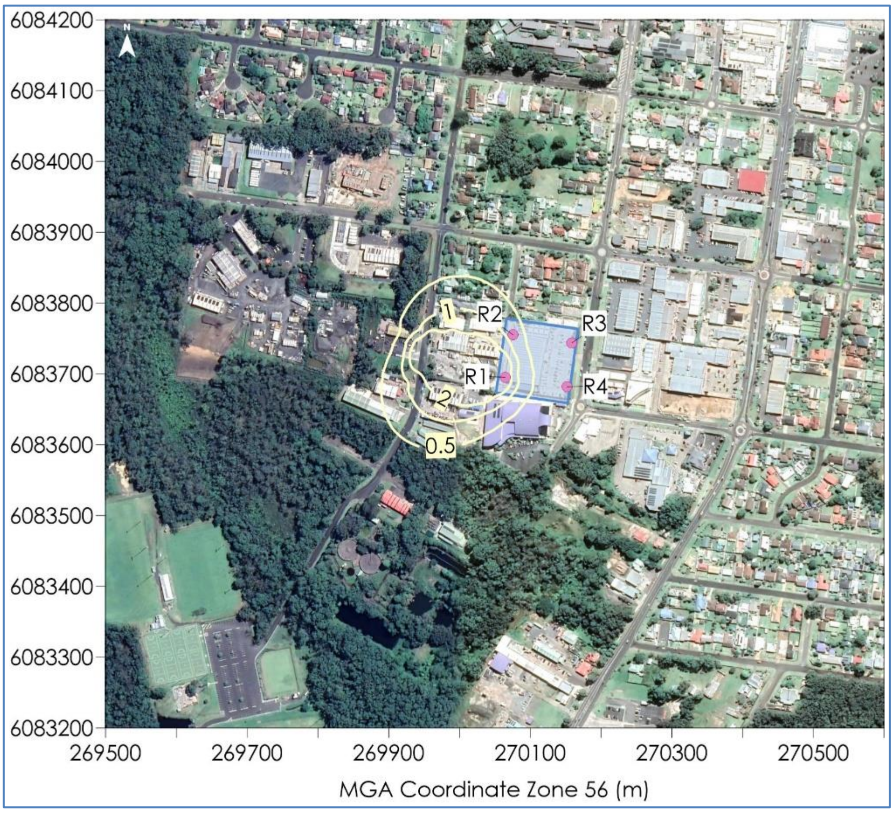

Figure C-2: Predicted incremental annual average $PM_{2.5}$ concentrations (µg/m³)

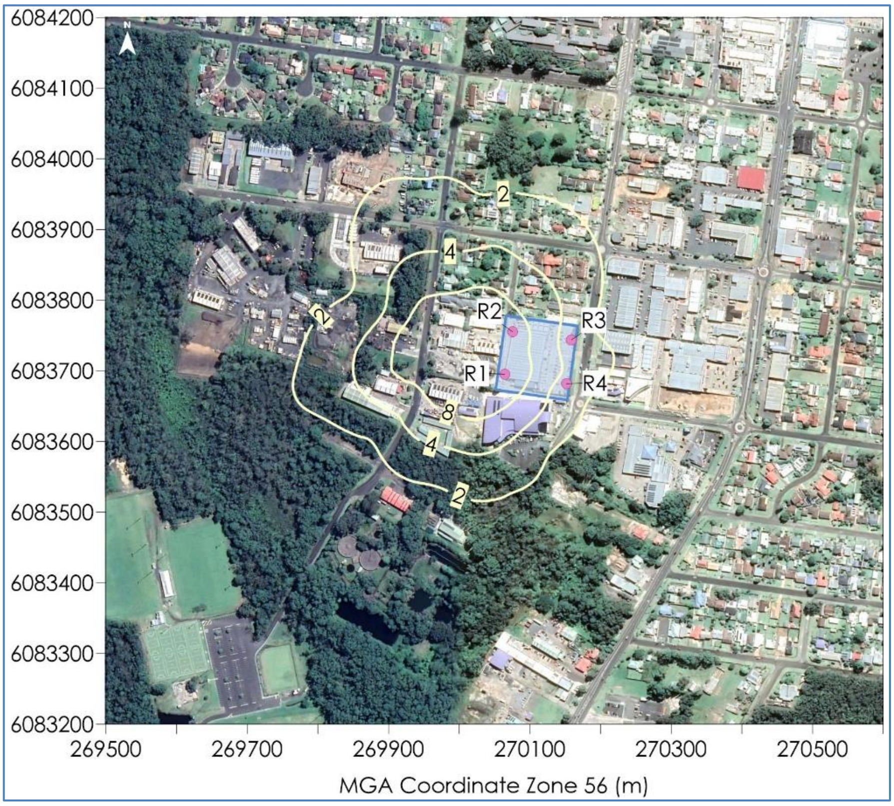

Figure C-3: Predicted incremental maximum 24-hour average PM_{10} concentrations (µg/m³)

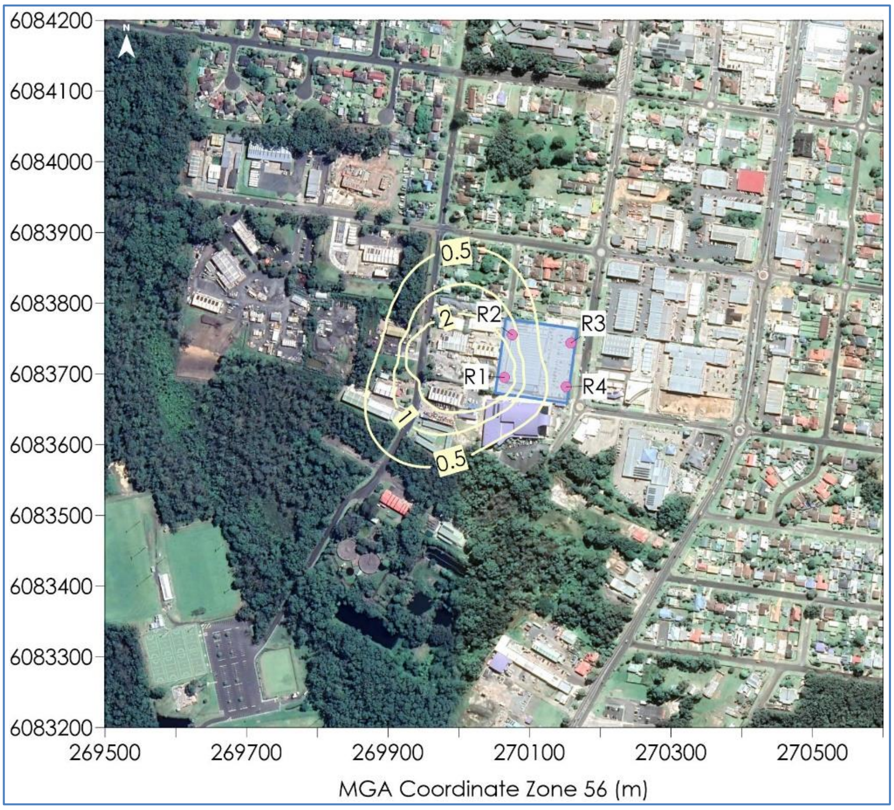

Figure C-4: Predicted incremental annual average PM_{10} concentrations (µg/m³)

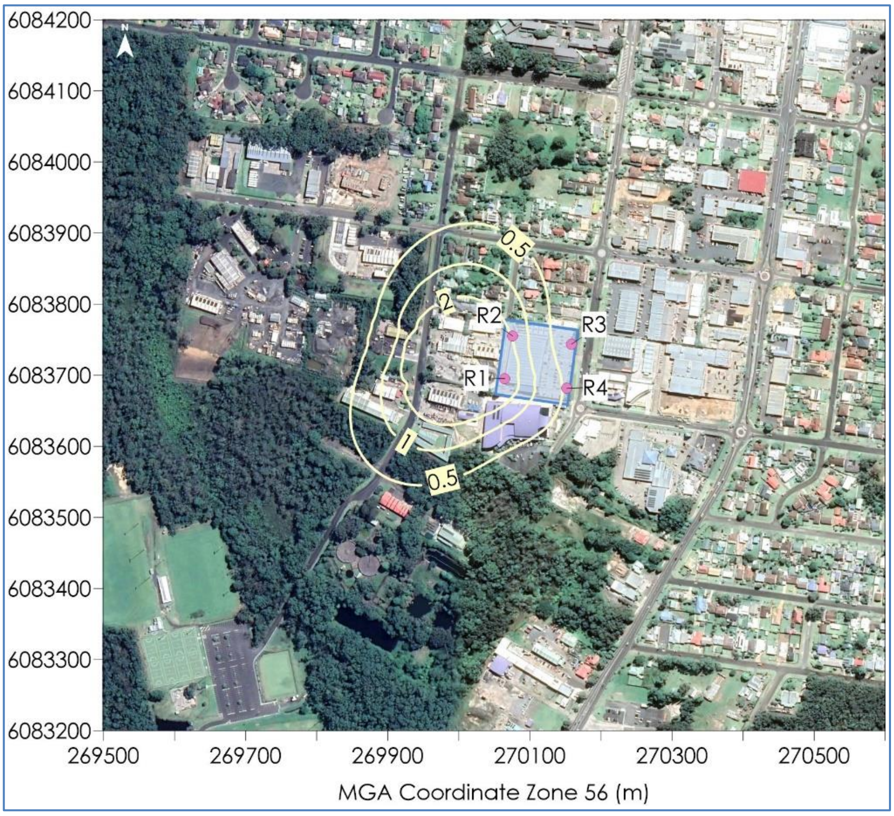

Figure C-5: Predicted incremental annual average TSP concentrations (µg/m³)

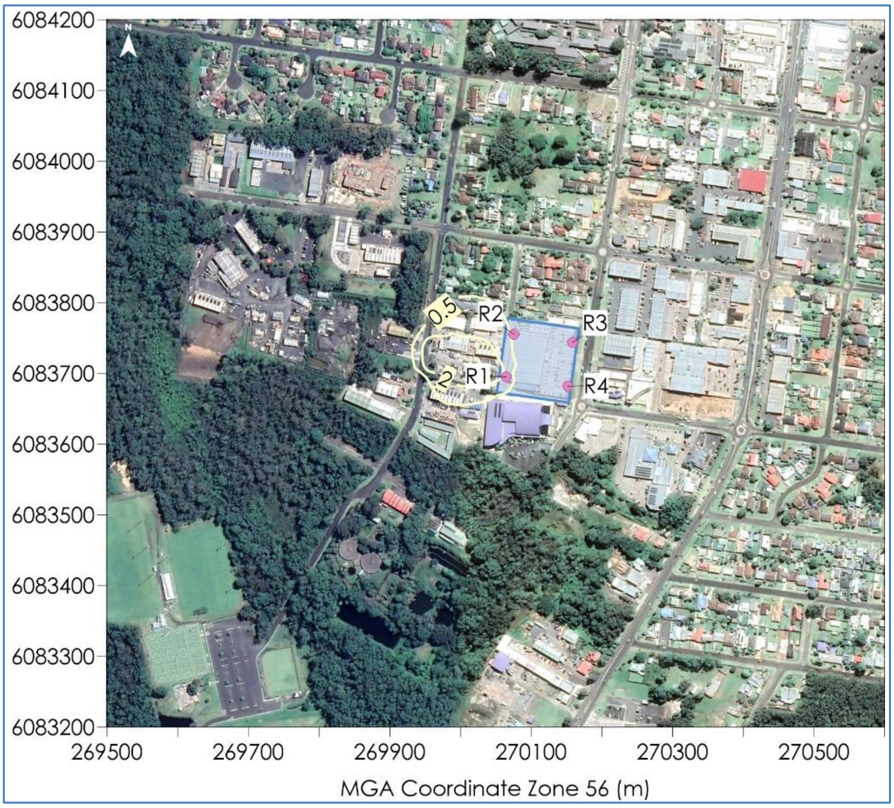

Figure C-6: Predicted incremental annual average dust deposition levels (g/m²/month)

Appendix D

Further detail regarding 24-hour $PM_{2.5}$ and PM_{10} analysis

Further detail regarding 24-hour average $PM_{2.5}$ and PM_{10} analysis

The analysis below provides a cumulative 24-hour $PM_{2.5}$ and PM_{10} impact assessment in accordance with the NSW EPA Approved Methods; refer to the worked example on Page 46 to 47 of the Approved Methods.

The background level is the ambient level at the Albion Park South monitoring station.

The predicted increment is the predicted level to occur at the receptor due to the Project.

The total is the sum of the background level and the predicted level. The totals may have minor discrepancies due to rounding.

The left half of the table examines the cumulative impact during the periods of highest background levels and the right half of the table examines the cumulative impact during the periods of highest contribution from the project.

The green shading represents days ranked per the highest background level but below the criteria.

The blue shading represents days ranked per the highest predicted increment level but below the criteria.

The orange shading represents days where the measured background level is already over the criteria.

Any value above the PM_{10} criterion of 50µg/m^3 and the $PM_{2.5}$ criterion of 25µg/m^3 is shown in **bold red.**

Table D-1: Cumulative 24-hour average $PM_{2.5}$ concentration (µg/m³) – Receptor R1

Ranked by Highest to Lowest Background Concentrations				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment	Total cumulative 24-hr average level
29/04/2021	23.3	0.1	23.4	02/06/2021	ND	0.7	0.7
30/04/2021	21.9	0.3	22.2	10/06/2021	3.5	0.7	4.2
03/05/2021	13.4	0.3	13.7	19/05/2021	7.9	0.6	8.5
22/08/2021	12.6	0.3	12.9	24/05/2021	2.9	0.6	3.5
24/01/2021	12.4	0.3	12.7	01/07/2021	5.6	0.6	6.2
25/01/2021	12.4	0.2	12.6	16/05/2021	2.6	0.5	3.1
27/04/2021	12.1	0.0	12.1	31/05/2021	4	0.5	4.5
28/10/2021	12	0.3	12.3	08/04/2021	2.2	0.5	2.7
18/12/2021	11.5	0.2	11.7	27/09/2021	2.1	0.4	2.5
29/08/2021	10.7	0.1	10.8	08/07/2021	6.2	0.4	6.6

ND – no data

Table D-2: Cumulative 24-hour average $PM_{2.5}$ concentration (µg/m³) – Receptor R2

Ranked by Highest to Lowest Background Concentrations				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment	Total cumulative 24-hr average level
29/04/2021	23.3	0.2	23.5	02/06/2021	ND	0.8	0.8
30/04/2021	21.9	0.4	22.3	19/05/2021	7.9	0.8	8.7
03/05/2021	13.4	0.3	13.7	10/06/2021	3.5	0.7	4.2
22/08/2021	12.6	0.3	12.9	24/05/2021	2.9	0.6	3.5
24/01/2021	12.4	0.2	12.6	01/07/2021	5.6	0.6	6.2
25/01/2021	12.4	0.1	12.5	22/05/2021	6.8	0.5	7.3
27/04/2021	12.1	0.0	12.1	30/07/2021	8.3	0.5	8.8
28/10/2021	12	0.3	12.3	16/05/2021	2.6	0.5	3.1
18/12/2021	11.5	0.2	11.7	08/04/2021	2.2	0.5	2.7
29/08/2021	10.7	0.1	10.8	08/07/2021	6.2	0.5	6.7

ND – no data

Table D-3: Cumulative 24-hour average $PM_{2.5}$ concentration (µg/m³) – Receptor R3

Ranked by Highest to Lowest Background Concentrations				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment	Total cumulative 24-hr average level
29/04/2021	23.3	0.2	23.5	19/05/2021	7.9	0.9	8.8
30/04/2021	21.9	0.4	22.3	02/06/2021	ND	0.9	0.9
03/05/2021	13.4	0.3	13.7	22/05/2021	6.8	0.8	7.6
22/08/2021	12.6	0.3	12.9	10/06/2021	3.5	0.7	4.2
24/01/2021	12.4	0.2	12.6	18/05/2021	4	0.7	4.7
25/01/2021	12.4	0.1	12.5	30/07/2021	8.3	0.7	9.0
27/04/2021	12.1	0.0	12.1	24/05/2021	2.9	0.5	3.4
28/10/2021	12	0.3	12.3	08/07/2021	6.2	0.5	6.7
18/12/2021	11.5	0.2	11.7	08/04/2021	2.2	0.5	2.7
29/08/2021	10.7	0.1	10.8	01/07/2021	5.6	0.5	6.1

ND – no data

Table D-4: Cumulative 24-hour average $PM_{2.5}$ concentration (µg/m³) – Receptor R4

Ranked by Highest to Lowest Background Concentrations				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment	Total cumulative 24-hr average level
29/04/2021	23.3	0.2	23.5	19/05/2021	7.9	1.1	9.0
30/04/2021	21.9	0.5	22.4	22/05/2021	6.8	1.0	7.8
03/05/2021	13.4	0.2	13.6	18/05/2021	4	0.9	4.9
22/08/2021	12.6	0.3	12.9	02/06/2021	ND	0.9	0.9
24/01/2021	12.4	0.2	12.6	30/07/2021	8.3	0.7	9.0
25/01/2021	12.4	0.1	12.5	10/06/2021	3.5	0.7	4.2
27/04/2021	12.1	0.0	12.1	27/05/2021	3.3	0.6	3.9
28/10/2021	12	0.3	12.3	08/04/2021	2.2	0.5	2.7
18/12/2021	11.5	0.2	11.7	08/07/2021	6.2	0.5	6.7
29/08/2021	10.7	0.1	10.8	27/09/2021	2.1	0.5	2.6

* Exceptional event day, ND – no data

Table D-5: Cumulative 24-hour average PM_{10} concentration (µg/m³) – Receptor R1

Ranked by Highest to Lowest Background Concentrations				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment	Total cumulative 24-hr average level
25/01/2021	39.4	0.3	39.7	02/06/2021	ND	0.9	0.9
29/04/2021	33.9	0.2	34.1	10/06/2021	5.5	0.8	6.3
22/01/2021	33.1	0.3	33.4	19/05/2021	14.8	0.8	15.6
24/01/2021	33.1	0.4	33.5	24/05/2021	7.5	0.7	8.2
28/10/2021	30.6	0.4	31.0	01/07/2021	14.1	0.7	14.8
29/10/2021	28.6	0.0	28.6	31/05/2021	12.4	0.6	13.0
18/12/2021	28.3	0.3	28.6	16/05/2021	7.2	0.6	7.8
27/04/2021	27.7	0.0	27.7	27/09/2021	10	0.6	10.6
30/04/2021	27.4	0.4	27.8	08/04/2021	9.4	0.6	10.0
23/01/2021	27.2	0.1	27.3	08/07/2021	15	0.6	15.6

* Exceptional event day, ND – no data

Table D-6: Cumulative 24-hour average PM_{10} concentration (μg/m³) – Receptor R2

Ranked by Highest to Lowest Background Concentrations				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment	Total cumulative 24-hr average level
25/01/2021	39.4	0.2	39.6	02/06/2021	ND	1.0	1.0
29/04/2021	33.9	0.2	34.1	19/05/2021	14.8	0.9	15.7
22/01/2021	33.1	0.3	33.4	10/06/2021	5.5	0.8	6.3
24/01/2021	33.1	0.3	33.4	01/07/2021	14.1	0.7	14.8
28/10/2021	30.6	0.4	31.0	24/05/2021	7.5	0.7	8.2
29/10/2021	28.6	0.0	28.6	30/07/2021	16.8	0.7	17.5
18/12/2021	28.3	0.3	28.6	22/05/2021	15.2	0.7	15.9
27/04/2021	27.7	0.0	27.7	08/04/2021	9.4	0.7	10.1
30/04/2021	27.4	0.5	27.9	27/09/2021	10	0.7	10.7
23/01/2021	27.2	0.2	27.4	08/07/2021	15	0.6	15.6

* Exceptional event day, ND – no data

Table D-7: Cumulative 24-hour average PM_{10} concentration (μg/m³) – Receptor R3

Ranked by Highest to Lowest Background Concentrations				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment	Total cumulative 24-hr average level
25/01/2021	39.4	0.2	39.6	19/05/2021	14.8	1.2	16.0
29/04/2021	33.9	0.2	34.1	02/06/2021	ND	1.0	1.0
22/01/2021	33.1	0.3	33.4	22/05/2021	15.2	0.9	16.1
24/01/2021	33.1	0.3	33.4	30/07/2021	16.8	0.9	17.7
28/10/2021	30.6	0.4	31.0	10/06/2021	5.5	0.8	6.3
29/10/2021	28.6	0.0	28.6	18/05/2021	15.3	0.8	16.1
18/12/2021	28.3	0.3	28.6	08/07/2021	15	0.7	15.7
27/04/2021	27.7	0.0	27.7	08/04/2021	9.4	0.7	10.1
30/04/2021	27.4	0.6	28.0	27/09/2021	10	0.7	10.7
23/01/2021	27.2	0.2	27.4	24/05/2021	7.5	0.7	8.2

* Exceptional event day, ND – no data

Table D-8: Cumulative 24-hour average PM_{10} concentration (μg/m³) – Receptor R4

Ranked by Highest to Lowest Background Concentrations				Ranked by Highest to Lowest Predicted Incremental Concentration			
Date	Measured background level	Predicted increment	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment	Total cumulative 24-hr average level
25/01/2021	39.4	0.2	39.6	19/05/2021	14.8	1.4	16.2
29/04/2021	33.9	0.3	34.2	22/05/2021	15.2	1.3	16.5
22/01/2021	33.1	0.2	33.3	18/05/2021	15.3	1.1	16.4
24/01/2021	33.1	0.3	33.4	02/06/2021	ND	1.1	1.1
28/10/2021	30.6	0.4	31.0	30/07/2021	16.8	1.0	17.8
29/10/2021	28.6	0.0	28.6	10/06/2021	5.5	0.8	6.3
18/12/2021	28.3	0.3	28.6	27/05/2021	7.2	0.8	8.0
27/04/2021	27.7	0.0	27.7	08/04/2021	9.4	0.7	10.1
30/04/2021	27.4	0.6	28.0	27/09/2021	10	0.7	10.7
23/01/2021	27.2	0.3	27.5	08/07/2021	15	0.7	15.7

* Exceptional event day, ND – no data