Appendix I.3

Air quality and greenhouse gas assessment

creating opportunities

Kurri Kurri Integrated Resource Recovery Centre

Air quality and greenhouse gas assessment

Prepared for Central Waste Station Pty Ltd

August 2025

Kurri Kurri Integrated Resource Recovery Centre

Air quality and greenhouse gas assessment

Central Waste Station Pty Ltd

E230029 RP6

August 2025

Version	Date	Prepared by	Reviewed by	Comments
V1	5 February 2025	A Gilbert, S Fishwick	S Fishwick, P Towler	Final

Approved by

Scott Fishwick
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1 August 2025

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Executive Summary

EMM Consulting Pty Ltd (EMM) has been engaged by CWS Central Waste Station Pty Ltd (CWS) to undertake an air quality and greenhouse gas assessment (AQGHGA) for a proposed increase in materials throughput processing at the resource recovery facility (RRF) owned by Central Waste Plant Pty Ltd (CWP) at 8 Styles Street in Kurri Kurri. The AQGHGA has been conducted following the methods prescribed in the *Approved Methods for Modelling* (NSW EPA 2022).

Background air quality concentrations were adopted from data recorded during the 2023 calendar year at NSW Department of Climate Change, Energy, Environment and Water (DCCEEW) Beresfield AQMS site. Meteorological modelling was completed using TAPM and AERMET, with real-world observations incorporated from the Bureau of Meteorology (BoM) automatic weather stations (AWS) at Maitland Airport and Williamtown RAAF.

Emissions were quantified for the following air pollutants:

- particulate matter (PM), specifically:
  - total suspended particulate matter (TSP)
  - particulate matter less than 10 micrometres (µm) in aerodynamic diameter (PM_{10})
  - particulate matter less than 2.5 µm in aerodynamic diameter ($PM_{2.5}$).

Emissions were quantified using publicly available emission estimation techniques. Atmospheric dispersion model predictions for the proposed activities were undertaken using the AERMOD dispersion modelling system.

The results of the modelling show that the predicted concentrations and deposition rates for incremental particulate matter (TSP, PM_{10}, $PM_{2.5}$ and dust deposition) are below the applicable impact assessment criteria at all assessment locations.

Cumulative impacts were assessed by combining the adopted background concentrations with the predicted incremental concentrations from the project. Cumulative results indicated that air pollution concentrations associated with emissions from the project would be in compliance with the NSW EPA impact assessment criteria at all surrounding assessment locations for all pollutants and averaging periods.

A range of best practice dust mitigation measures are currently implemented at the site and are proposed for the project. These include the use of enclosure and extraction to dust filters of primary processing plant equipment, the use of water sprays to external operations and stockpiles, three sided enclosures with awnings for material storage bays, and cleaning of paved surfaces. These measures have been taken into account in the emissions estimation and dispersion modelling.

A greenhouse gas (GHG) assessment was also completed for the project. Annual average GHG emissions (Scope 1) generated by the project represent approximately 0.00542% of NSW total emissions and 0.00139% of national total emissions on an annual average basis based on the National GHG Inventory for 2022. The calculated total annual Scope 1 and 2 emissions from site are below than the National Greenhouse Emissions Reporting (NGER) scheme facility reporting threshold of 25,000 tonnes per annum (tpa) CO_2-e. Therefore, no annual NGER Scheme reporting obligations apply to the site. The calculated annual Scope 1 GHG emissions are also well below the Safeguard Mechanism threshold of 100,000 tpa CO_2-e.

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1 Introduction

1.1 Overview

Central Waste Station Pty Ltd (CWS) operates a resource recovery facility (RRF) owned by Central Waste Plant Pty Ltd (CWP) at 8 Styles Street in Kurri Kurri. The most recent development consent (Cessnock Council Development Application (DA) 8/2019/568) allows a material throughput of 90,000 tonnes per annum (tpa) of General Solid Waste (non-putrescible) with up to 30,000 tonnes of material stored on site at any time and 24 hours per day, 6 days per week operations. The RRF is capable of a significantly higher throughput than is permitted under the existing development approval, which constrains the company's ability to achieve greater volumes of resource recovery for the region, to satisfy the demand for its services, and to grow the business. The facility currently has to reduce operational hours to avoid exceeding the annual throughput tonnage limit.

Therefore, CWP is applying for an expansion of the RRF operations to allow:

- a material throughput of up to 450,000 tpa
- on site storage of up to 40,000 tonnes of material
- operating hours of 24 hours per day, 7 days per week.

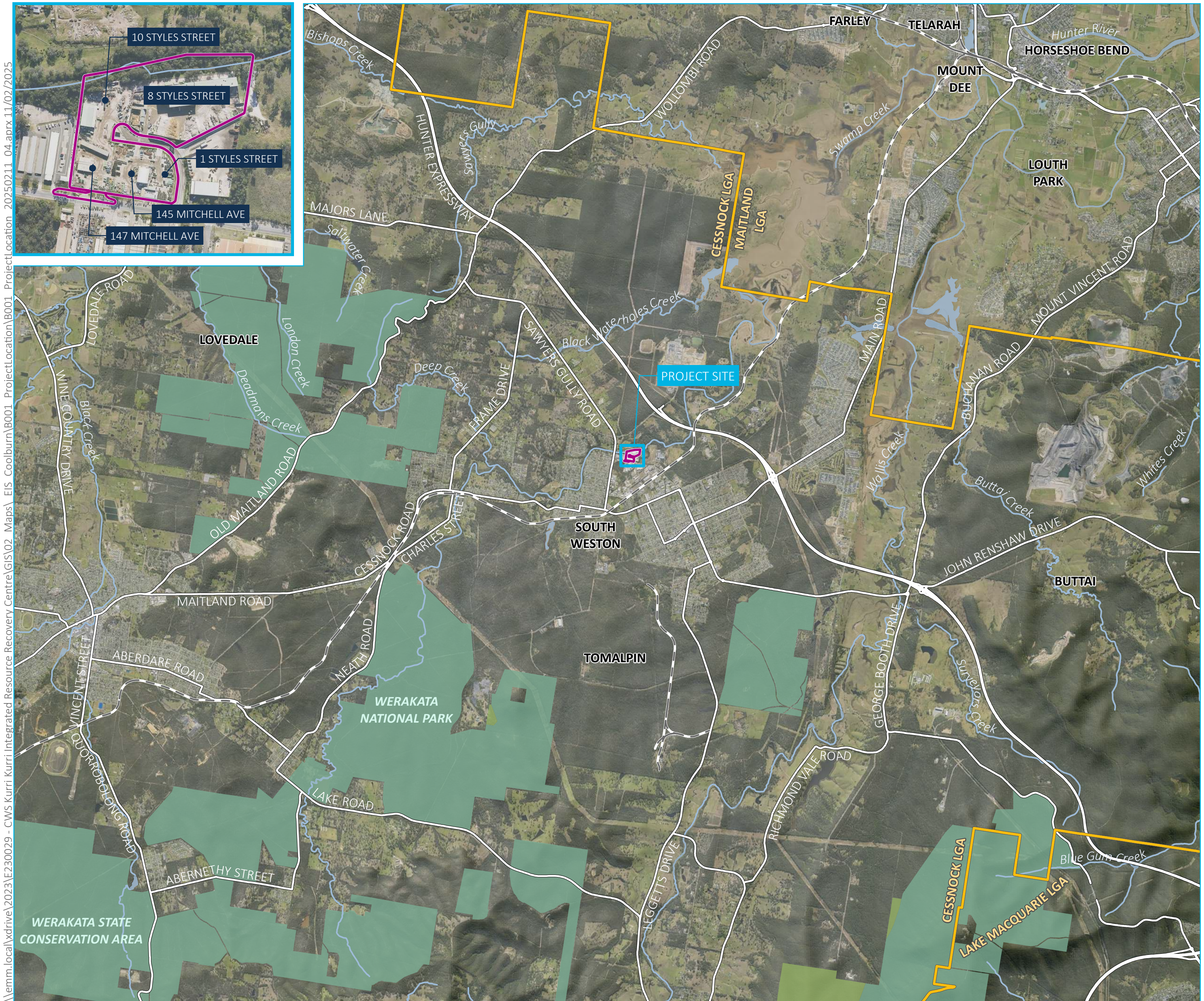
The RRF operational processes will remain generally the same. However, changes to the site layout are proposed to optimise the RRF operations and to allow further sorting and processing on site to increase the value of dispatched recovered materials. The revised site will occupy 1, 8 and 10 Styles Street and 145 and 147 Mitchell Avenue. The larger site and higher waste throughput is referred to as the Integrated Resource Recovery Centre (IRRC, 'the project'). The regional setting and local context for the project are shown in Figure 1.1 and Figure 1.2.

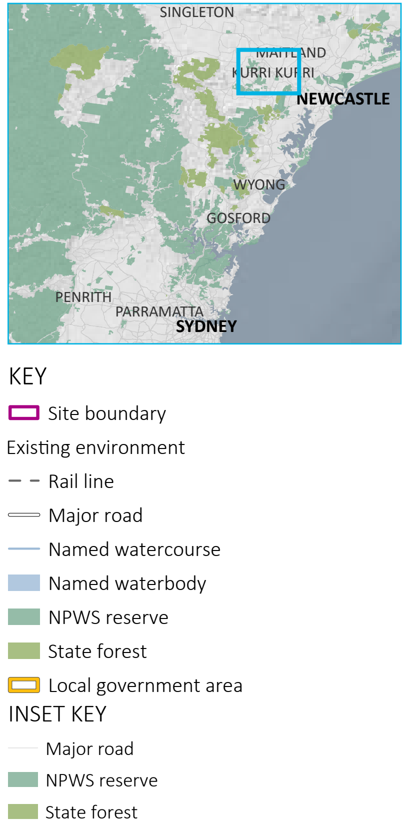
The existing infrastructure, the proposed changes and the project infrastructure (including the proposed changes) are summarised in Table 1.1 and proposed IRRC site layout are provided in Figure 1.3.

Table 1.1 Project summary

Lot	Existing infrastructure	Project changes	Project infrastructure (with changes)
8 Styles Street	An RRF comprising automated processing plant enclosure, weighbridge, receival shed, open material storage bays, water management basin and mobile plant and equipment for yard processing including crushing and screening. The main entry/exit to the site is via Styles Street, with car parking and demountable offices for staff.	• Remove demountable offices and weighbridge. • Close off the entry/exit onto Styles Street. • Add additional material storage bays by adding and extending concrete walls. • Extend awnings to cover external material storage bays.	**Resource recovery facility** • Automated processing plant enclosure. • Waste receival shed. • Covered material storage bays. • Yard processing comprising mobile equipment for sorting, shearing, crushing and screening. • Water management basin.
10 Styles Street	Ancillary area for CWS operations, comprising a workshop utilised for vehicle and equipment maintenance and general laydown and storage.	• Repurpose the existing workshop by replacing internal plant and equipment with metal recovery equipment. • Install stormwater and fire safety infrastructure and provide concrete hardstand throughout operations area. • Delineate car and truck parking. • Erect perimeter walls/fencing.	**Metal processing facility** • Shed with metal processing equipment and storage bunkers. • Car and truck parking. • General laydown and storage.

Lot	Existing infrastructure	Project changes	Project infrastructure (with changes)
147 Mitchell Avenue	Two sheds and a gravel hardstand area. Currently utilised for equipment laydown and storage.	• Demolish existing sheds. • Construct weighbridges and office. • Install stormwater infrastructure and provide concrete hardstand throughout operations area. • Delineate car and truck parking. • Erect perimeter walls/fencing.	**Auxiliary operations area** • Incoming and outgoing weighbridges with office over the top. • Car and truck parking. • Pedestrian linkages.
145 Mitchell Avenue 1 Styles Street	Gravel hardstand utilised for vehicle and equipment storage, temporary offices in the form of demountable buildings and a temporary awning.	• Remove demountable offices. • Install stormwater and fire safety infrastructure and provide concrete hardstand throughout operation area. • Construct residual waste processing building. • Erect perimeter walls/fencing.	**Residual waste recovery plant** • Shed with residual waste recovery plant and storage areas.
Mitchell Avenue road reserve	Gravel hardstand entry/exit into 147 Mitchell Avenue. Grassed/gravel verge between the road and the lot boundaries.	• Establish a new access for heavy vehicles into 147 Mitchell Avenue, including a deceleration lane on the northern side of Mitchell Avenue. • Construct a new footpath and provide landscaping along Mitchell Avenue between 143 Mitchell Avenue and Styles Street.	• IRRC main entry/exit with a deceleration lane on Mitchell Avenue. • Landscaped verge with footpath.



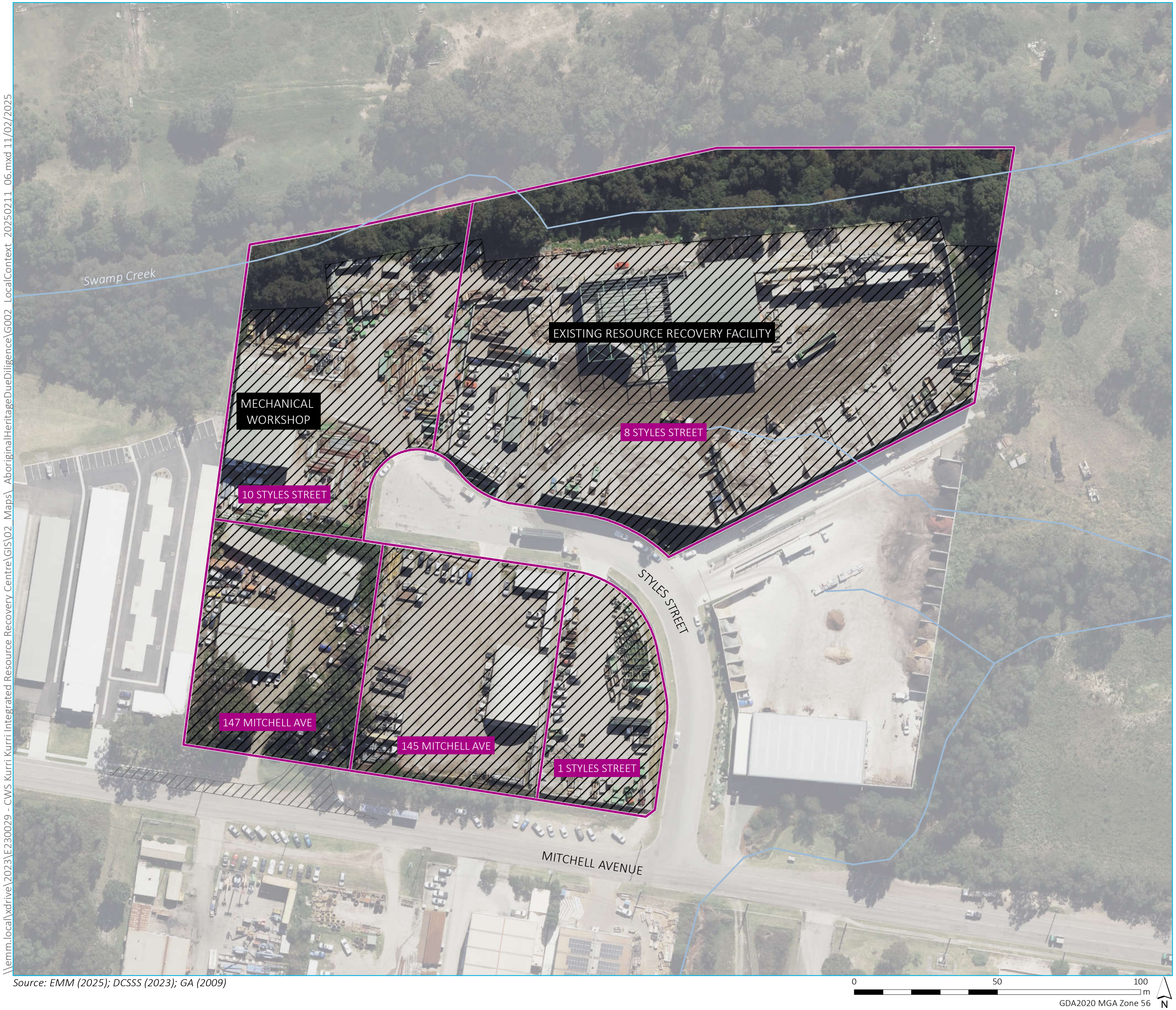


Source: EMM (2025); DCSSS (2024); GA (2009); ESRI (2025); ABS (2021)

Regional setting

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure 1.1

EMM creating opportunities



Source: EMM (2025); DCSSS (2023); GA (2009)

Local context

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure 1.2

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Figure 1.3 Indicative IRRC layout

1.2 Assessment approach and requirements

This air quality and greenhouse gas assessment (AQGHGA) has been conducted in general accordance with the guidelines specified by the NSW Environment Protection Authority (EPA) in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA 2022), hereafter 'the Approved Methods for Modelling'. Consistent with Section 2.1 of the Approved Methods for Modelling, this AQGHGA is classed as a Level 2 assessment and implements a refined dispersion modelling approach using the site-specific / representative input.

This AQGHGA report comprises:

- a description of the local setting
- relevant pollutants for assessment and applicable impact assessment criteria
- a description of baseline inputs, specifically:
  - meteorology and climate
  - existing air quality environment
- a detailed air pollution emissions inventory for average day and busy day operations
- results of atmospheric dispersion modelling including an analysis of project-only and cumulative impacts accounting for background air quality
- management and mitigation measures for the construction of the project
- a greenhouse gas assessment including estimation of Scope 1, 2 and 3 emissions for the operation of the Project.

This AQGHGA is an appendix to the project's EIS and should be read in conjunction with it. This AQGHGA has been prepared in to meet the Secretary Environmental Assessment Requirements (SEARs) for the State Significant Development Application (SSDA) (SSD-71547218), issued by the Department of Planning, Housing and Infrastructure (DPHI) on 28 June 2024. The SEARs identify matters which must be addressed in the EIS. Individual requirements relevant to this AQGHGA and where they are addressed in this report are listed in Table 1.2.

Table 1.2 Air quality and greenhouse gas related SEARs

Requirements	Section addressed
Air quality and odour – including	
• a quantitative assessment of the potential air quality, dust and odour impacts of the development (construction and operation) on surrounding landowners, businesses and sensitive receptors, in accordance with relevant Environment Protection Authority (EPA) guidelines, including:	This report
– details of buildings and air handling systems and strong justification for any material handling, processing or stockpiling external to buildings	Chapter 6 and Chapter 8
– a description and appraisal of air quality impact monitoring, emissions control techniques and mitigation measures.	Section 6.3 and Chapter 8

2 Site setting and assessment locations

2.1 Site setting and existing operations

The site consists of five land lots in the Cessnock local government area (LGA) towards the north-western boundary of Kurri Kurri, these are:

- Lot 1 of DP1309128 (8 Styles Street)
- Lot 6 of DP1251190 (10 Styles Street)
- Lot 3 of DP586741 (147 Mitchell Avenue)
- Lot 4 of DP586741 (145 Mitchell Avenue)
- Lot 1 of DP1128108 (1 Styles Street).

The site is primarily zoned as E3 Heavy Industrial under the Cessnock Local Environmental Plan 2011 (LEP) with a small area along the northern boundary zoned C3 Environmental management (Swamp Creek) and RU2 Rural Landscape. The nearest residential zone is an area of R2 Low Density Residential and is approximately 250 metres (m) west of the site. The nearest sensitive receptor is located approximately 250 m north-west of the site.

The Styles Street heavy industrial estate subdivision was approved in 2005 under DA 8/2005/362. Central Waste Property Pty Ltd own 1, 8 and 10 Styles Street as well as 145 and 147 Mitchell Avenue. CWS has been operating the existing resource recovery facility on 8 Styles Street since 2015.

The site at 8 Styles Street holds an existing environment protection license (EPL 13013) allowing resource recovery and waste storage. All wastes are transported to the site by truck where they are weighed and recorded through the weighbridge system.

Mixed wastes are unloaded in the unprocessed material stockpile area within a processing shed, where the loads are inspected to confirm their contents and to confirm the absence of contaminants, such as asbestos, prior to acceptance. Loads containing non-permitted waste are rejected. Mixed waste is pre-sorted to remove any objects that are unsuitable to go through the processing plant, or that do not need to go through the plant. These are stored directly in the appropriate storage bay.

The remaining mixed waste is processed to recover the recyclable materials such as metals, aggregates, and wood from the waste. Green waste and single-type wastes such as source-segregated wood, scrap metal, plasterboard and soil are tipped outside directly into designated storage bays.

Recovered materials are transported to third party recyclers or, in the case of masonry materials, are recycled on site. Non-recoverable wastes are transported to a suitable facility with appropriate licensing which will generally be one of the surrounding landfills.

2.2 Assessment locations

A selection of representative residential, industrial and commercial properties surrounding the project have been chosen as assessment locations (Table 2.1 and shown in Figure 2.1).

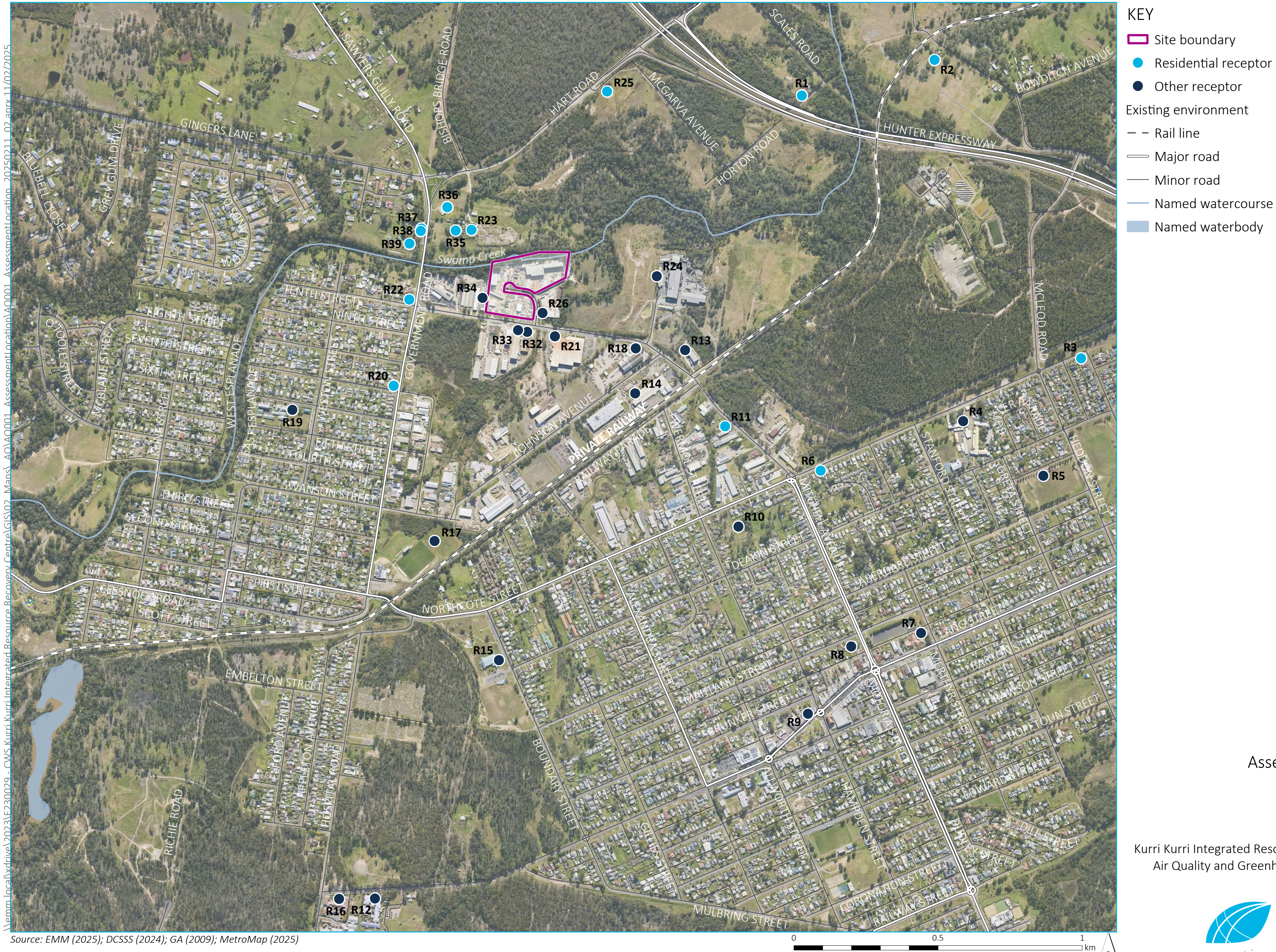
These locations are used as points for detailed model analysis of air quality impacts from the project's operational activities. Compliance with applicable assessment criteria at these representative assessment locations would indicate the criteria will be met at other more distant locations.

Table 2.1 Assessment locations

Location ID	Classification	Address	Coordinates (MGA,56)	
			Easting (m)	Northing (m)
R1	Residential	4 Horton Road, Loxford	357732	6369938
R2	Residential	7 McLeod Road, Loxford	358192	6370061
R3	Residential	20 James Street, Kurri Kurri	358700	6369027
R4	Classroom	11 Deakin Street, Kurri Kurri	358291	6368809
R5	Active recreation	10 Grieve Street, Kurri Kurri	358569	6368620
R6	Residential	66 Northcote Street, Kurri Kurri	357797	6368638
R7	Classroom	107 Lang Street, Kurri Kurri	358145	6368075
R8	Place of worship	134 Maitland Street, Kurri Kurri	357903	6368028
R9	Commercial	312 Lang Street, Kurri Kurri	357753	6367795
R10	Active recreation	73-81 Deakin Street, Kurri Kurri	357512	6368444
R11	Residential	122 Mitchell Avenue, Kurri Kurri	357466	6368791
R12	Hospital	412 Lang Street, Kurri Kurri	356252	6367155
R13	Industrial	125 Mitchell Avenue, Kurri Kurri	357327	6369055
R14	Industrial	126 Mitchell Avenue, Kurri Kurri	357154	6368906
R15	Active recreation	160 Northcote Street, Kurri Kurri	356682	6367981
R16	Hospital	434 Lang Street, Kurri Kurri	356128	6367153
R17	Active recreation	3 Government Road, Weston	356459	6368394
R18	Industrial	130 Mitchell Avenue, Kurri Kurri	357156	6369062
R19	Classroom	20-34 Sixth Street, Weston	355966	6368848
R20	Residential	62 Government Road, Weston	356317	6368932
R21	Industrial	142 Mitchell Avenue, Kurri Kurri	356876	6369103
R22	Residential	86 Government Road, Weston	356371	6369231
R23	Residential	18 Hart Road, Loxford	356587	6369472
R24	Industrial	129 Mitchell Avenue, Kurri Kurri	357229	6369312
R25	Residential	72 Hart Road, Loxford	357057	6369952
R26	Industrial	2 Styles Street, Kurri Kurri	356833	6369184
R32	Industrial	146 Mitchell Avenue, Kurri Kurri	356780	6369119
R33	Industrial	152 Mitchell Avenue, Kurri Kurri	356748	6369124
R34	Industrial	149 Mitchell Avenue, Kurri Kurri	356625	6369237
R35	Residential	65 Government Road, Loxford	356532	6369470
R36	Residential	67 Government Road, Loxford	356503	6369551

Location ID	Classification	Address	Coordinates (MGA,56)	
			Easting (m)	Northing (m)
R37	Residential	94C Government Road, Weston	356413	6369477
R38	Residential	94B Government Road, Weston	356411	6369468
R39	Residential	92 Government Road, Weston	356372	6369424

Note: R28 to R31 formed assessment locations for previous environmental assessments. They have been removed from this assessment as they now form part of the project site (1 and 10 Styles Street, 145 and 147 Mitchell Avenue)



Assessment location

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure 2.1

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Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

3 Pollutants and assessment criteria

3.1 Potential air pollutants

The operation of the site has potential to generate emissions of various pollutants to the ambient atmosphere. Emissions sources will comprise of a mixture of fugitive source (material handling activities and movement of mobile plant and equipment) and mobile combustion sources (diesel combustion by site equipment fleet and trucks). The main air pollutants will include:

- particulate matter, specifically:
    - total suspended particulate matter (TSP)
    - particulate matter less than 10 micrometres in aerodynamic diameter (PM_{10})
    - particulate matter less than 2.5 micrometres in aerodynamic diameter ($PM_{2.5}$)
- oxidise of nitrogen (NO_X)
- sulfur dioxide (SO_2)
- carbon monoxide (CO)
- volatile organic compounds (VOCs).

Particulate matter pollutants (TSP, PM_{10} and $PM_{2.5}$) are anticipated to be key pollutants with regards to both magnitude of emissions generated by the project and the associated compliance with impact assessment criteria at surrounding assessment locations. This assessment will therefore focus on the quantification of particulate matter emissions and impacts (fugitive release and diesel combustion related particulate matter).

Emissions and impacts from other pollutants associated with diesel combustion (NO_X, SO_2, CO and VOCs) are expected to be minor and have not been addressed further in this assessment.

3.2 Applicable air quality assessment criteria

3.2.1 Particulate matter

The NSW EPA's impact assessment criteria for particulate matter, as documented in Section 7 of the Approved Methods for Modelling, are presented in Table 3.1. The assessment criteria for PM_{10} and $PM_{2.5}$ are consistent with the National Environmental Protection (Ambient Air Quality) Measure (AAQ NEPM) national reporting standards (Department of the Environment (DoE) 2021).

TSP, which related to air borne particulates less than 50 micrometres (µm) in diameter, is used as a metric for assessing amenity impacts (reduction in visibility, dust deposition and soiling of building and surfaces) rather than health impacts (NSW EPA 2013). Particles less than 10 µm and 2.5 µm in diameter are fine enough to enter the human respiratory system and can lead to adverse human health impacts. The NSW EPA impact assessment criteria for PM_{10} and $PM_{2.5}$ are, therefore, used to assess the potential impact to human health from particulate matter concentrations.

Approved Methods for Modelling classifies TSP, PM_{10} and $PM_{2.5}$ and dust deposition as 'criteria pollutants'. Assessment criteria for 'criteria pollutants' are applied at the nearest existing or likely future off-site sensitive receptor and compared against the 100th percentile (i.e. the highest) dispersion modelling prediction. Both the incremental and cumulative impacts need to be presented, requiring consideration of existing ambient background concentrations for the criteria pollutants assessed.

For dust deposition, the NSW EPA (2022) specify the criteria for project-only increment and cumulative dust deposition levels. Dust deposition impacts are derived from TSP emission rates and particle deposition calculations in the dispersion modelling process.

Table 3.1 Impact assessment criteria

Pollutant	Averaging period	Assessment criteria
TSP	Annual	90 µg/m^3
PM_{10}	24 hour	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hour	25 µg/m^3
	Annual	8 µg/m^3
Dust deposition	Annual	2 g/m^2/month (project increment only)
		4 g/m^2/month (cumulative)

Note: µg/m^3: micrograms per cubic meter; g/m^2/month: gram per square meter per month.

4 Meteorology and climate

4.1 Monitoring data resources

In reviewing the meteorological environment of the local area, the following publicly available data sources were used:

- Bureau of Meteorology (BoM) Automatic weather station (AWS) at Maitland Airport (station 061428), located approximately 11.5 km north-north-east of the site. One-hour average measurements of wind speed, wind direction, standard deviation of wind direction, temperature, relative humidity and station-level barometric pressure were sourced from this AWS.

- BoM Williamtown RAAF AWS (station 061078) located approximately 34.2 km east of the site. One-hour average measurements of station-level barometric pressure and cloud observations were sourced from this AWS.

There are no meteorological measurements taken at the site.

4.2 Selection of a representative year

Meteorological data recorded by the BoM Maitland Airport AWS were analysed for the five-year period between 2019 and 2023 (Attachment A). The analysis demonstrated a similarity across years in the most important parameters for pollutant dispersion, such as wind speed and wind direction winds. The annual average recorded wind speed ranged from 3.0 metres per second (m/s) to 3.2 m/s, while frequency of calm conditions (wind speeds less than 0.5 m/s) ranged from 11.7% to 14.2% of the time.

Inter-annual profiles for air temperature and relative humidity were also generally comparable between 2019 and 2023 (Attachment A). The 2019 and 2023 datasets showed higher daytime temperatures and lower relative humidity, which are indicative of the strong drought conditions experienced in 2019 and the coinciding onset of wetter La Niña conditions in the years between 2020 and 2022.

On the basis of similarities in inter-annual trends with wind speed and direction for the years between 2019 and 2023, the 2023 calendar year was adopted as the 12-month modelling period for the purpose of this AQIA and is considered suitably representative of meteorological conditions recorded at the BoM Maitland Airport AWS.

4.3 Meteorological modelling

Atmospheric dispersion modelling for this assessment has been completed using the AMS[1]/USEPA[2] regulatory model (AERMOD) (model version v23132, further discussion presented in Section 7). The meteorological inputs for AERMOD were generated using the AERMET meteorological processor (model number v23132), using local surface observations and upper air profiles generated by the Commonwealth Science and Industrial Research Organisation (CSIRO) TAPM meteorological modelling module.

Further details of the TAPM meteorological modelling and AERMET data processing completed to prepare the inputs for AERMOD are documented in Attachment A.

1 AMS – American Meteorological Society

2 USEPA – United States Environmental Protection Agency

4.4 Prevailing winds

The annual wind rose showing the wind speed and direction from BoM Maitland Airport AWS recorded during 2023 is presented in Figure 4.1. The wind rose shows a prevailing wind alignment from the east-south-east and west-north-west. The annual average wind speed for the year 2023 was 3.0 m/s. The annual average frequency of calm conditions was 14.0%. Calm winds are typically associated with stable atmospheric conditions (see Section 4.5 for additional discussion) which have lower potential for the dispersion of air pollutant emissions.

Seasonal wind roses from the BoM Maitland Airport AWS 2023 dataset are shown in Figure 4.2. The mean wind speed ranges from 2.7 m/s in autumn to 3.4 m/s in summer. The frequency of calm conditions ranges from 8.6% in summer to 17.0% in autumn. The autumn, winter and spring months show prevailing west-north-westerly winds, while winds from the east-south-east are more dominant in the summer months.

Diurnal wind roses from the BoM Maitland Airport AWS 2023 dataset are shown in Figure 4.3. The wind direction patterns during the night hours are dominated by air flow from the south-east and north-westerly direction. While a notable north-westerly is experienced during the day. Wind speeds are higher during the daylight hours, with an average wind speed of 3.8 m/s compared to 2.4 m/s at night-time, while the percentage of calms in higher at night (20.6% versus 6.3% during the day).

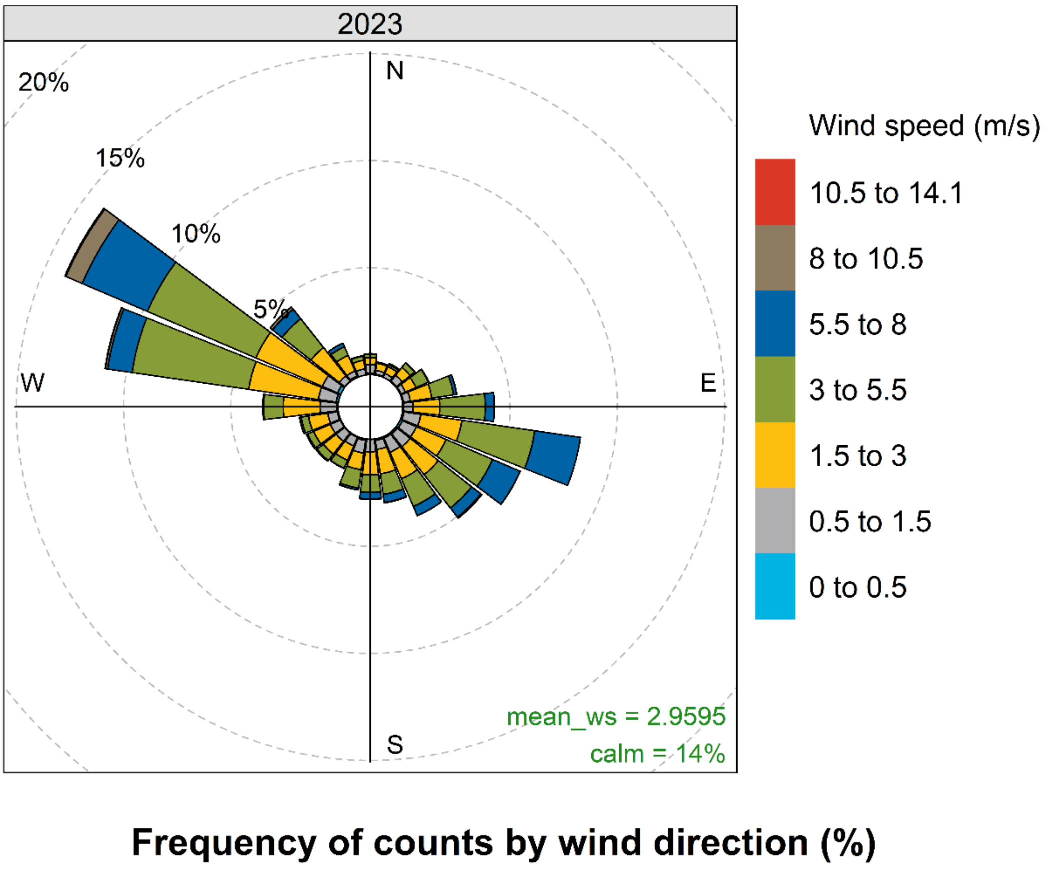


Figure 4.1 Annual wind speed and direction – BoM Maitland Airport AWS – 2023

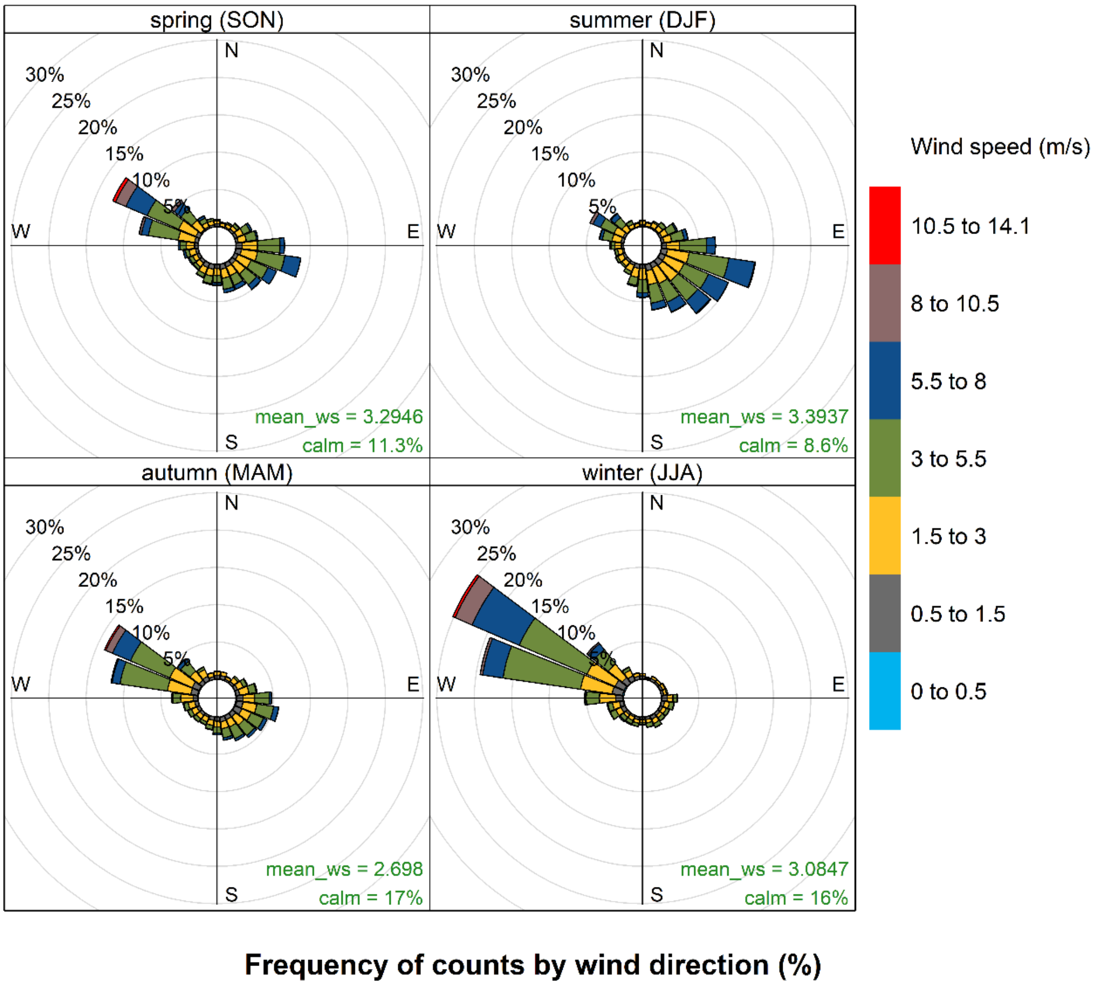


Figure 4.2 Seasonal wind speed and direction – BoM Maitland Airport AWS – 2023

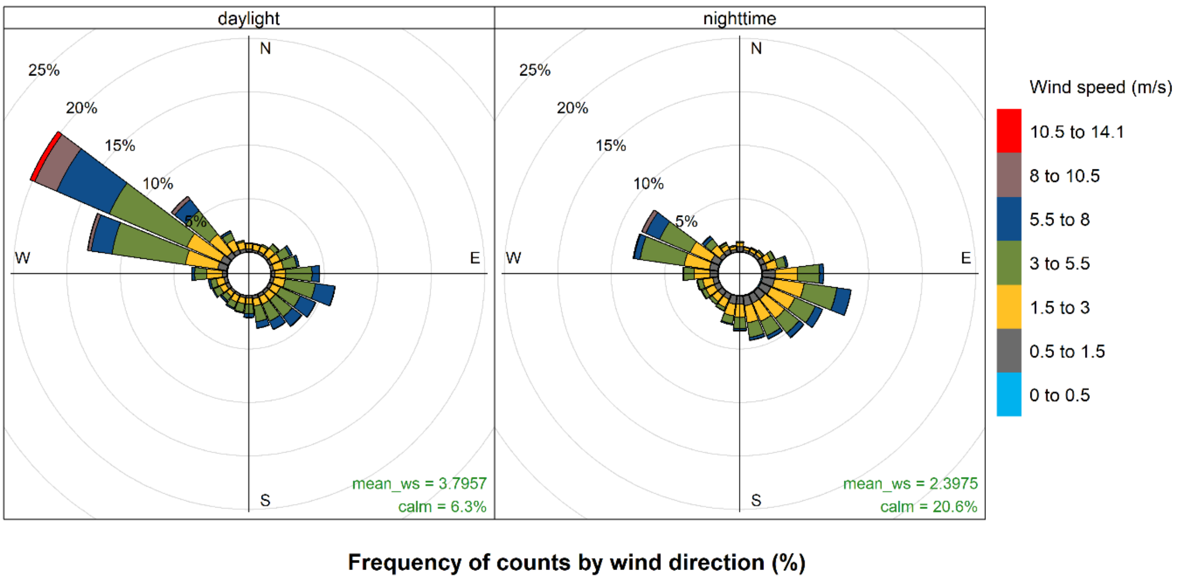


Figure 4.3 Diurnal wind speed and direction – BoM Maitland Airport AWS - 2023

4.5 Atmospheric stability and mixing depth

Atmospheric stability refers to the degree of turbulence or mixing that occurs within the atmosphere and is a controlling factor in the rate of atmospheric dispersion of pollutants.

The Monin-Obukhov length (L) provides a measure of the stability of the surface layer (i.e. the layer above the ground in which vertical variation of heat and momentum flux is negligible; typically, about 10% of the mixing height). Negative L values correspond to unstable atmospheric conditions, while positive L values correspond to stable atmospheric conditions. Very large positive or negative L values correspond to neutral atmospheric conditions.

Figure 4.4 illustrates the diurnal variation of atmospheric stability, derived from the Monin-Obukhov length calculated by AERMET based on observation data collected from the BoM Maitland AWS in 2023.

The diurnal profile presented illustrates that atmospheric instability increases during daylight hours as convective energy increases, whereas stable atmospheric conditions prevail during the night-time. This profile indicates that the potential form atmospheric dispersion of emissions would be greatest during daytime hours and lowest during evening through to early morning hours.

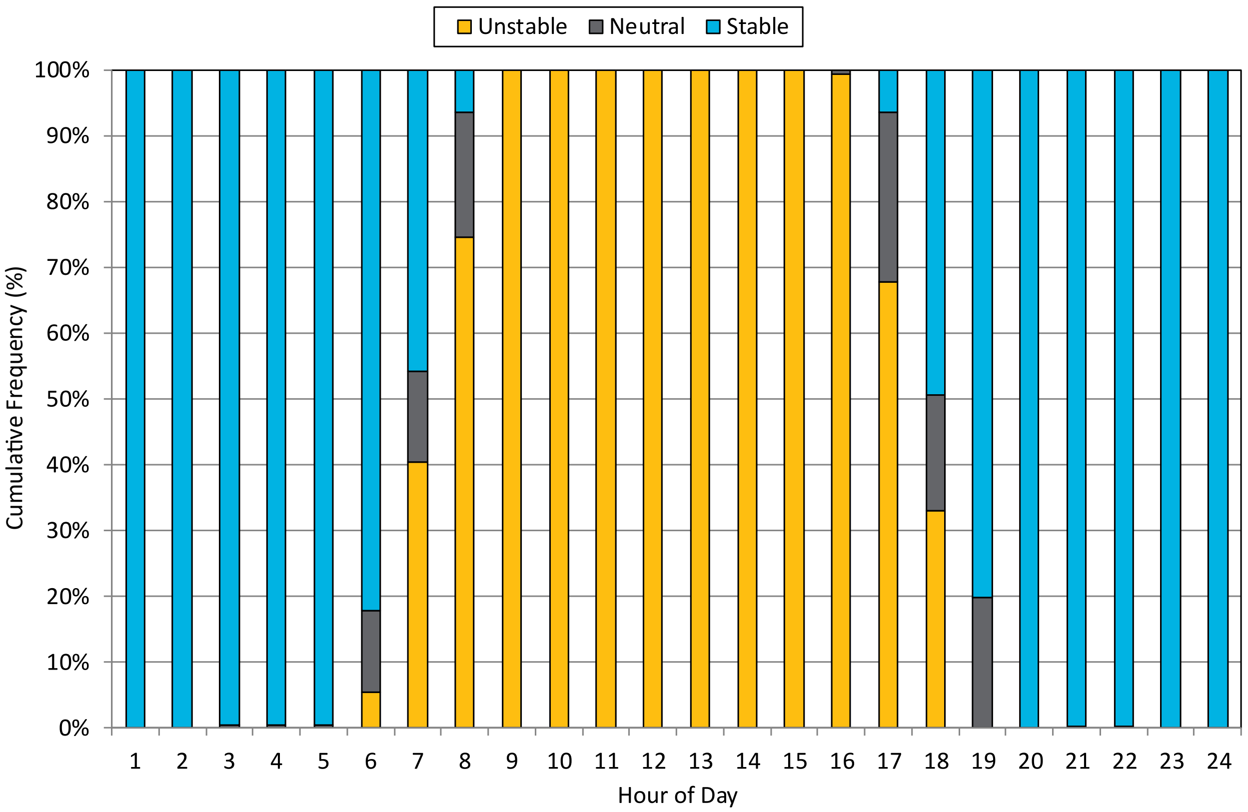
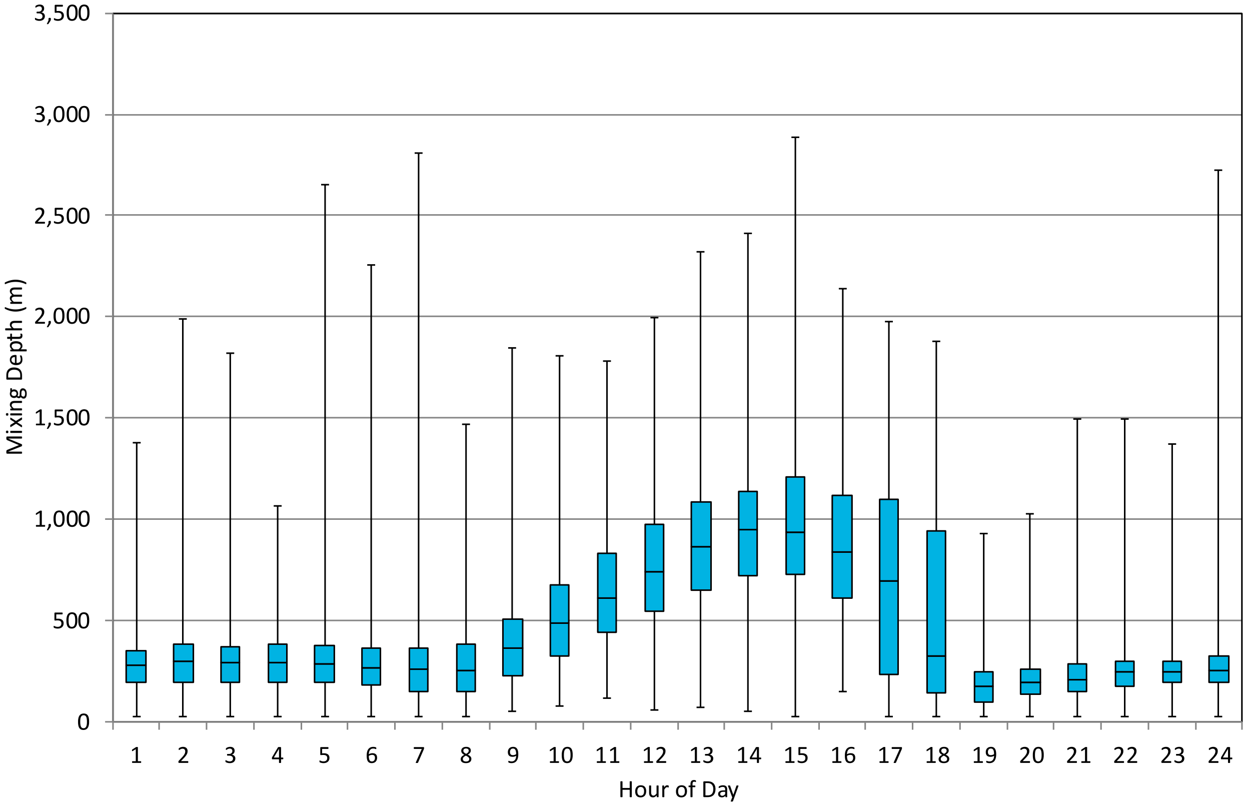


Figure 4.4 AERMET-generated diurnal variation in atmospheric stability – BoM Maitland Airport AWS – 2023

Hourly-varying atmospheric boundary layer depths (the height of the atmosphere above ground level within which the dispersion of air pollution occurs) were calculated by AERMET. The variation in boundary layer depth by hour of the day is illustrated in Figure 4.5 shows that greater boundary layer depths are experienced during the daytime hours between mid-morning and later afternoon. Higher day-time wind velocities and the onset of incoming solar radiation increase the amount of mechanical and convective turbulence in the atmosphere. As turbulence increases, too does the depth of the boundary layer, generally contributing to higher mixing depths and greater potential for atmospheric dispersion of pollutants.



Note: blue bars indicate the interquartile range (IQR), or middle 50% of the data, while the whiskers indicate highest and lowest values.

Figure 4.5 AERMET-generated diurnal variation in atmospheric boundary layer depth – BoM Maitland Airport AWS – 2023

5 Background air quality

5.1 Existing sources of emissions

The site is located in north-western Kurri Kurri, with predominant surrounding land used being industrial and business properties. Existing neighbouring sources include the Australian Natural Landscaping (ANL) Weston, located along the eastern and southern border of the project, the Weston Aluminium plant, approximately 315 m east of the site and the Kurri Kurri Smelter Remediation, approximately 1.2 km north of the site. It is assumed that emissions from these sources would be accounted for in the background air quality measurements (see Section 5.2).

Potential emissions from other nearby sources such as the Kurri Kurri Battery Recycling facility (yet to be constructed), approximately 500 m east of the site and the Hunter Power Project, approximately 2 km north of the site, were assessed in the air quality impact assessments completed by Ramboll Environ (2016) and Jacobs (2021), respectively). Results indicate that associated particulate matter emissions would be minor and cumulative impacts with the site are unlikely.

Other sources that contribute to particulate matter concentration in the vicinity of the site include:

- dust entrainment and tyre and break wear due to vehicle movements along public roads
- petrol and diesel emissions from vehicle movements along public roads
- wind-generated dust from exposed areas within the surrounding region
- seasonal emissions from household wood burning fires.

Other remote sources which contribute episodically to suspended particulates in the region include dust storms and bushfires.

5.2 Air quality monitoring data resources

There are no air quality measurements available for the site. The NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) maintains air quality monitoring stations (AQMS) at Beresfield approximately 17.8 km east of the site. Daily average PM_{10} and $PM_{2.5}$ concentrations from the Beresfield AQMS were collated for the period between 2019 and 2023.

5.3 Baseline air quality environment

5.3.1 PM_{10}

A time series of 24-hour average PM_{10} concentrations recorded at the Beresfield AQMS between 2019 and 2023 is presented in Figure 5.1. Recorded 24-hour average PM_{10} concentrations fluctuate throughout the presented period. Recorded 24-hour average PM_{10} concentrations throughout the period are typically below the applicable NSW EPA impact assessment criterion of 50 µg/m^3; however, a higher frequency of elevated concentrations occurred between 2019 and early 2020 relative to the later years of the data period.

Key statistics for the five years of data from the Beresfield AQMS dataset are presented in Table 5.1.

The 2023 calendar year PM_{10} dataset from the Beresfield AQMS has been adopted to represent background conditions consistent with the adopted meteorological year.

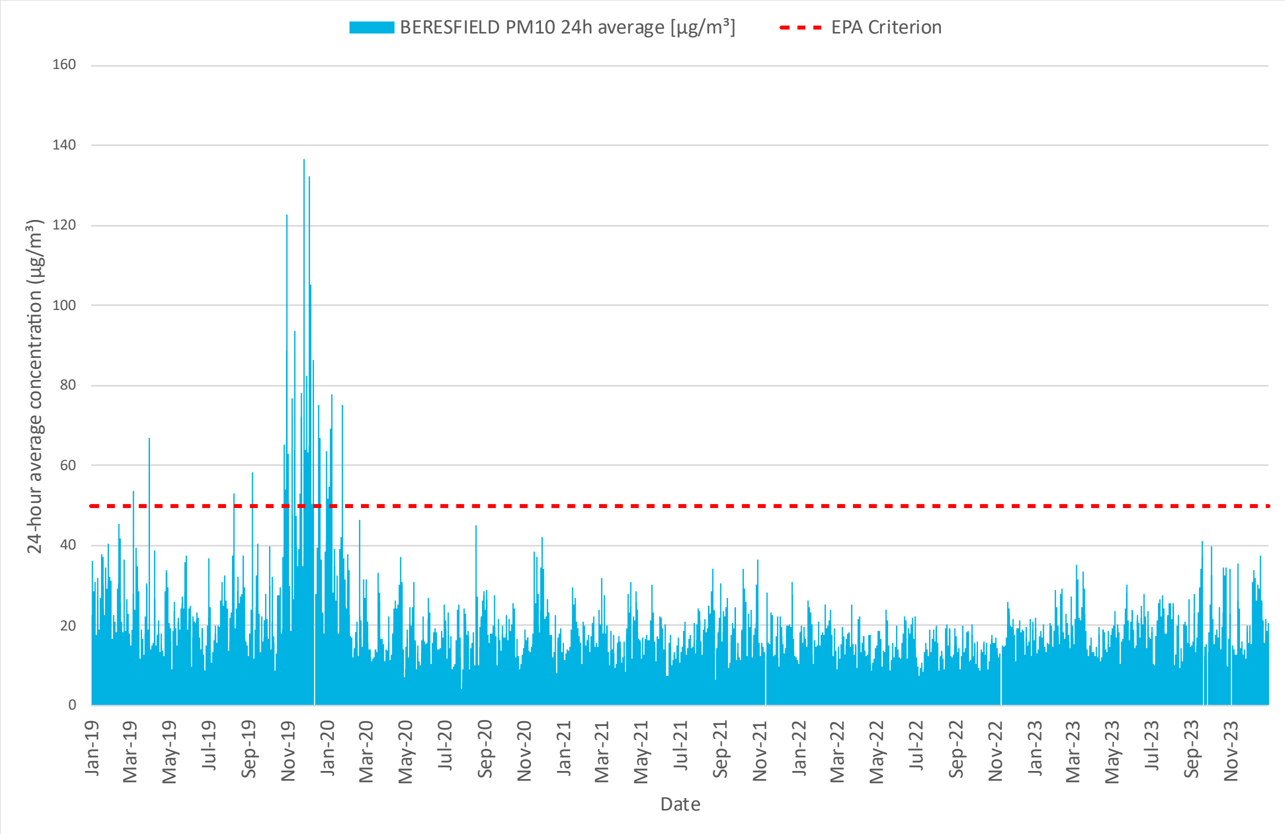


Figure 5.1 Time series of 24-hour average PM_{10} concentrations – Beresfield AQMS – 2019 to 2023

Table 5.1 Statistics for PM_{10} concentrations – Beresfield AQMS dataset – 2019 to 2023

Year	Maximum	75th percentile	Median	Average	Days >50 µg/m³	Data availability (%)
	24-hour average PM_{10} concentration (µg/m³)					
2019	136.7	29.5	20.8	25.6	30	98.6
2020	77.7	22.2	16.3	18.4	6	99.2
2021	36.3	19.3	15.3	15.8	0	99.5
2022	26.2	17.2	13.9	14.1	0	98.4
2023	41.0	20.8	16.5	17.8	0	98.4

Exceedance of the 24-hour average criterion occurred in four of the five years between 2019 and 2023, ranging from no days in 2021 to 2023, to 30 days for 2019. There was an increasing trend in the magnitude of recorded concentrations from 2019 through to early 2020, coinciding with the Black Summer bushfires between October 2019 and February 2020.

The recorded PM_{10} concentrations decreased during 2020 relative to 2019, associated with the onset of La Niña conditions (i.e. increasing rainfall and reduction in drought conditions). Annual average PM_{10} concentrations were below the applicable criterion of 25 µg/m³ for all years.

5.3.2 $PM_{2.5}$

A time series of recorded 24-hour average $PM_{2.5}$ concentrations from the Beresfield AQMS dataset recorded between 2019 to 2023 is presented in Figure 5.2. Similar to PM_{10} concentrations, the recorded 24-hour average $PM_{2.5}$ concentrations fluctuate throughout the presented period. Recorded 24-hour average $PM_{2.5}$ concentrations were generally below the NSW EPA impact assessment criterion of 25 µg/m³. Recorded 24-hour average $PM_{2.5}$ concentrations were generally below the NSW EPA impact assessment criterion of 25 µg/m³.

Key statistics for the five years of analysed $PM_{2.5}$ monitoring data from the Beresfield AQMS are presented in Table 5.2. Consistent with PM_{10}, the 2023 calendar year $PM_{2.5}$ dataset from the Beresfield AQMS has been adopted to represent background conditions.

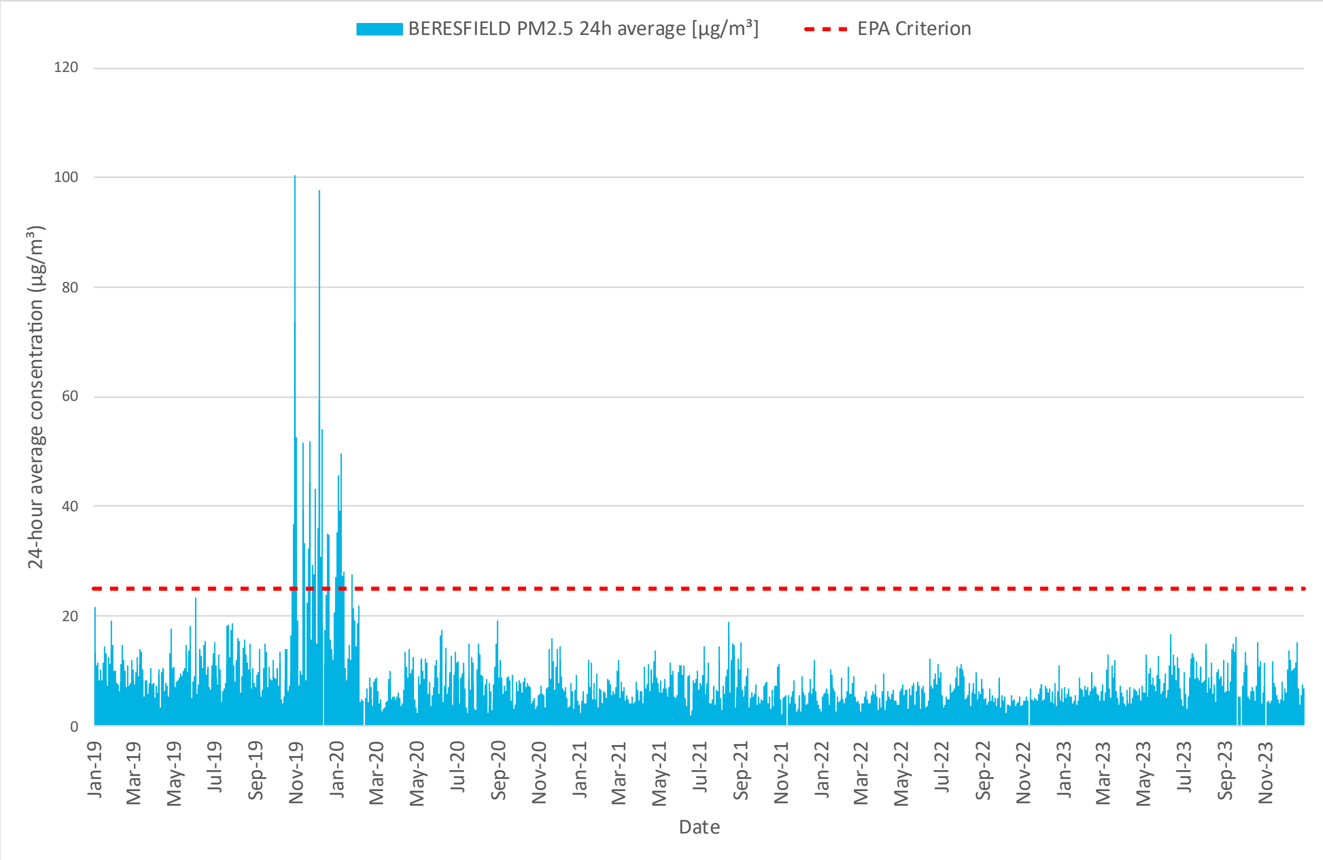


Figure 5.2 Time series of 24-hour average $PM_{2.5}$ concentrations – Beresfield AQMS – 2019 to 2023

Table 5.2 Statistics for $PM_{2.5}$ concentrations –Beresfield AQMS dataset – 2019 to 2023

Year	Maximum	75th percentile	Median	Average	Days >25 µg/m³	Data availability (%)
	24-hour average $PM_{2.5}$ concentration (µg/m³)					
2019	100.5	12.9	9.0	11.6	23	96.2
2020	49.7	9.1	6.2	7.4	8	96.7
2021	18.9	7.4	5.4	5.8	0	99.2
2022	12.3	6.0	4.7	4.9	0	98.1
2023	16.6	8.1	6.0	6.7	0	98.4

5.3.3 TSP

There are no measurements of TSP available at the site. The NSW DPE (then Office of Environment and Heritage 2012) presents monitoring data from co-located TSP and PM_{10} monitoring stations in the Lower Hunter region for the period between 1999 and 2011. Across the collated stations, the typical ratio between annual average PM_{10} and TSP concentrations was 0.44. In the absence of locally sourced TSP monitoring data, a ratio of 0.44 has been applied to the adopted annual average PM_{10} concentrations for 2023 of 17.8 µg/m³, returning an annual average TSP background concentration of 40.5 µg/m³.

5.3.4 Dust deposition

There are no measurements of dust deposition available at the site. This assessment therefore focuses on the incremental contribution from the site emissions only. This approach is suitable for assessment against the NSW EPA incremental criterion of 2.0 g/m²/month, expressed as an annual average.

5.3.5 Adopted background summary

In summary, the following background values were adopted for cumulative assessment:

- 24-hour PM_{10} concentration – daily varying with a maximum of 41.0 µg/m³
- annual average PM_{10} concentration – 17.8 µg/m³
- 24-hour $PM_{2.5}$ concentration – daily varying with a maximum of 16.6 µg/m³
- annual average $PM_{2.5}$ concentration – 6.7 µg/m³
- annual average TSP concentration – 40.5 µg/m³.

6 Emissions inventory

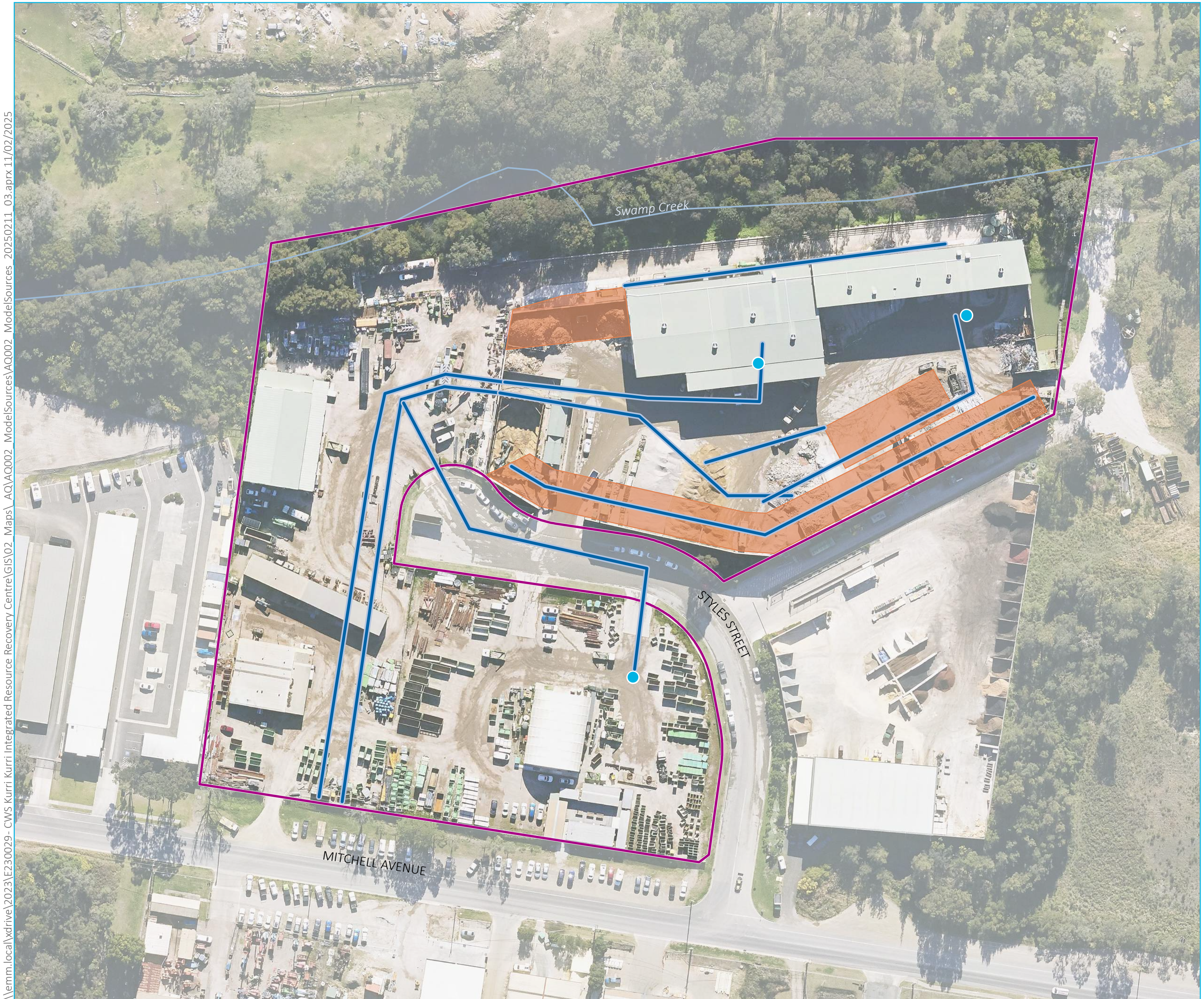
6.1 Sources of operational emissions

Sources of atmospheric emissions associated with the project include:

- the movement of vehicles along paved roads and surfaces
- unloading of concrete material to the external concrete stockpile
- external crushing of concrete material (campaign only)
- external processing of soils (campaign only)
- unloading, handling and sorting of materials within the processing shed and residual waste recovery shed
- crushing, shredding, screening and picking in the processing line and in the residual waste recovery shed
- loading and transfer of processed materials to storage bunkers and bins
- loading of product to truck for dispatch to market
- diesel fuel combustion by on-site plant, equipment and vehicles
- wind erosion associated with material stockpiles and storage bunkers.

Each activity has been represented in the model as either an area, volume, or line-volume source. The modelled source locations are shown in Figure 6.1.

Fugitive dust sources associated with the operation of the proposed development were quantified through the application of National Pollution Inventory (NPI) emission estimation techniques and United States Environmental Protection Agency (US-EPA) AP-42 emission factor equations. Particulate matter emissions were quantified for various particle size fractions, with the TSP fraction being estimated to provide an indication of dust deposition rates. Coarse particles (PM_{10}) and fine particle ($PM_{2.5}$) were estimated using ratios for the different particle size fractions available within the literature (principally the US-EPA AP-42).



\\emm.local\xdrive\2023\E230029 - CWS Kurri Kurri Integrated Resource Recovery Centre\GIS\02_Maps_AQ\AQ002_ModelSources\AQ002_ModelSources_20250211_03.aprx 11/02/2025

Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

Model source location

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure 6.1

EMM
creating opportunities

6.2 Emissions scenario

Activity data for future operations at the site under 450,000 tpa throughput were estimated based on the proportion of material processed at the site between March 2023 and February 2024. The following indicative incoming material break down was derived for the site operating a at peak future throughput:

- total incoming material: 450,000 tpa
- mixed waste direct to the automated processing plant: 334,644 tpa
- concrete/masonry product to the external yard for crushing: 87,479 tpa
- soils to the external yard for processing: 3,782 tpa
- metals transferred to metal processing building: 888 tpa
- other material not requiring processing (e.g. wood/timber materials, paper/cardboard, metals, etc.): 23,207 tpa.

Of the total mixed waste processed through the automated processing plant, it is anticipated that approximately 66,628 tpa of material will be transferred to the residual material processing shed for further processing.

Material processed by the automated processing plant will be relatively consistent on a day-to-day basis over two eight-hour shifts. Materials deliveries to the receival sheds will occur at the site 24 hours a day. External yard activities (i.e. concrete crushing and soil processing) will be completed on a campaign basis during daylight hours, anticipated by CWS to be six days per month for each.

CWS has provided average and busy day activity rates for the automated processing plant, concrete crushing and soil processing components, these totals are provided in Table 6.1. The relationship between average and busy day operations is approximately 1.6 times higher for the automated processing plant and 1.8 times higher for the concrete and soil processing activities.

Table 6.1 Indicative average and busy day throughputs (tonnes per day)

Process	Average day	Busy day
Automated processing plant	1,500	2,400
Concrete crushing	1,215	2,187
Soil processing	53	95

To assess the potential impacts from the project, a single operational day emissions scenario was configured based on average day operations, featuring deliveries and operation of the automated processing plant, the new residual waste processing plant, campaign concrete crushing and soils processing in the external yard.

Additionally, the following assumptions are applied to the emissions scenario:

- Materials such as wood/timber, soils and plasterboard which do not require further processing are unloaded direct to storage bunkers.
- Concrete/masonry and soil materials are processed (crushed and screened) in the external yard. Although these activities occur on a campaign basis, for emissions estimations it has been assumed that processing of concrete and soils will occur daily.

- Unrecovered waste materials from the automated processing plant are transferred to the residual waste processing shed by road truck.
- Based on information provided by CWS, material processing and handling of material within the processing shed will be covered over two eight-hour shifts: 6:00 am to 2:00 pm and 2:00 pm to 10:00 pm.
- A diurnal variation profile for truck deliveries and material unloading and loading was developed based on input from CWS and is presented in Figure 6.2.

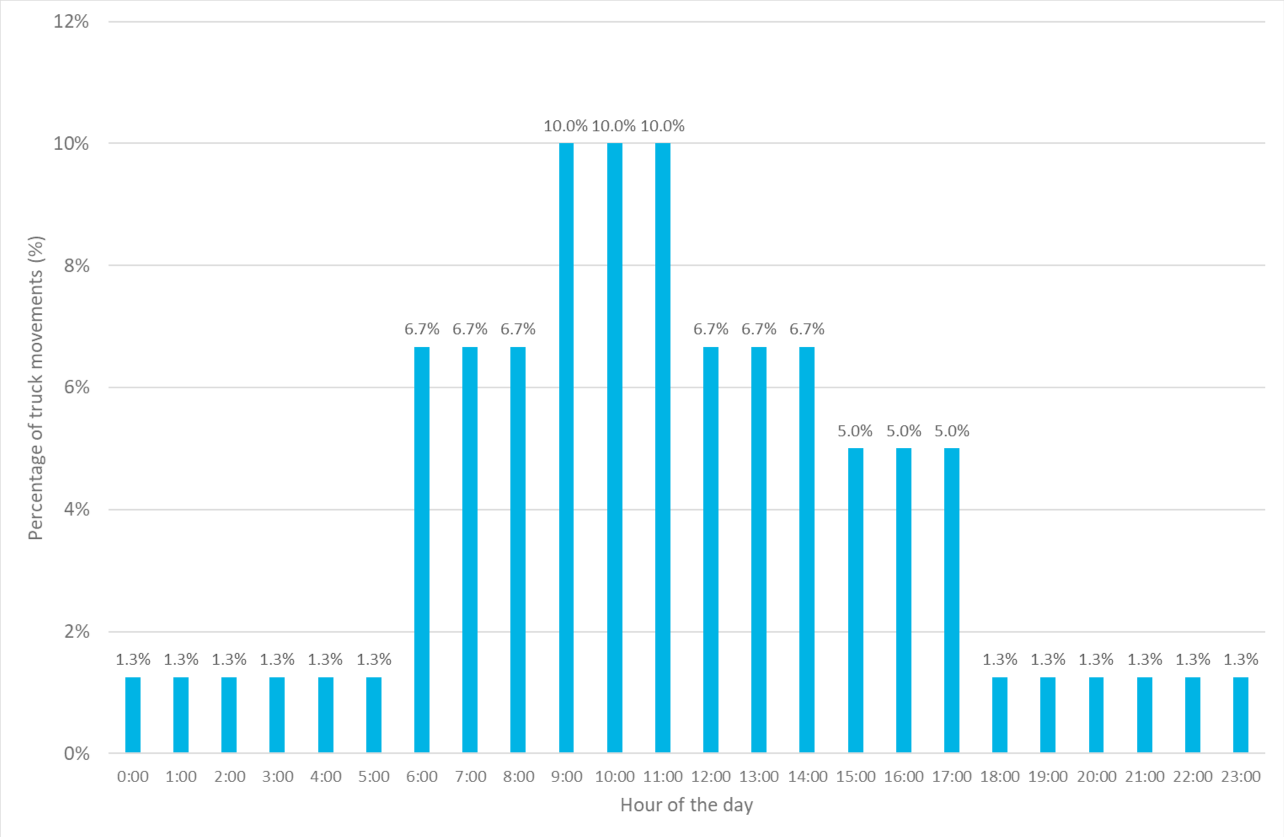


Figure 6.2 Diurnal profile of truck movements for materials delivery and dispatch

6.3 Emissions reduction factors

A range of dust mitigation measures to control emissions are currently implemented at the RRF and will be incorporated into the IRRC project. These measures include:

- the processing shed, materials bay structures and site boundary walls provide a wind break to activities occurring within the processing area (Figure 1.3)
- with the exception of concrete, scrap metals, plasterboard, wood/timber and the occasional green waste, all incoming trucks are unloaded directly into the receivals area of the processing shed
- the processing and receival shed are fitted with misting nozzles distributed along the roof trusses, fog curtains at the open entrances and misting nozzles at the feed hopper of the shredder
- misting nozzles are also fitted in several of the recovery materials bays (bunkers) of the processing plant, namely the fines bay, the large aggregates bay and the residual bay

- processing line emission sources feature misting nozzles and ducting to baghouse filters for dust capture as well as tarping of conveyors
- all materials from the processing line are discharged into bunkers with walls and a roof
- external crushing of concrete and screening of soil will be controlled by water sprays
- roofs/awnings will be provided for all currently external material storage bays
- external concreted surfaces will continue to be wet down by sprays and water cart, and routinely swept with a bobcat-mounted broom.

On the basis of the above, the following emissions reduction factors were applied to account for controls at the site:

- Paved internal haul roads between processing areas combined reduction factor of 74% applied – combined use of water flushing and sweeping, reduction of 63% (US-EPA 2011) and wind breaks by site boundary wall and processing shed, reduction of 30% (NPI 2012).
- Materials handling within processing shed combined reduction factor of 85% applied – use of water sprays, reduction of 50% (NPI 2012) and enclosure within shed, reduction of 70% (NPI 2012).
- Materials processing within processing shed reduction factor of 92% applied – use of water sprays, reduction of 50% (NPI 2012) and dust extraction to filters within the processing line, reduction of 83% (NPI 2012).
- Materials handling in external yard – wind breaks from processing shed, materials bay structures and site boundary walls, reduction of 30% (NPI 2012).
- Unloading of processed materials into storage bunkers – three-sided enclosure, reduction of 70% (NPI 2012).
- Materials handling within residual waste processing shed – 90% reduction for enclosure within shed (NPI 2012).
- Materials screening within residual waste processing shed combined reductio factor of 98% - use of dust extracting to filters, reduction of 83% (NPI 2012) and enclosure within shed, reduction of 90% (NPI 2012).
- Materials crushing within residual waste processing shed combined reduction factor of 95% - use of water sprays, reduction of 50% (NPI 2012) and enclosure within shed, reduction of 90% (NPI 2012).

6.4 Particulate matter emissions

A summary of the calculated average day TSP, PM_{10} and $PM_{2.5}$ emissions rates by source type is presented Table 6.2. The significance of key source types by particulate size is illustrated in Figure 6.3. Particulate matter control measures, as documented in Section 6.3, are accounted for in the daily emissions totals. The data shows that the movements of vehicles on paved surfaces and material handling are the key contributing sources to daily project emissions.

Busy day emissions were calculated using an upscaling ratio based on the indicative average day and busy day throughputs (see Table 6.1), excluding wind erosion from storage bunkers and stockpiles. For activities associated with the crushing of concrete and soil processing a scaling factor of 1.8 was applied to the average day particulate matter emissions. For all other activities (e.g. materials processing in the material processing shed) a scaling factor of 1.6 was applied to the average day particulate matter emissions.

Further details regarding emission estimation factors and assumptions are provided in Attachment B.

Table 6.2 Calculated average daily TSP, PM_{10} and $PM_{2.5}$

Emission source	Calculated daily emissions (tonnes/day) by source		
	TSP	PM_{10}	$PM_{2.5}$
Material transportation			
Incoming material - site entrance to yard entrance	0.000923	0.000177	0.000043
Incoming material - yard to processing shed tipping area	0.002415	0.000464	0.000112
Outgoing material - product stockpiles to yard exit	0.003487	0.000669	0.000162
Outgoing material - yard exit to site exit	0.000784	0.000150	0.000036
Material transfers - processing shed to stockpiles	0.001617	0.000310	0.000075
Residual waste transfer - yard exit to residual waste processing shed	0.000094	0.000018	0.000004
Residual waste transfer - residual waste processing shed to yard entrance	0.000181	0.000035	0.000008
Material processing – Materials processing shed on 8 Styles Street			
Material unloading (in shed)	0.000369	0.000175	0.000026
Material transfer to primary hopper (in shed)	0.000274	0.000130	0.000020
Material screening (in shed)	0.002252	0.000775	0.000005
Material crushing (in shed)	0.000333	0.000148	0.000027
Material conveying (in shed)	0.000404	0.000191	0.000029
Loading trucks to residual waste processing shed and metals processing	0.000055	0.000026	0.000004
Transfer to storage bays	0.000219	0.000104	0.000016
Material processing – Yard			
Concrete unloading to external yard	0.001395	0.000660	0.000100
Concrete crusher loading (external)	0.001395	0.000660	0.000100
Concrete crusher (external)	0.001148	0.000510	0.000094
Concrete screening (external)	0.000893	0.000307	0.000002
Crushed concrete handling (external)	0.001395	0.000660	0.000100
Soil unloading to external yard	0.000004	0.000002	0.0000003
Soil screen loading (external)	0.000004	0.000002	0.0000003

Emission source	Calculated daily emissions (tonnes/day) by source		
	TSP	PM_{10}	$PM_{2.5}$
Soil screening (external)	0.000039	0.000013	0.0000001
Processed soil handling (external)	0.000004	0.000002	0.0000003
Front end loader (FEL) movements - concrete/soil	0.000831	0.000159	0.000039
Unloading to storage bays - concrete and soil	0.000624	0.000295	0.000045
Unloading to storage bays - processing plant output	0.000438	0.000207	0.000031
Loading to product trucks - all material	0.001463	0.000692	0.000105
Materials processing – Residual waste processing shed			
Material unloading (in shed)	0.000036	0.000017	0.000003
Material transfer (in shed)	0.000036	0.000017	0.000003
Material conveying (in shed)	0.000098	0.000046	0.000007
Material screening (in shed)	0.000094	0.000032	0.000000
Material crushing/shredding (in shed)	0.000025	0.000011	0.000002
Material palletisation (in shed)	0.000060	0.000027	0.000005
Processing storage bunker loading (in shed)	0.000036	0.000017	0.000003
Loading to trucks for transfer to storage bays	0.000036	0.000017	0.000003
Wind erosion			
Wind erosion - storage bays south	0.000053	0.000027	0.000004
Wind erosion - storage bays north	0.000012	0.000006	0.000001
Wind erosion - concrete stockpile	0.000029	0.000015	0.000002
Diesel combustion			
Diesel combustion - onsite plant	0.0005066	0.0005066	0.0004644
Diesel combustion - trucks	0.00000003	0.00000003	0.00000002
Total average daily emissions	**0.024063**	**0.0082798**	**0.001680264**

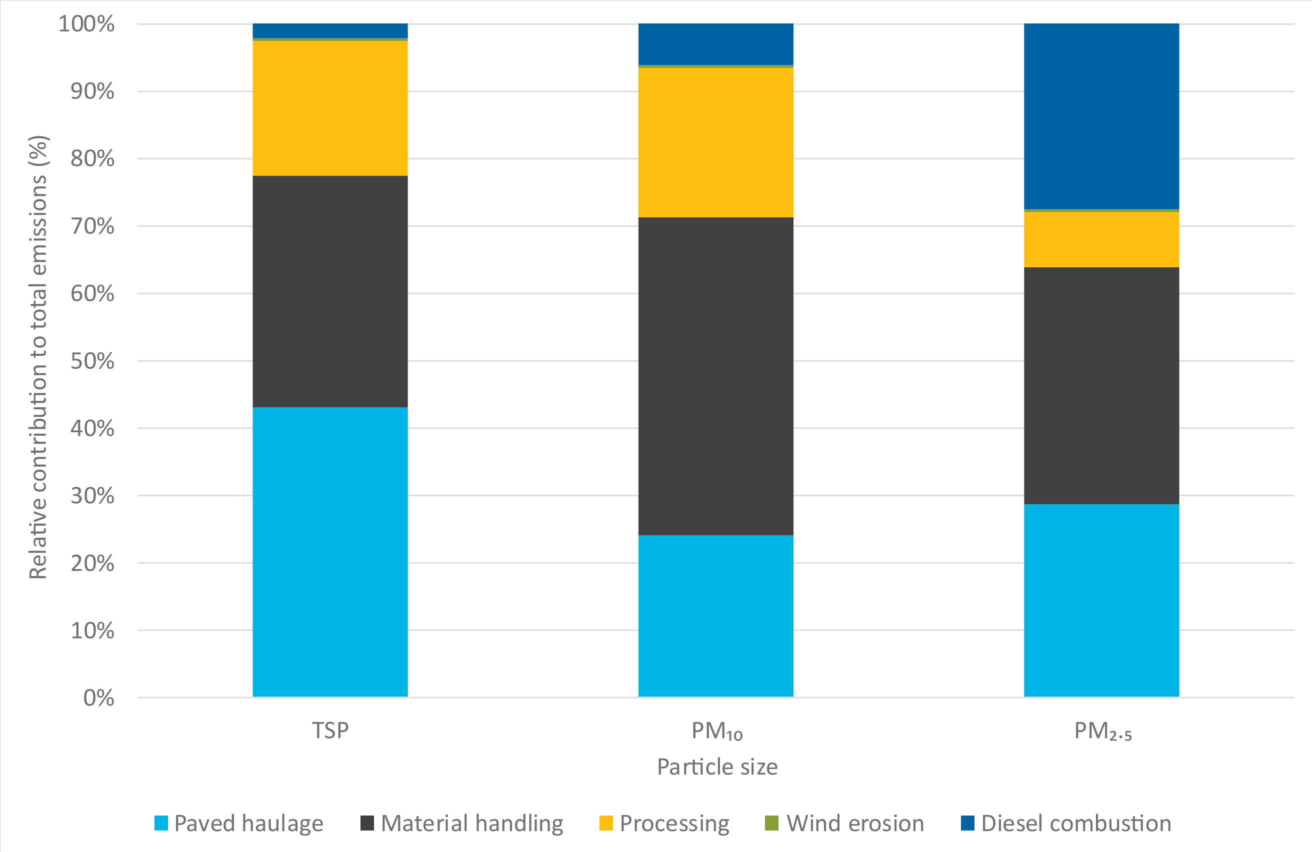


Figure 6.3 Contribution to annual emissions by source type and particle size

6.5 Odour emissions

The majority of material received by the site is inert construction, demolition, commercial and industrial waste. A limited amount of green waste (tree branches, vegetation or garden waste) is occasionally received at the site; however, this material is transferred on the same day as receipt to the neighbouring ANL Weston facility for processing. There are no stockpiles for green waste material kept at the site and no composting will occur. The site does not currently accept odour generating materials, such as putrescible wastes, and will not in the future.

No odour related complaints have been received by the existing RRF to date.

On this basis, odour emissions and impacts from the site are assumed to be negligible and therefore are not considered further in this assessment.

7 Air dispersion modelling

7.1 Dispersion model selection and configuration

The atmospheric dispersion modelling completed for this assessment used the AERMOD dispersion model (version v23132). AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain.

In addition to the 34 individual assessment locations (documented in Section 2.2), air pollutant concentrations were predicted over a nested grid domain of 4.4 km by 4.4 km with spacing ranging from 200 m to 25 m decreasing with proximity to the site (totalling 1,809 receptor points).

Simulations were undertaken for the 12-month period of January to December 2023 using the AERMET generated meteorological domain file (see Chapter 4 for description of input meteorology).

7.2 Incremental (project-only) results

Predicted incremental TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates from the project under average day operations are presented in Table 7.1 for each assessment location. Maximum predicted incremental 24-hour average PM_{10} and $PM_{2.5}$ concentrations under busy day operations are presented in Table 7.2.

The predicted incremental concentrations and deposition rates for all pollutants and averaging periods are below the applicable NSW EPA assessment criteria at all assessment locations. Aside from dust deposition, the assessment criteria are applicable to cumulative concentrations. Analysis of cumulative impact compliance is presented in Section 7.3.

Contour plots, illustrating spatial variations in project-related incremental TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates are provided in Attachment C. Contour plots of the maximum 24-hour average concentrations presented in Appendix C do not represent the dispersion pattern on any individual day, but rather illustrate the maximum daily concentration that was predicted to occur at each model calculation point given the range of meteorological conditions occurring over the 2023 modelling period.

Table 7.1 Incremental (project-only) concentrations and deposition results – average day operations

Assessment location ID	Predicted incremental concentrations (µg/m³) or dust deposition rates (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R1	0.1	0.5	<0.1	0.1	<0.1	<0.1
R2	<0.1	0.4	<0.1	0.1	<0.1	<0.1
R3	0.1	0.4	<0.1	0.2	<0.1	<0.1
R4	0.1	0.8	<0.1	0.2	<0.1	<0.1
R5	0.1	0.6	<0.1	0.2	<0.1	<0.1
R6	0.1	0.5	0.1	0.1	<0.1	<0.1
R7	<0.1	0.3	<0.1	0.1	<0.1	<0.1
R8	<0.1	0.2	<0.1	<0.1	<0.1	<0.1

Assessment location ID	Predicted incremental concentrations (µg/m³) or dust deposition rates (g/m²/month)					
	TSP	PM_{10}		$PM_{2.5}$		Dust deposition
	Annual	24-hour maximum	Annual	24-hour maximum	Annual	Annual
Criterion	**90**	**50**	**25**	**25**	**8**	**2**
R9	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
R10	0.1	0.8	<0.1	0.2	<0.1	<0.1
R11	0.2	1.3	0.1	0.3	<0.1	<0.1
R12	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
R13	0.8	2.1	0.3	0.6	0.1	0.1
R14	0.3	1.9	0.2	0.4	<0.1	<0.1
R15	<0.1	0.3	<0.1	0.1	<0.1	<0.1
R16	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
R17	0.1	0.3	<0.1	0.1	<0.1	<0.1
R18	1.0	2.7	0.4	0.8	0.1	0.1
R19	0.1	0.3	<0.1	0.1	<0.1	<0.1
R20	0.1	1.4	0.1	0.3	<0.1	<0.1
R21	1.2	4.5	0.6	1.0	0.2	0.1
R22	0.4	1.8	0.2	0.4	0.1	<0.1
R23	1.3	2.5	0.4	0.6	0.1	0.1
R24	0.6	2.6	0.3	0.6	0.1	<0.1
R25	0.1	1.1	0.1	0.3	<0.1	<0.1
R26	3.7	8.0	1.3	2.2	0.4	0.2
R32	1.3	5.3	0.6	1.2	0.2	0.1
R33	1.3	5.2	0.6	1.1	0.2	0.1
R34	2.6	5.3	0.9	1.2	0.3	0.2
R35	1.0	2.9	0.4	0.7	0.1	0.1
R36	0.7	1.7	0.2	0.5	0.1	0.1
R37	0.6	2.8	0.2	0.7	0.1	0.1
R38	0.6	2.7	0.2	0.6	0.1	0.1
R39	0.6	1.2	0.2	0.4	0.1	0.1

Notes: Criteria for TSP, PM_{10} and $PM_{2.5}$ is applicable to cumulative (increment + background) concentrations and is provided for comparison purposes only.

Table 7.2 Incremental (project-only) concentrations and deposition results – busy day operations

Assessment location ID	Predicted incremental concentrations (µg/m³)	
	PM_{10}	$PM_{2.5}$
	24-hour maximum	24-hour maximum
Criterion	**50**	**25**
R1	0.9	0.2
R2	0.6	0.1
R3	0.6	0.1
R4	1.1	0.3
R5	1.0	0.2
R6	0.8	0.2
R7	0.5	0.1
R8	0.3	0.1
R9	0.2	<0.1
R10	1.3	0.3
R11	2.0	0.5
R12	0.2	0.0
R13	3.4	0.9
R14	3.4	0.8
R15	0.5	0.1
R16	0.1	<0.1
R17	0.6	0.2
R18	4.4	1.1
R19	0.7	0.2
R20	2.5	0.6
R21	6.4	1.8
R22	3.5	0.9
R23	4.1	1.1
R24	3.9	1.1
R25	2.0	0.5
R26	14.6	4.1
R32	9.1	2.3
R33	7.8	2.0
R34	10.0	2.5

Assessment location ID	Predicted incremental concentrations (µg/m³)	
	PM_{10}	$PM_{2.5}$
	24-hour maximum	24-hour maximum
Criterion	**50**	**25**
R35	4.3	1.2
R36	3.3	0.9
R37	4.0	1.0
R38	3.8	1.0
R39	2.5	0.7

Notes: Criteria for PM_{10} and $PM_{2.5}$ is applicable to cumulative (increment + background) concentrations and is provided for comparison purposes only.

7.3 Cumulative (project + background) results

Predicted cumulative TSP, PM_{10} and $PM_{2.5}$ concentrations for average day operations at each of the assessment locations presented in Table 7.3. Further, maximum 24-hour PM_{10} and $PM_{2.5}$ concentrations for busy day operations are presented in Table 7.4.

Cumulative impacts at each of the assessment locations surrounding the site have been assessed in the following ways:

- For 24-hour average concentrations – each daily varying predicted 24-hour concentration for PM_{10} and $PM_{2.5}$ from the project have been combined with the corresponding concentrations from the adopted assessment period background concentration datasets (Section 5.3.5).
- For annual average concentrations – the predicted annual concentrations from the project have been paired with the corresponding background annual average concentrations (Section 5.3.5).

The predicted cumulative concentrations for all pollutants and averaging periods comply with the applicable NSW EPA assessment criteria at all assessment locations.

Table 7.3 Cumulative (project + background) concentrations results – average day operations

Assessment location ID	Predicted cumulative concentrations (µg/m³)				
	TSP	PM_{10}		$PM_{2.5}$	
	Annual	24-hour maximum	Annual	24-hour maximum	Annual
Criterion	**90**	**50**	**25**	**25**	**8**
R1	40.5	41.0	17.8	16.6	6.6
R2	40.5	41.0	17.8	16.6	6.6
R3	40.5	41.0	17.8	16.6	6.6
R4	40.6	41.0	17.8	16.6	6.6
R5	40.6	41.0	17.8	16.6	6.6
R6	40.6	41.3	17.8	16.6	6.6

Assessment location ID	Predicted cumulative concentrations (µg/m³)				
	TSP	PM_{10}		$PM_{2.5}$	
	Annual	24-hour maximum	Annual	24-hour maximum	Annual
Criterion	**90**	**50**	**25**	**25**	**8**
R7	40.5	41.0	17.8	16.6	6.6
R8	40.5	41.0	17.8	16.6	6.6
R9	40.5	41.0	17.8	16.6	6.6
R10	40.5	41.0	17.8	16.6	6.6
R11	40.7	41.3	17.9	16.7	6.7
R12	40.5	41.0	17.8	16.6	6.6
R13	41.2	41.5	18.1	16.7	6.7
R14	40.8	41.1	17.9	16.7	6.7
R15	40.5	41.0	17.8	16.6	6.6
R16	40.5	41.0	17.8	16.6	6.6
R17	40.5	41.0	17.8	16.6	6.6
R18	41.4	42.0	18.1	16.7	6.7
R19	40.5	41.0	17.8	16.6	6.6
R20	40.6	41.0	17.9	16.7	6.6
R21	41.6	42.2	18.3	17.3	6.8
R22	40.9	41.1	18.0	16.8	6.7
R23	41.7	41.1	18.2	16.7	6.7
R24	41.0	41.1	18.0	16.7	6.7
R25	40.6	41.0	17.9	16.7	6.6
R26	44.2	43.1	19.1	18.4	7.0
R32	41.8	41.6	18.4	17.6	6.8
R33	41.8	41.5	18.4	17.6	6.8
R34	43.0	41.3	18.7	17.8	6.9
R35	41.5	41.1	18.2	16.8	6.7
R36	41.1	41.1	18.0	16.7	6.7
R37	41.1	41.0	18.0	16.7	6.7
R38	41.1	41.0	18.0	16.7	6.7
R39	41.1	41.0	18.0	16.7	6.7

Table 7.4 Cumulative (project + background) concentrations results – busy day operations

Assessment location ID	Predicted cumulative concentrations (µg/m³)	
	PM_{10}	$PM_{2.5}$
	24-hour maximum	24-hour maximum
Criterion	**50**	**25**
R1	41.0	16.6
R2	41.0	16.6
R3	41.0	16.6
R4	41.1	16.6
R5	41.0	16.6
R6	41.4	16.6
R7	41.0	16.6
R8	41.0	16.6
R9	41.0	16.6
R10	41.0	16.7
R11	41.4	16.7
R12	41.0	16.6
R13	41.7	16.7
R14	41.3	16.8
R15	41.0	16.7
R16	41.0	16.6
R17	41.0	16.7
R18	42.4	16.9
R19	41.0	16.6
R20	41.1	16.8
R21	43.4	17.7
R22	41.1	16.9
R23	41.2	16.8
R24	41.3	16.9
R25	41.0	16.7
R26	46.1	19.6
R32	42.2	18.2
R33	41.9	18.2
R34	41.7	18.7

Assessment location ID	Predicted cumulative concentrations (µg/m³)	
	PM_{10}	$PM_{2.5}$
	24-hour maximum	24-hour maximum
Criterion	**50**	**25**
R35	41.2	16.9
R36	41.1	16.8
R37	41.1	16.7
R38	41.1	16.7
R39	41.1	16.7

Predicted cumulative annual average TSP, PM_{10} and $PM_{2.5}$ concentrations by assessment location for average day operations are presented in Figure 7.1, Figure 7.2 and Figure 7.3. Compliance with the applicable impact assessment criteria is predicted for annual average TSP, PM_{10} and $PM_{2.5}$ concentrations.

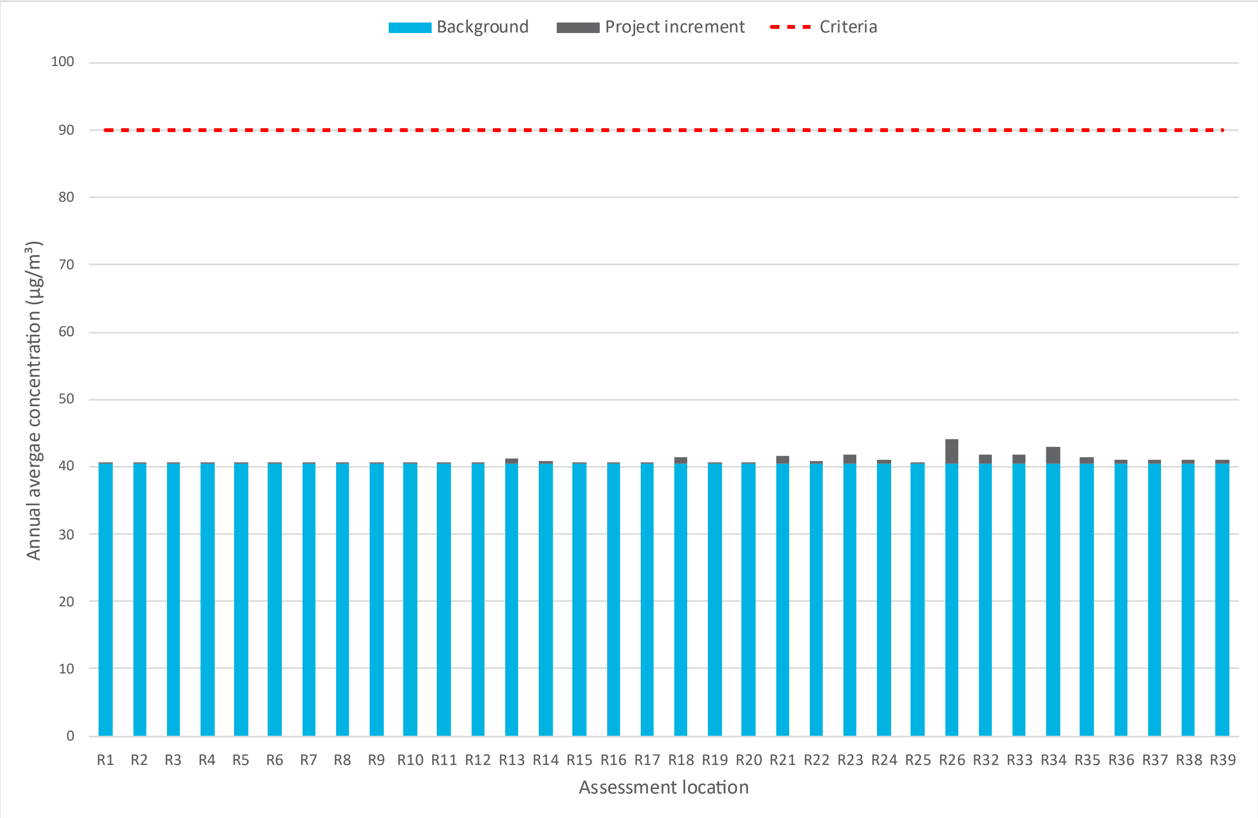


Figure 7.1 Predicted cumulative annual average TSP concentrations

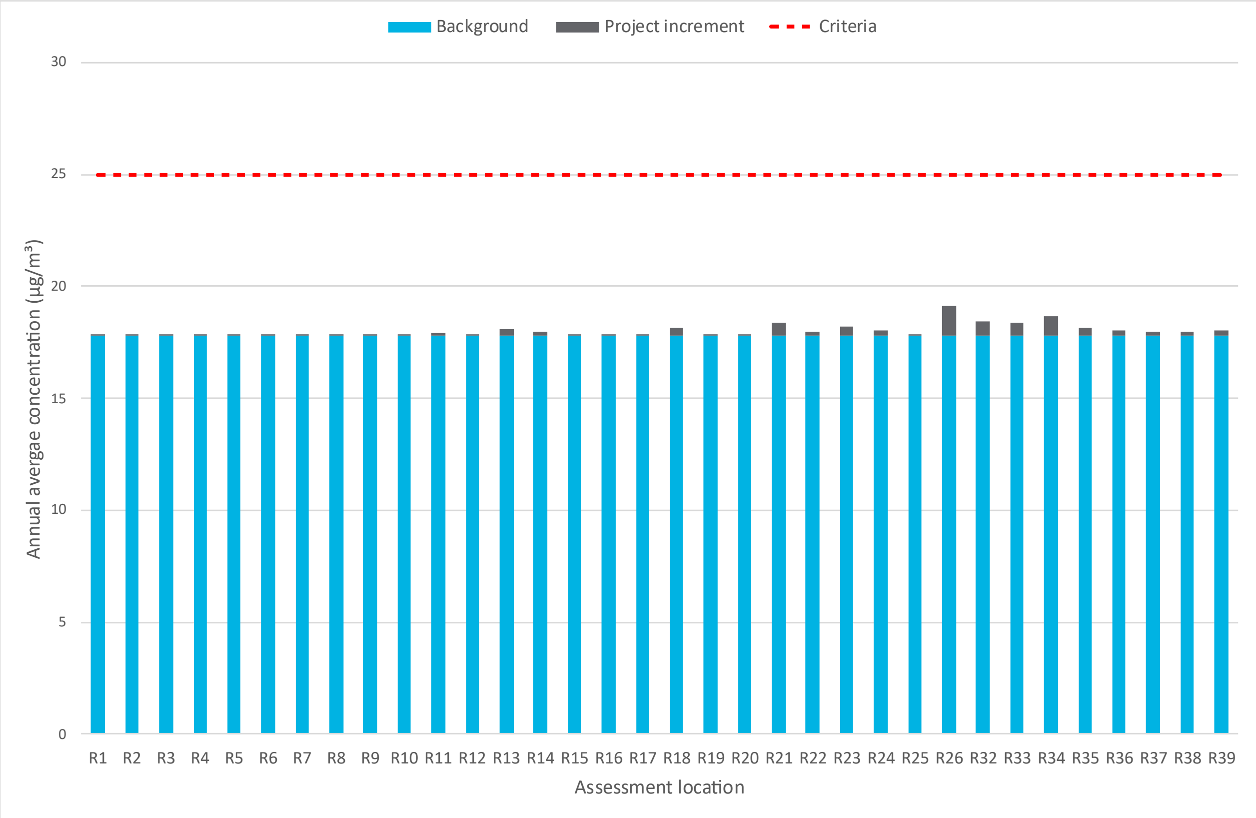


Figure 7.2 **Predicted cumulative annual average PM_{10} concentrations**

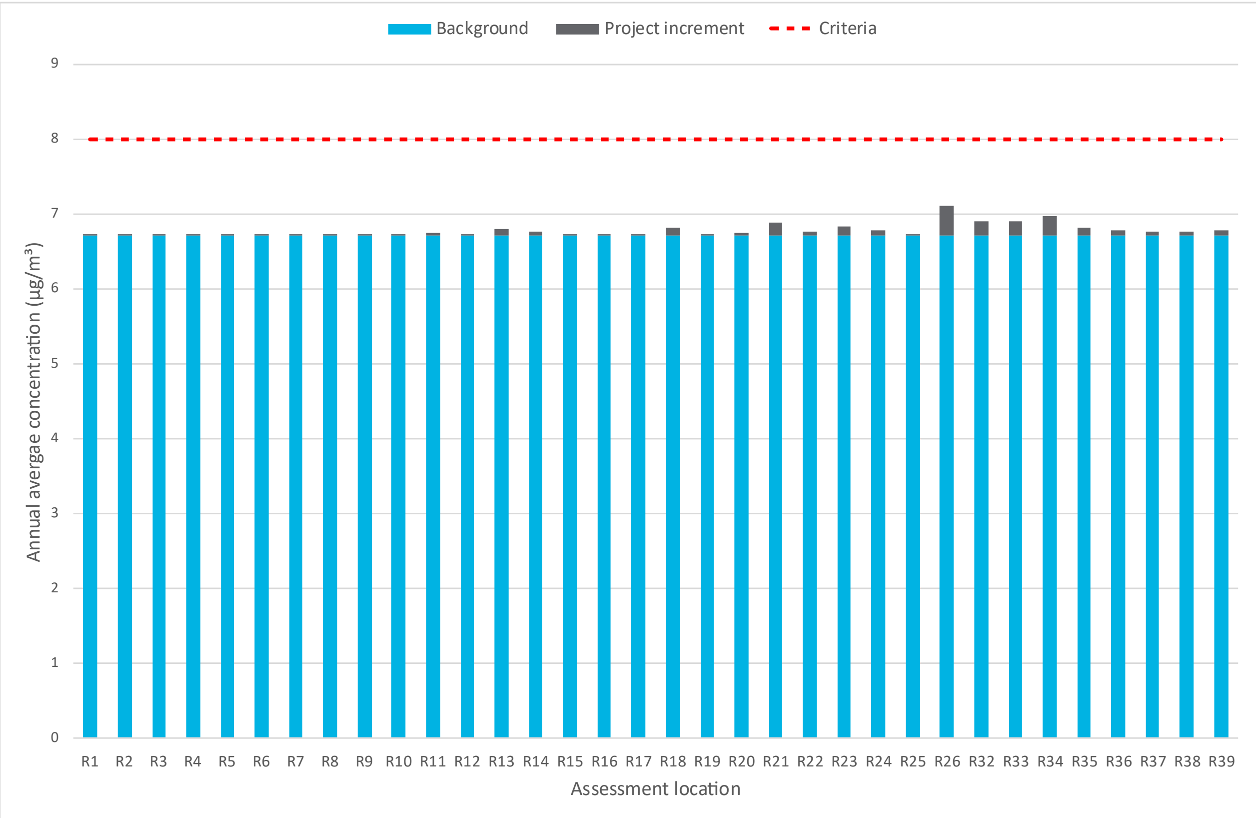


Figure 7.3 **Predicted cumulative annual average $PM_{2.5}$ concentrations**

8 Management and mitigation

There is currently no documented guidance in NSW for best practice emission controls relating specifically to this type of project (i.e. a material recycling facility). Therefore, the following best practice dust control examples from similar industries have been reviewed:

- Best practice dust measures relating to resource recovery operations, as detailed by Sustainability Victoria in the *Guide to Best Practice at Resource Recovery Centres* (Sustainability Victoria 2019. The documented best practice dust-control measures, and a commentary on whether each measure will be implemented at the site, are provided in Table 8.1

- The NSW EPA guidance document *Environmental Guidelines: Solid Waste Landfills* (NSW EPA 2016) describes dust-control methods for solid-waste landfill operations. While the site is not a solid waste landfill, the dust-control measures listed in this guideline document is referenced as an example of NSW EPA best practice dust-control measures for the waste industry in NSW. The dust-control measures and their relevance to the site are provided in Table 8.2.

Table 8.1 Comparison of site dust-control measures with Sustainability Victoria *Guide to Best Practice at Resource Recovery Centres*

Dust control method (Sustainability Victoria 2019)	Measures implemented at site	Justification
Minimise the area of exposed soils	Yes	Entire site is paved.
Stabilise exposed areas (e.g. through revegetation) and stockpiles of dusty materials as soon as practicable	N/A	While dusty materials are controlled through wet suppression, stockpiles are continually active, and therefore additional stabilisation of surface is not practical.
Water sprinklers at crushing/screening plant	Yes	Water sprays are applied to the concrete/masonry crushing plant while the processing shed features misting sprays and dust extraction to filters.
Paving of all operating, storage, unloading and loading areas	Yes	The entire site is sealed with concrete.
Sealing of roads if dust is considered likely to be an issue	Yes	The entire site is sealed with concrete.
Minimising areas of exposed earth through suitable landscaping	Yes	The entire site is sealed with concrete.
Utilising dust suppressants (e.g. light water spray)	Yes	The site features water misting sprays at processing shed, as well as sprinklers at stockpiles and concrete processing areas.
Installing windbreaks to prevent particulates becoming airborne	Yes	All material is stored in bunkers featuring three-sided walls and entire site features wind breaks from boundary walls or built structures.
Regular cleaning/sweeping of paved surfaces	Yes	Cleaning of paved surfaces through and sweeping.

Note: N/A – not applicable.

Table 8.2 Comparison of site dust-control measures with NSW EPA Environmental Guidelines: Solid Waste Landfills, Second edition 2016

Dust-control method (NSW EPA 2016)	Measure implemented at site	Justification
Minimise the area of exposed soils.	Yes	Entire site is paved.
Stabilise exposed areas (e.g. through revegetation) and stockpiles of dusty materials as soon as practicable.	N/A	While dusty materials are controlled through wet suppression, stockpiles are continually active, and therefore additional stabilisation of surface is not practical.
Revegetate completed areas as soon as practicable.	N/A	Not practical given the active nature of stockpiles. The remainder of the site is sealed.
Use sealed or gravel roads, particularly from the public roadway to the gatehouse or waste reception section of the landfill.	Yes	The entire site is sealed with concrete.
Reduce drop heights, where applicable.	Yes	Material drop heights during truck unloading and loading operations are minimised as much as practicable.
Spray water for dust suppression, particularly over exposed surfaces, at key material transfer points, and on unsealed haul roads to minimise wheel-generated dust.	Yes	The site features water misting at processing shed, and sprinklers at stockpiles and concrete processing areas. Concrete stockpiles are dampened prior crushing commencing.
Appropriately modify excavation works and operations on dry, windy days or when the wind is blowing towards sensitive receptors.	N/A	Site does not feature excavation works.
Enforce speed limits to minimise wheel-generated dust.	Yes	Site travel speeds are restricted to 10 km/h.
Cover loads of dusty material transported by road in open-topped trucks.	Yes	All in-coming and out-going truck loads are covered.
Minimise dirt tracked from the site to external roads; measures include visual inspection of trucks leaving the site, use of wheel-wash and shaker grids, and construction of sealed haul roads.	Yes	All roads are paved.
Install wind barriers and enclosures (where practicable) to deflect wind from erodible areas and to minimise exposure of falling dusty materials to winds.	Yes	All material is stored in bunkers featuring three-sided walls and entire site features wind breaks from boundary walls or built structures.

Note: N/A – not applicable

It can be seen from the tables that the dust-control methods implemented at the site are consistent, or in the case of dust extraction and filtration exceeding, best practice dust control measures for the resource recovery and waste industry. It is therefore considered that CWS will implement best practice dust-control measures at the site.

For diesel combustion emissions, the following measures will be implemented:

- any new trucks purchased for site must meet the Euro V emission standards
- all plant and equipment will be regularly serviced and maintained to meet manufacturers emissions specifications
- idling of trucks, plant and equipment onsite will be minimised wherever practicable.

Where possible to quantify, these mitigation measures have been integrated into the emissions inventory and dispersion modelling conducted for the site.

The results of the modelling indicate that the mitigation measures at the site are generally effective for the purpose of reducing air quality impacts to the surrounding environment.

9 Greenhouse gas assessment

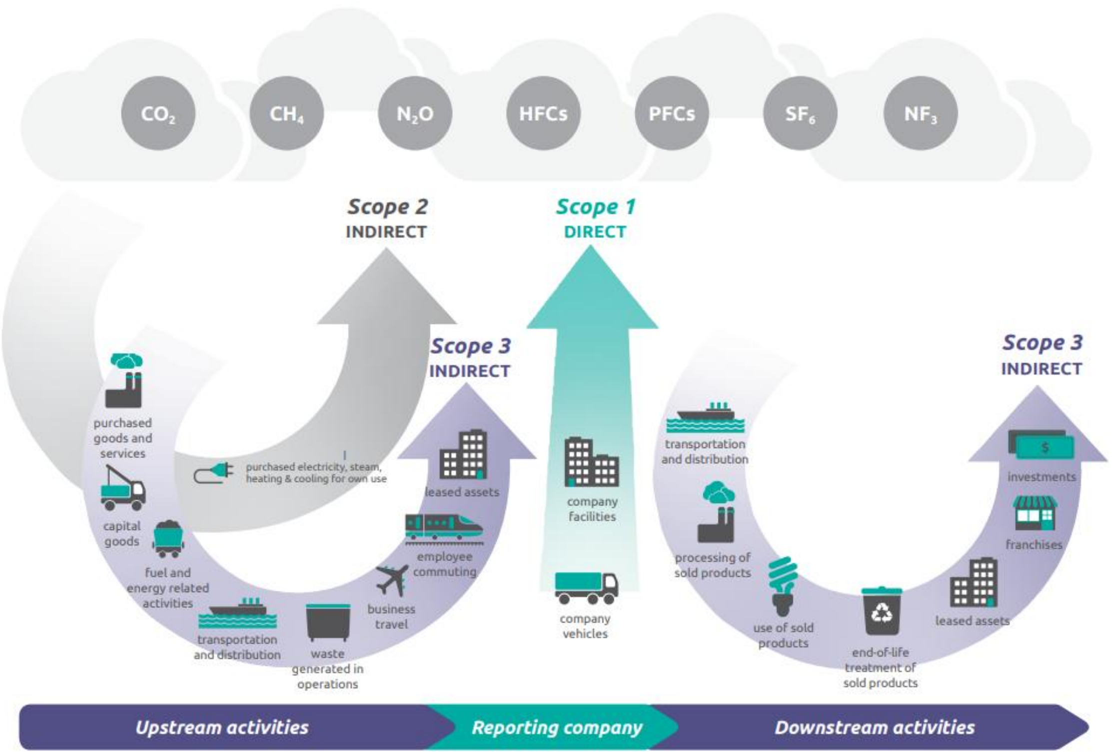
9.1 Introduction

The GHG emissions for the project were estimated based on the Australian Government Department of Climate Change, Energy, the Environment and Water (AGDCCEEW) National Greenhouse Accounts Factors (NGAF) workbook (AGDCCEEW 2024). The methodologies in the NGAF workbook follow a simplified approach, equivalent to the 'Method 1' approach outlined in the National Greenhouse and Energy Reporting (Measurement) Technical Guidelines (DoE 2014). The Technical Guidelines are used for the purpose of reporting under the Commonwealth *National Greenhouse and Energy Reporting Act 2007* (the NGER Act).

For accounting and reporting purposes, GHG emissions are defined as 'direct' and 'indirect'. Direct emissions (also referred to as Scope 1 emissions) occur within the boundary of an organisation and are a result of the organisation's activities. Indirect emissions are generated as a consequence of an organisation's activities, but are physically produced by the activities of another organisation (AGDCCEEW 2024).

Indirect emissions are further defined as Scope 2 and Scope 3 emissions. Scope 2 emissions occur from the generation of the electricity purchased and consumed by an organisation. Scope 3 emissions occur from all other upstream and downstream activities, such as the downstream extraction and production of raw materials or the upstream use of products and services.

Scope 3 is an optional reporting category (Bhatia et al 2010) and should not be used to make comparisons between organisations, for example in benchmarking GHG intensity of products or services. Typically, only major sources of Scope 3 emissions are accounted and reported by organisations.



Source: WRI & WBCSD (2013).

Figure 9.1 Overview of GHG emission scopes

In this assessment, GHG emissions are presented as carbon dioxide equivalents (CO_2-e) and include emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), calculated based on the applicable global warming potentials (GWPs).

9.2 Australian legislative context

9.2.1 The National Greenhouse and Energy Reporting Scheme

The National Greenhouse Emissions Reporting (NGER) scheme, established by the NGER Act, is a single national framework for reporting information about greenhouse gas emissions, energy production and energy consumption.

Facilities or corporations must report under the NGERs scheme if they emit GHG emissions or produce/consume energy at or above the following thresholds:

- Greater than 25 kilotons (kt) GHG emissions (as CO_2-e) or produced/consume greater than 100 terajoules (TJ) of energy (facility level).
- Greater than 125 kt of GHG emissions (as CO_2-e) or produce/consume greater that 500 TJ of energy (corporate level).

The NGER Act is underpinned by the National Greenhouse and Energy Reporting Regulations 2008 and the National Greenhouse and Energy Reporting (Measurement) Determination 2008. The Measurement Determination provides methods, criteria and measurement standard for calculating GHG emissions and energy data and covers Scope 1 and Scope 2 emissions and energy production and consumption.

The Measurement Determination has been updated for 2020–21 onwards to include:

- the GWPs prescribed by the Intergovernmental Panel on Climate Change in its Fifth Assessment Report (AR5)
- updating Scope 2 emissions factors; for each state.

9.2.2 The Safeguard Mechanism

The Safeguard Mechanism is the Australian Government's policy for reducing GHG emissions at Australia's largest industrial facilities, and is enacted through the NGER Act and other legislation[3]. The Safeguard Mechanism was first legislated in 2014 and has been in place since 2016. It was reformed in 2023 to ensure that the facilities it covers will contribute to meeting GHG-reduction targets.

There are currently around 220 Safeguard Facilities across the mining, manufacturing, transport, oil, gas and waste sectors. These facilities produce around 28% of Australia's GHG emissions. The Safeguard Mechanism sets legislated limits—known as baselines—on the GHG emissions of these facilities. These baselines will decrease on a trajectory that is consistent with achieving Australia's GHG emission-reduction targets of 43% below 2005 levels by 2030 and net zero by 2050. The baselines will decrease gradually from 1 July 2023. The decline rate will be set at 4.9% each year to 2030.

In general terms, the Safeguard Mechanism applies to facilities with Scope 1 emissions[4] of more than 100,000 tonnes of CO_2-e per year.

It is acknowledged that the Safeguard Mechanism provides minimum requirements for the highest emitting facilities, but does not preclude the need for NSW EPA and the consent authority to properly understand the potential GHG impacts of proposed new or significantly modified developments, and to ensure that all proponents are adequately avoiding, minimising and managing their GHG emissions over all stages of the development.

3 https://www.dcceew.gov.au/climate-change/emissions-reporting/national-greenhouse-energy-reporting-scheme/safeguard-mechanism

4 The threshold applies to actual (gross) emissions from a facility, and does not take into account any offset or displaced emissions.

9.2.3 NSW EPA Draft Guide for Large Emitters

The *NSW EPA Guide for Large Emitters* (the GLE, EPA 2024) provides guidance on the GHG assessment requirements to be prepared for large emitting projects within environment impact assessments in NSW.

As stated in Section 2.1 of the GLE, the NSW EPA may consider a project to have large emissions if the project meets three criteria.

1. The project requires development assessments and approvals under the *Environmental Planning and Assessment Act 1979*.
2. The project involves one or more scheduled activities under Schedule 1 of the Protection of the Environment (POEO) Act and/or will be carried out at an existing licensed premises.
3. The project is likely to emit 25,000 tonnes or more of scope 1 and 2 emissions (CO_2-e) in any financial year during the operational life of the project (based on planned operational throughput and as designed).

The NSW EPA also specifies that when a project involves a modification to an existing operation, the 25,000 tonne CO_2-e threshold applies specifically to the activities falling within the GHG assessment boundary and not necessarily to the whole operation.

The GLE prescribes eight steps to undertaking a GHG assessment. The first step is to define the GHG assessment boundary.

Projects involving new operations and modifications to existing operations should develop emission projections that address all sources within the assessment boundary. For proposed modifications, this 'project only' scenario must include both:

- new sources of emissions associated with proposed activities within the modification
- emission sources associated with existing activities to be altered by the modification.

In this manner, the net GHG emissions impact of the proposed modification may be clearly assessed and communicated within the 'project only' scenario.

Where a project involves a modification to existing activities, the GHG assessment must include the following additional scenarios:

- A 'business-as-usual' scenario addressing sources and projected emissions expected to occur without the project, including any existing or planned emissions reductions.
- A 'modified-business' scenario addressing sources and emissions associated with existing operations and including the implementation of the proposed modification.

For the purpose of this assessment, the activity rates of all processes will increase as the throughput increases from 90,000 tpa to 450 000 tpa. Therefore, the assessment boundary encompasses all sources at the site. The 'business-as-usual' scenario is considered to be the approved operations at 90,000 tpa, while the 'modified business' scenario is represented by the subsequent years of operation, as throughput increases to 450,000 tpa (see Table 9.2 for further details). The net difference in annual GHG emissions between the 'business-as-usual' scenario and the 'modified business' scenario will be used to compare against the 25,000 tonne CO_2-e threshold for the NSW EPA GLE.

9.3 Emission sources and assessment boundary

The GHG emission sources included in this assessment are listed in Table 9.1, representing the most significant sources associated with the site.

GHG emissions from the Project are estimated using the methodologies outlined in the NGAF workbook, using fuel energy contents and Scope 1, 2 and 3 emission factors for diesel combustion and electricity use in NSW.

Table 9.1 Scope 1, 2 and 3 emission sources

Scope 1	Scope 2	Scope 3
Direct emissions from diesel fuel combustion (diesel) by onsite plant and equipment and CWS-owned trucks delivering material to the site.	Indirect emissions associated with the consumption of purchased electricity.	Indirect upstream emissions from the extraction, production and transport of diesel used for onsite plant and equipment.
		Diesel combustion by third-party vehicles transporting material to and from the site.
		Indirect upstream emissions from electricity lost in delivery in the transmission and distribution network.

GHG emissions have been quantified based the following assumptions:

- A monthly diesel consumption rate for existing 90,000 tpa operations (56,290 litres (L)/month) was upscaled to 450,000 tpa operations to return a peak annual diesel fuel consumption of 3,377,400 L.
- The annual diesel amount accounts for both onsite diesel consumption (e.g. FEL, excavators, etc.) and the proportion of incoming material transported from the CWS-owned waste transfer stations in CWS-owned trucks.
- A monthly electricity consumption rate for existing 90,000 tpa operations (45,000 kilowatt hours (kWh)/month) was upscaled to 450,000 tpa operations to return a peak annual electricity consumption of 2,700,000 kWh. This amount accounts for existing plant at the site.
- For the residual processing shed, based on the equipment proposed for installation by the CWS, the hourly power demand is 1,256 kW. Through the assumption of 16 hours of processing per day, and 300 days of operations per year, this equates to an additional annual electricity consumption at peak future operations (i.e. 450,000 tpa) of 6,026,400 kW.
- Raw material and product material transport:
  - Excluding incoming material from CWS-owned trucks (accounted for in the scope 1 diesel combustion emissions), it is estimated for 450,000 tpa operations, there will be 42,900 incoming loads and 15,660 outgoing loads via third party vehicles (a mixture of articulated trucks, rigid trucks and tippers).
  - Diesel consumption rates for articulated trucks (53.1 L/100 km) and rigid trucks (28.6 L/100 km) were adopted (ABS 2020). When combined with the truck loads by weight class, weighted average diesel consumption rates of 37.8 L/100 km were calculated for incoming and outgoing truck loads.
  - For incoming material, a return trip travel distance per load of 60 km was assumed.

- For outgoing material, a return trip travel distance per load of 40 km was assumed.
- The calculated annual kilometres travelled for incoming trucks and outgoing trucks under 450,000 tpa operations were 1,415,700 km/year and344,520 km/year respectively.
- The calculated combined annual diesel consumption rate for incoming trucks and outgoing trucks under 450,000 tpa operations was calculated to be 665,143 L/year.

CWS anticipates that production intensity will gradually ramp up over a period of 10 years from 90,000 tpa to 450,000 tpa. To account for this projected rate of material throughput increase in the GHG emission calculations, the diesel consumption and electricity activity rates have been prorated over a 10-year period, as shown in Table 9.2

Table 9.2 Projected annual activity rates and energy consumption

Year	Throughput	Diesel (L)	Electricity (kWh) - existing plant	Electricity (kWh) - future plant	Electricity (kWh) - total	Third-party diesel (L)
2025	90,000	675,480	540,000	-	540,000.0	133,028.6
2026	126,000	945,672	756,000	33,305	789,305	186,240.1
2027	162,000	1,215,864	972,000	118,948	1,090,948	239,451.5
2028	198,000	1,486,056	1,188,000	330,411	1,518,411	292,663.0
2029	234,000	1,756,248	1,404,000	750,935	2,154,935	345,874.4
2030	270,000	2,026,440	1,620,000	1,444,105	3,064,105	399,085.9
2031	306,000	2,296,632	1,836,000	2,406,842	4,242,842	452,297.3
2032	342,000	2,566,824	2,052,000	3,539,473	5,591,473	505,508.8
2033	378,000	2,837,016	2,268,000	4,657,202	6,925,202	558,720.2
2034	414,000	3,107,208	2,484,000	5,544,288	8,028,288	611,931.7
2035 - onwards	450,000	3,377,400	2,700,000	6,026,400	8,726,400	665,143.1

GHG emissions from the fuel and electricity were estimated using the methodologies outlined in the NGAF workbook, using fuel energy contents and scope 1, 2 and 3 emission factors for diesel and electricity use in NSW.

9.4 Excluded emissions

There are a number of GHG emissions that are considered minor relative to diesel and electricity consumption and have been excluded from this GHG assessment. Excluded sources are:

- fugitive leaks from high voltage switch gear and refrigeration (scope 1)
- use of paints, solvents, oils and grease (scope 1)
- employee travel to and from site (scope 3)
- disposal of solid waste at landfill (scope 3).

9.5 Emission estimates

The following emission factors have been used to estimate GHG emissions from the project:

- Diesel consumption on-site and CWS trucks (Scope 1, Scope 3) – diesel oil factors from Table 8 of the NGAF workbook (AGDCCEEW 2024a).
- Diesel consumption off-site by third party trucks (Scope 3, using Scope 1 emission factors) – *Transport fuel emissions: HDV Euro IV+, diesel* factors from Table 9 of the NGAF workbook (AGDCCEEW 2024a).
- Electricity consumption (Scope 2) – NSW/ACT emission factors between 2025 and 2035 from Table 46 of *Australia's emissions projections 2024* (AGDCCEEW 2024b) and annual projected use.
- Electricity consumption (Scope 3) – NSW/ACT emission factors between 2025 and 2035, derived from Table 47 of (DCCEEW 2023) and annual projected use.

The estimated annual GHG emissions for each emission source are presented in Table 9.3. The breakdown of annual GHG emissions by scope is illustrated in Figure 9.2. Additional details of the GHG emissions calculations are provided in Attachment D.

Table 9.3 Annual GHG emission estimates – 2025 to 2035 onwards

Year	Annual GHG emissions (tonnes CO_2-e/year) by scope				
	Scope 1	Scope 2	Scope 3		
	Diesel combustion – onsite and CWS trucks	Electricity consumption	Diesel combustion – onsite and CWS trucks	Diesel combustion - third party material transportation (incoming/outgoing)	Electricity consumption
2025	1,830	275	451	361	22
2026	2,563	371	632	506	24
2027	3,295	436	812	650	33
2028	4,027	516	992	795	30
2029	4,759	453	1,173	939	43
2030	5,491	460	1,353	1,084	31
2031	6,223	636	1,534	1,229	42
2032	6,955	727	1,714	1,373	56
2033	7,688	623	1,895	1,518	69
2034	8,420	723	2,075	1,662	80
2035	9,152	611	2,255	1,807	87

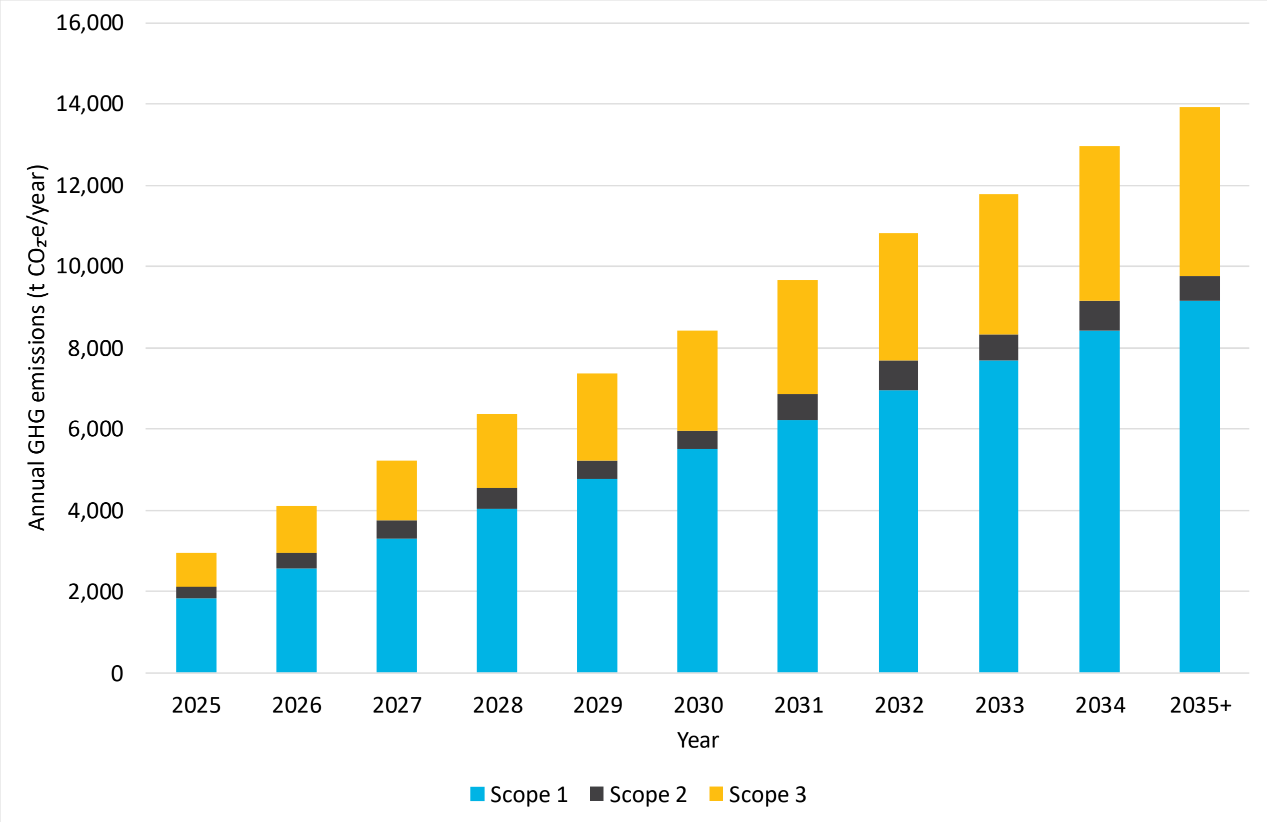


Figure 9.2 Annual GHG emissions by scope

The annual Scope 1 and 2 emissions for all future operational years will be lower than the 25,000 tonnes CO_2-e/year threshold (Table 9.3). Consideration however must be given to the net change in emission relative to approved operations. The net change in Scope 1, 2 and 3 GHG emissions relative to 90,000 tpa operations is presented in Table 9.4.

Table 9.4 Net change in annual GHG emission relative to 90,000 tpa operations – 2025 to 2035 onwards

Year	Net change in annual GHG emissions (t CO_2-e/year) by scope				
	Scope 1	Scope 2	Scope 3		
	Diesel combustion – onsite and CWS trucks	Electricity consumption	Diesel combustion - – onsite and CWS trucks	Diesel combustion - third party material transportation (incoming/outgoing)	Electricity consumption
2025	-	-	-	-	-
2026	732	96	180	145	2
2027	1,464	161	361	289	11
2028	2,196	241	541	434	9
2029	2,929	177	722	578	21
2030	3,661	184	902	723	9
2031	4,393	361	1,083	867	21
2032	5,125	451	1,263	1,012	34

Year	Net change in annual GHG emissions (t CO_2-e/year) by scope				
	Scope 1	Scope 2	Scope 3		
	Diesel combustion – onsite and CWS trucks	Electricity consumption	Diesel combustion - – onsite and CWS trucks	Diesel combustion - third party material transportation (incoming/outgoing)	Electricity consumption
2033	5,857	348	1,443	1,156	48
2034	6,589	447	1,624	1,301	59
2035+	7,321	335	1,804	1,445	66

The net change in combined Scope 1 and Scope 2 GHG emission will be lower than the 25,000 tonnes CO_2-e/year threshold for all years of operations (Table 9.4). On the basis of the calculations presented, the large emitters threshold of 25,000 tonnes CO_2-e per year will not be exceeded and therefore the GLE GHG assessment requirements do not apply to this application.

The significance of annual GHG emissions relative to State and National GHG emissions has been determined by comparing annual average GHG emissions against the most recent available total GHG emissions inventories (calendar year 2022[5]) for NSW (110,997 kt CO_2-e) and Australia (432,621 kt CO_2-e).

Relative to 2022 emission inventory totals, annual average Scope 1 and Scope 2 GHG emissions generated by the project will represent approximately 0.00542% of NSW total emissions and 0.00139% of national total emissions on an annual average basis; and approximately 0.0089% of NSW total emissions and 0.00228% of national total emissions when compared to the highest annual emissions.

The calculated total annual Scope 1 and 2 emissions from project will be below than the NGER Scheme facility reporting threshold of 25,000 tpa CO_2-e. Therefore, no annual NGER Scheme reporting obligations apply to the site. The calculated annual Scope 1 GHG emissions will be well below the Safeguard Mechanism threshold of 100,000 tpa CO_2-e.

9.6 GHG emissions management

CWS propose to reduce purchased electricity consumption in the future through the installation of an approximately 1 megawatt (MW) solar power system at the site. Based on an online solar system calculator configured for 1 MW solar systems in the Kurri Kurri region[6], the proposed solar power system at the site could theoretically reduce annual electricity consumption by approximately 17%.

5 https://greenhouseaccounts.climatechange.gov.au/

6 https://www.lgenergy.com.au/calculator/suburb/kurri-kurri-nsw/2327

10 Conclusion

EMM was engaged by CWS to undertake an AQGHGA for the Integrated Resource Recovery Centre project. The AQGHGA has been conducted following the methods prescribed in the *Approved Methods for Modelling* (NSW EPA 2022) and the technical guidelines provided under the Commonwealth *National Greenhouse and Energy Reporting Act 2007* (the NGER Act).

Background air quality concentrations were adopted from data recorded during the 2023 calendar year at NSW DCCEEW Beresfield AQMS sites. Meteorological modelling was completed using AERMET, with real-world observations incorporated from BoM Maitland Airport AWS and BoM Williamtown RAAF AWS monitoring resources.

Emissions of TSP, PM_{10}, and $PM_{2.5}$ associated with the project were quantified using publicly available emission estimation techniques. Atmospheric dispersion model predictions for the proposed activities were undertaken using the AERMOD dispersion modelling system.

The results of the modelling predict that concentrations and deposition rates for incremental particulate matter (TSP, PM_{10}, $PM_{2.5}$ and dust deposition) will be below the applicable impact assessment criteria at all assessment locations.

Cumulative impacts were assessed by combining the adopted background concentrations with the predicted incremental concentrations from the project. Cumulative results indicate that air pollution concentrations associated with emissions from the project will be in compliance with the NSW EPA impact assessment criteria at all surrounding assessment locations for all pollutants and averaging periods.

A range of best practice dust mitigation measures are currently implemented at the RRF and are proposed for the project. These include the use of enclosure and extraction to dust filters of primary processing plant equipment, the use of water sprays to external operations and stockpiles, three sided enclosures with awnings for material storage bays, and cleaning of paved surfaces. These measures have been taken into account in the emissions estimation and dispersion modelling.

A GHG assessment was completed. Annual average GHG emissions (Scope 1) generated by the project represent approximately 0.00542% of NSW total emissions and 0.00139% of national total emissions on an annual average basis based on the National GHG Inventory for 2022. The calculated total annual Scope 1 and 2 emissions from site will be below the NGER Scheme facility reporting threshold of 25,000 tpa CO_2-e. Therefore, no annual NGER Scheme reporting obligations apply to the site. The calculated annual Scope 1 GHG emissions will also be well below the Safeguard Mechanism threshold of 100,000 tpa CO_2-e.

References

Bhatia, P, Cummis, C, Brown, A, Rich, D, Draucker, L & Lahd, H 2010, Greenhouse Gas Protocol. *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*. Supplement to the GHG Protocol Corporate Accounting and Reporting Standard, World Resources Institute & World Business Council for Sustainable Development.

Bureau of Meteorology (BoM) 2024, Long-term climate statistics from Maitland Airport and Williamtown RAAF automatic weather station (AWS).

Australian Government Department of Climate Change, Energy, the Environment and Water (AGDCCEEW) 2024a, *Australian National Greenhouse Accounts Factors*, Department of Climate Change, Energy, the Environment and Water, Canberra, 2024.

AGDCCEEW 2024b*, Australia's emissions Projections 2024*, Department of Climate Change, Energy, the Environment and Water, Canberra, December. CC BY 4.0.

Department of Environment (DoE) 2014, *National Greenhouse and Energy Reporting (Measurement) Technical Guidelines.*

DoE 2021, *National Environment Protection (Ambient Air Quality) Measure.*

Jacobs 2021, *Hunter Power Project air quality impact assessment,* prepared for Snowy Hydro Limited by Jacobs Group (Australia) Pty Limited.

NPI 2008, *Emission Estimation Technique Manual for Combustion Engines.*

NPI 2012, *Emission Estimation Technique Manual for Mining.*

NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) 2024, Climate and Atmospheric Research Branch, air quality monitoring data from Beresfield air quality monitoring station.

NSW Environmental Protection Authority (NSW EPA) 2012, *Technical Report No. 7, Air Emissions Inventory for the Greater Metropolitan Region in New South Wales*, 2008 Calendar Year, On-Road Mobile Emissions.

NSW EPA 2013*,* Air Emissions in My Community web tool – Substance information. NSW Environment Protection Authority, Sydney, https://www.epa.nsw.gov.au/~/media/EPA/Corporate%20Site/resources/air/130841AEsubstance.ashx

NSW EPA 2016, Environmental Guidelines: Solid Waste Landfills. Second edition. New South Wales Environment Protection Authority, Sydney.

NSW EPA 2022, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*. New South Wales Environment Protection Authority, Parramatta.

NSW EPA 2024, *NSW EPA Guide for Large Emitters (Draft for Consultation)*. New South Wales Environment Protection Authority, Parramatta.

Ramboll Environ 2016, *Kurri Kurri Battery Recycling Facility air quality and greenhouse gas assessment,* prepared for EMM Consulting Pty Ltd on behalf of Pymore Recyclers International Pty Ltd by Ramboll Environ Australia Pty Ltd

Sustainability Victoria 2019, *Guide to Best Practice at Resource Recovery Centres.* Sustainability Victoria, Melbourne.

US-EPA 2004, AP-42 Chapter 11.19.2 – Crushed Stone Processing and Pulverized Mineral Processing

US-EPA 2006b, AP-42 Chapter 13.2.4 – Aggregate Handling and Storage Piles.

US-EPA 2011, AP-42 Chapter 13.2.1 – Paved Roads.

US-EPA 2016, Nonroad Compression-Ignition Engines: Exhaust Emission Standards (EPA-420-B-16-022, March 2016).

Abbreviations

AAQNEPM	Ambient Air Quality National Environment Protection Measure
AQGHGA	Air quality and Greenhouse Gas assessment
AQMS	air quality monitoring station
AWS	Automatic weather station
BoM	Bureau of Meteorology
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DoE	Commonwealth Department of the Environment
EIS	environmental impact statement
EMM	EMM Consulting Pty Limited
GWP	global warming potential
ha	hectares
km	kilometres
LGA	local government area
NGER	National Greenhouse Emissions Reporting
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
NSW EPA	NSW Environmental Protection Authority
NO_x	oxides of nitrogen
NO_2	nitrogen dioxide
NPI	National Pollution Inventory
PM_{10}	Particulate matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in aerodynamic diameter
SEARs	Secretary's Environmental Assessment Requirements
SO_2	sulphur dioxide
TAPM	The Air Pollution Model
tpa	tonnes per annum
TSP	Total suspected particulates
US-EPA	United States Environmental Protection Agency
VKT	Vehicle Kilometres Travelled
VOC	Volatile organic compounds

Attachment A

Meteorological analysis

creating opportunities

A.1 Meteorological data analysis for the BoM Maitland Airport AWS, 2019-2023

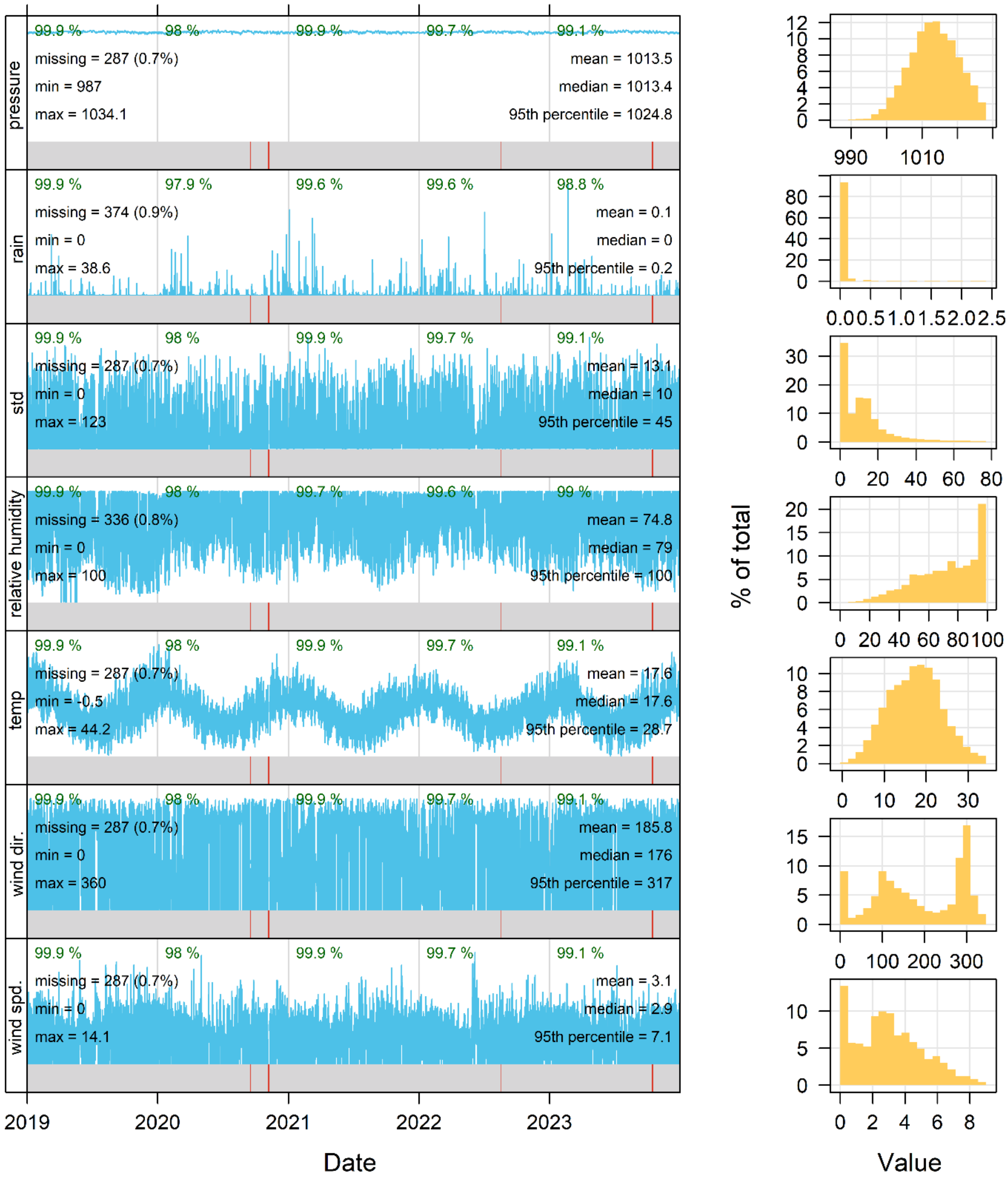


Figure A.1 Data completeness analysis plot – BoM Maitland Airport AWS – 2019 to 2023

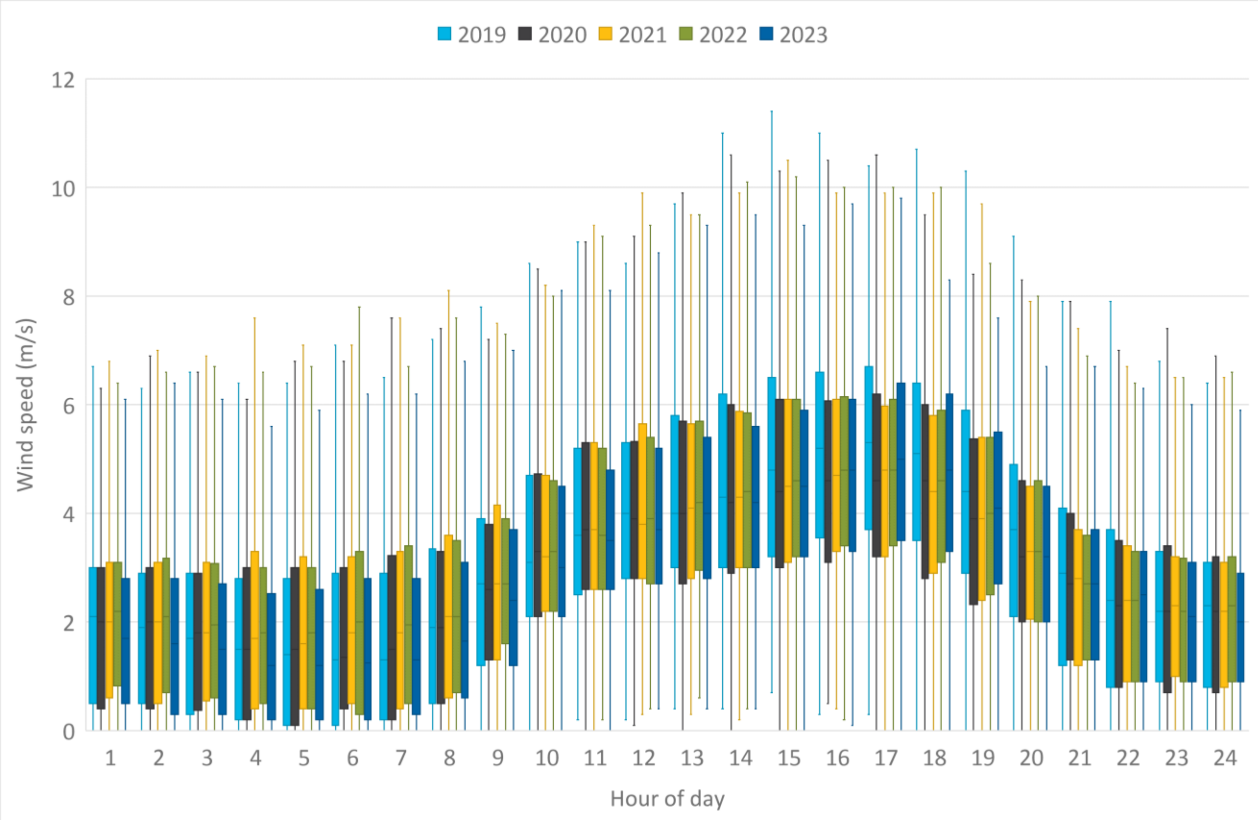


Figure A.2 Inter-annual variability in diurnal wind speed – BoM Maitland Airport AWS – 2019 to 2023

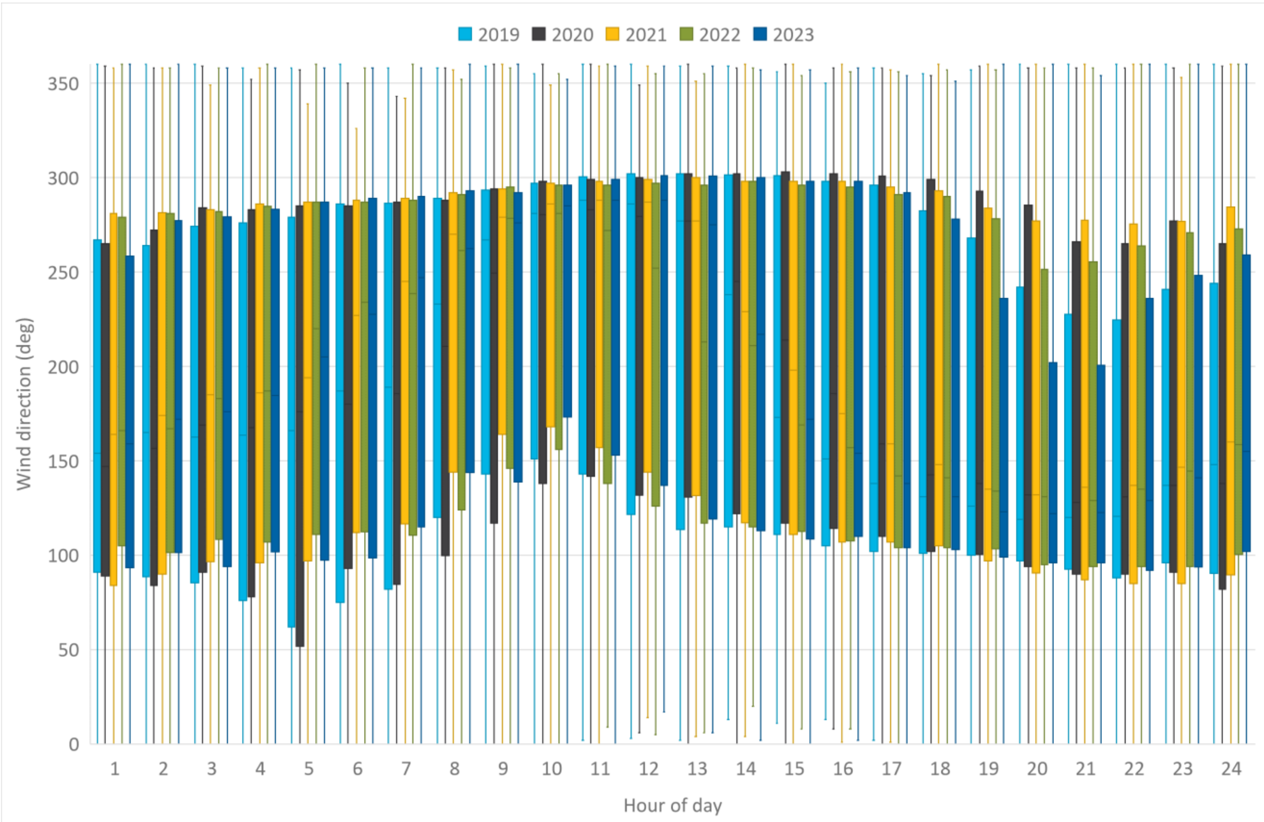


Figure A.3 Inter-annual variability in diurnal wind direction – BoM Maitland Airport AWS – 2019 to 2023

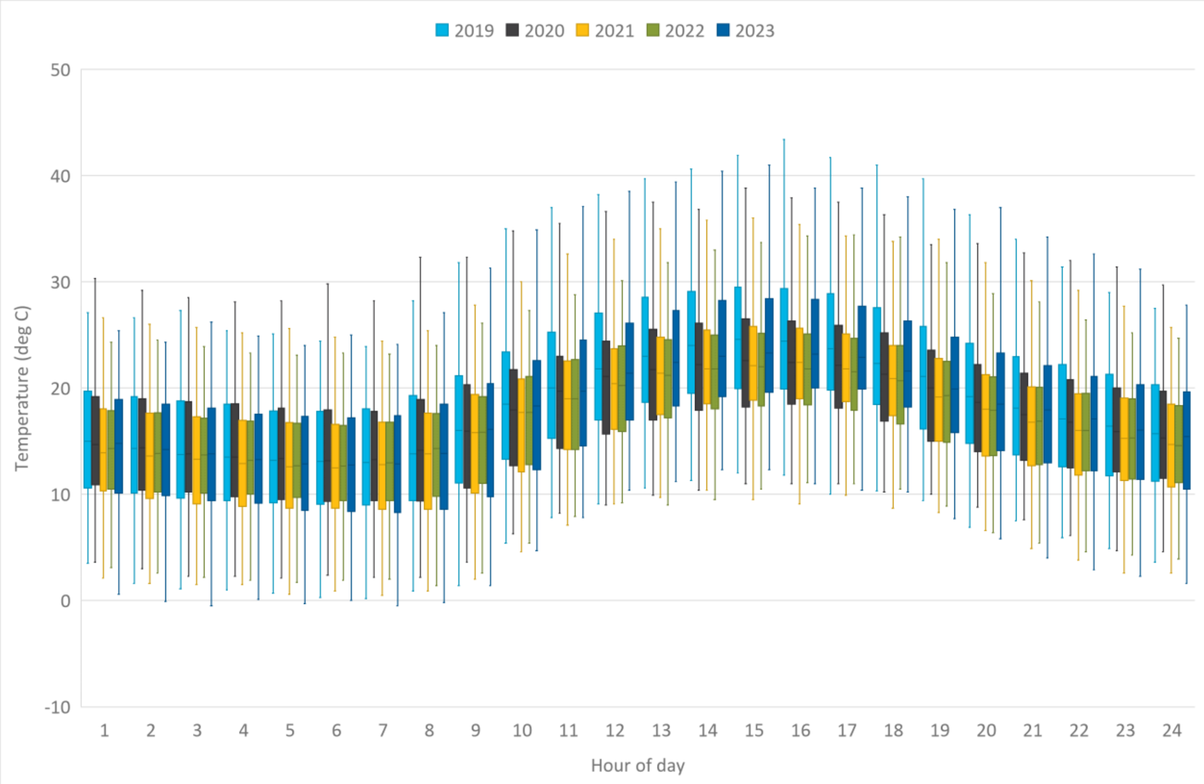


Figure A.4 **Inter-annual variability in diurnal air temperature – BoM Maitland Airport AWS – 2019 to 2023**

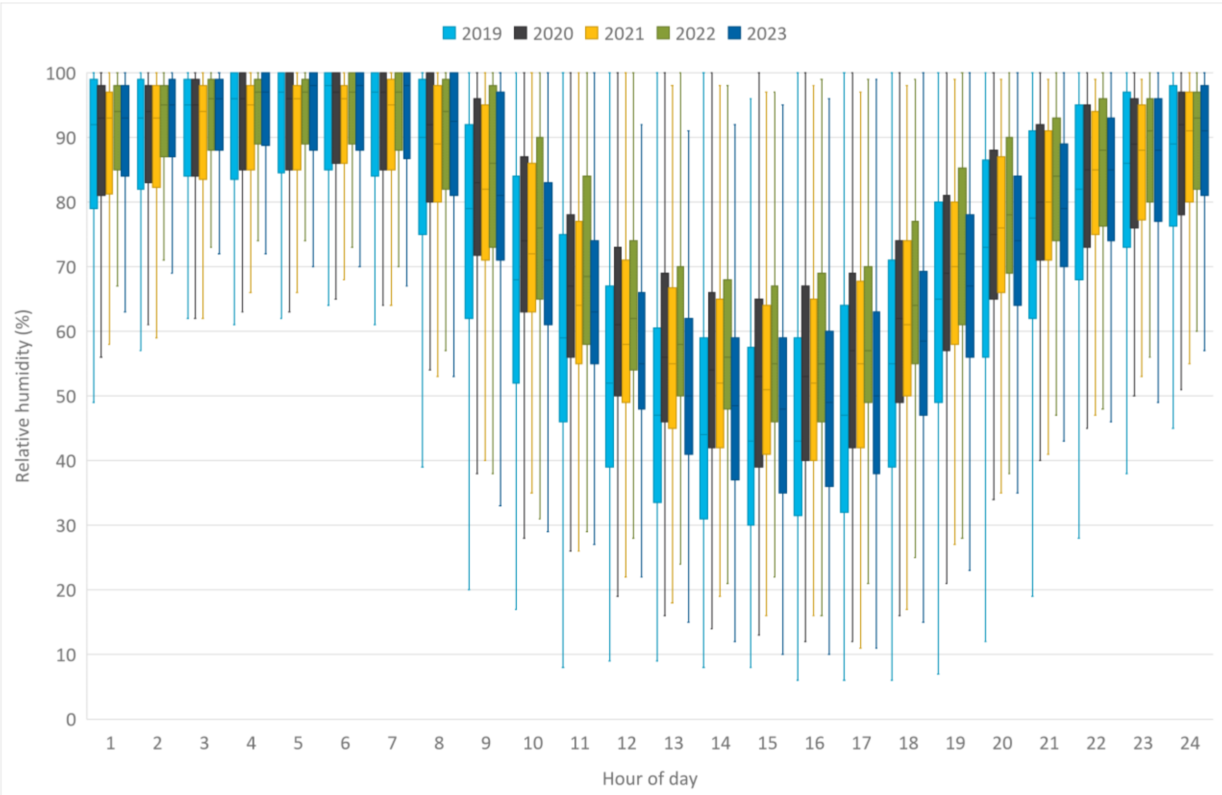


Figure A.5 **Inter-annual variability in diurnal relative humidity – BoM Maitland Airport AWS – 2019 to 2023**

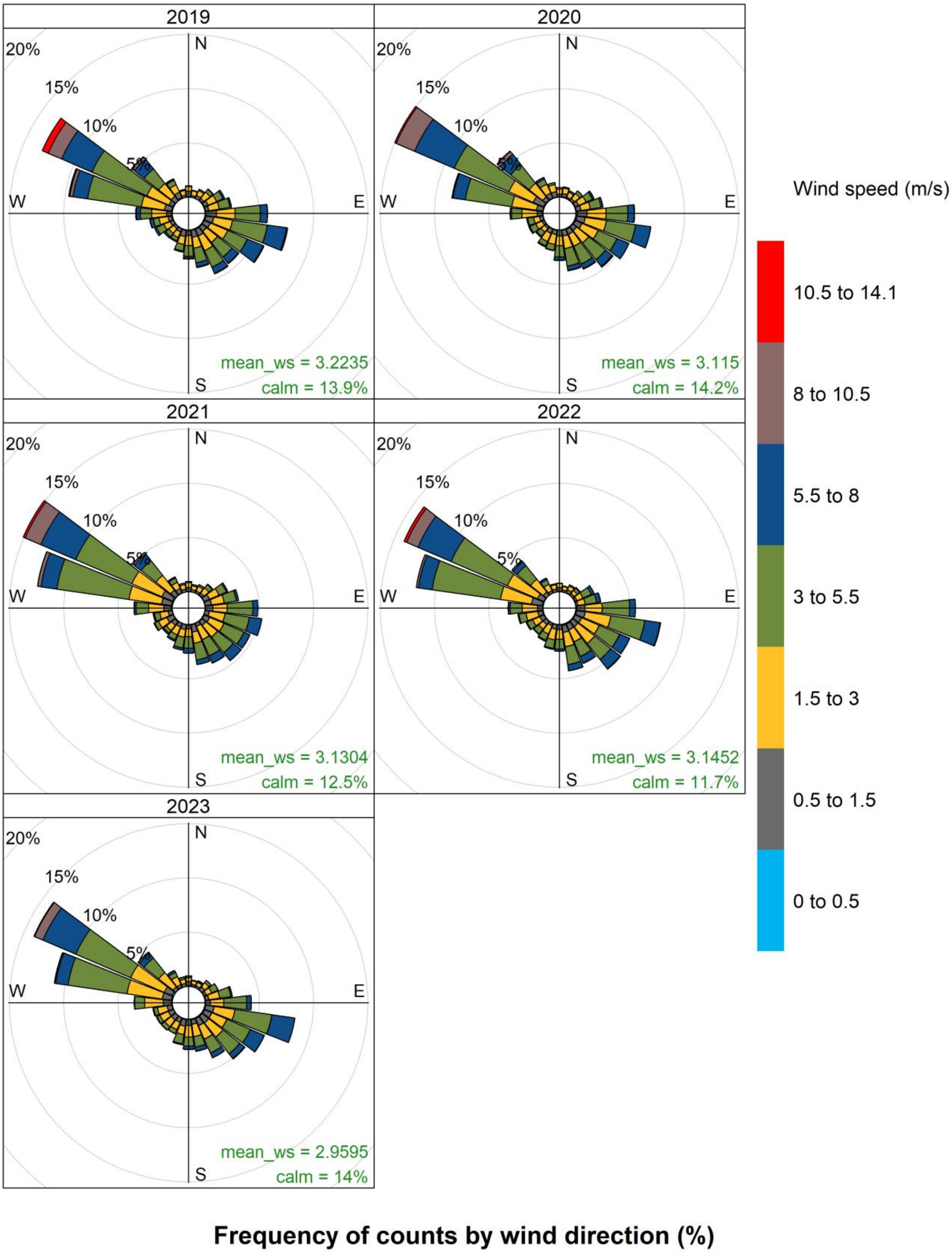


Figure A.6 Inter-annual comparison of recorded wind speed and direction – BoM Maitland Airport AWS – 2019 to 2023

A.2 Meteorological modelling

A.2.1 TAPM modelling

The CSIRO prognostic meteorology model TAPM was used to generate the required upper air prognostic dataset required for AERMET modelling.

TAPM was configured and run as follows:

- TAPM version 4.0.4.
- Inclusion of high resolution (80 m) regional topography (improvement over default 250 m resolution data).
- Grid domains with cell resolution of 30 km, 10 km, 3 km, 1 km and 0.3 km. Each grid domain features 25 x 25 horizontal grid points and 25 vertical levels.
- TAPM default databases for land use, synoptic analysis and asea surface temperature.
- TAPM defaults for advanced meteorological inputs.
- Two 'spin-up' days allowed at the beginning and end of the run.

A.2.2 AERMET meteorological processing

The meteorological inputs for AERMOD were generated using the AERMET meteorological processor. The following sections provide an overview of meteorological processing completed for this assessment.

A.2.3 Surface characteristics

Prior to processing meteorological data, the surface characteristics of the area surrounding the adopted monitoring station require parameterisation. The following surface parameters are required by AERMET:

- surface roughness length
- albedo
- Bowen ratio.

As detailed by USEPA (2013), the surface roughness length is related to the height of obstacle of the wind flow (e.g. vegetation, built environment) and is, in principle, the height at which the mean horizontal wind speed is zero based in a logarithmic profile. The surface roughness length influences the surface shear stress and is an important factor in determining the magnitude if mechanical turbulence and stability of the boundary layer. The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen ratio, an indicator of surface moisture, is the ration of sensible heat flux to latent heat flux and is used for determining planetary boundary layer parameters for convective conditions driven by the surface sensible heat flux.

The land cover of the 10 km by 10 km area surrounding the site was mapped (see Figure A.7). Using the AERSURFACE tool and following the associated guidance of USEPA (2013), surface roughness was determined for 12 (30 degree) sectors grouped by similar land use type within a 1 km radius around the on-site meteorological station, while the Bowen ratio and albedo were determined for the total area. Monthly-varying values for surface roughness, Bowen ratio and albedo were allocated to each sector based on the values prescribed by USEPA (2013).

Surface moisture characteristics for the 2023 modelling period was determined by comparing the period rainfall total to the previous 30-year rainfall records from the following BoM long term rainfall stations:

- Maitland Airport (61428)
- Cessnock Airport (61260)
- Raymond Terrace (Kinross) (61031).

Annual rainfall for the modelling year was 666 mm, which places the 12-month period on average with the 70th percentile rainfall totals for the previous 30 years, and therefore a 'average' surface moisture classification was allocated. It is noted that the rainfall records are not incorporated into dispersion model predictions (i.e. no wet deposition is modelled).

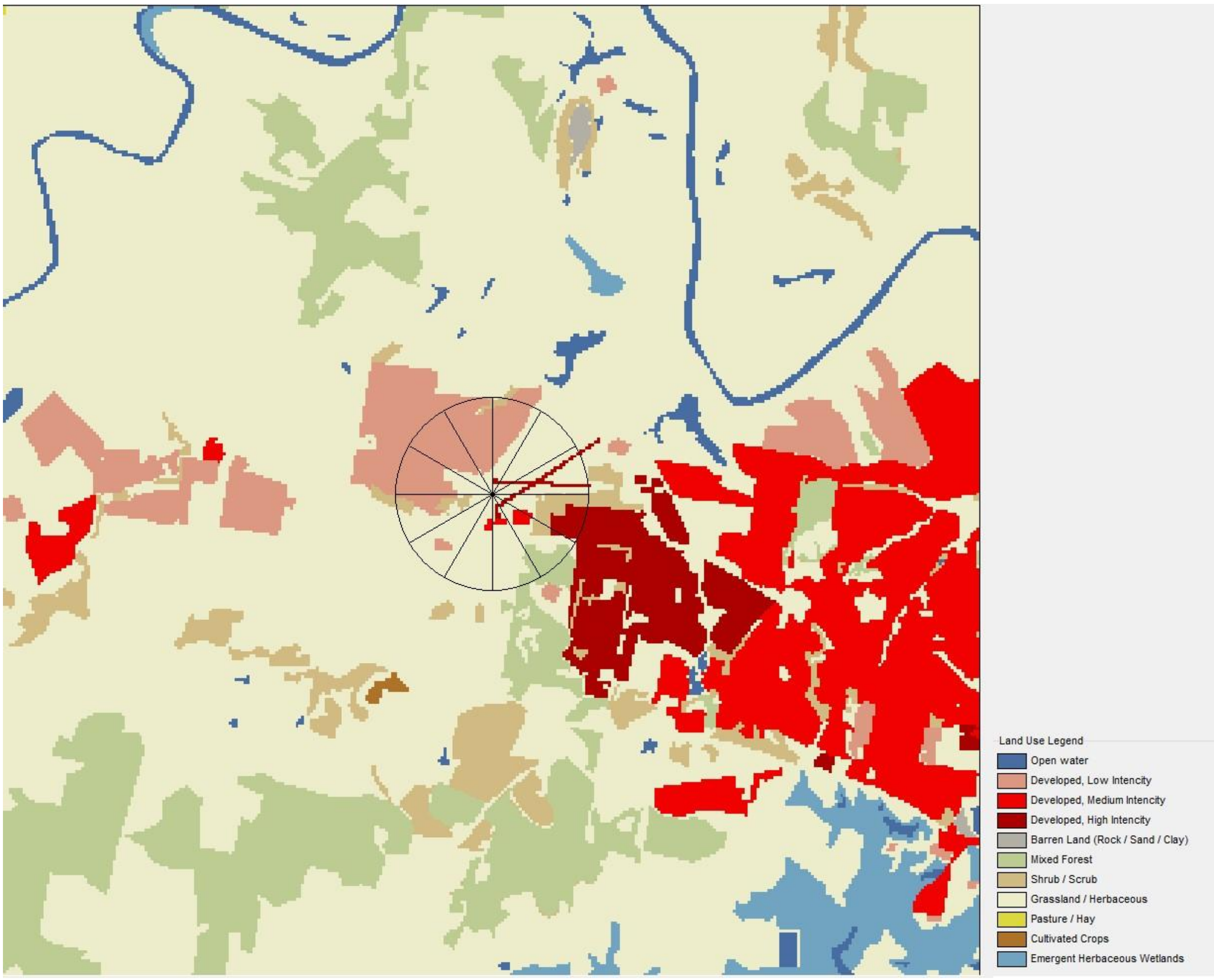


Figure A.7 Land use map for AERSURFACE processing

Note: Marked in figure are the 1 km radius for surface roughness (12 sectors defined) and 10 km by 10 km for albedo/Bowen ration (total image shown)

Table A.1 Monthly surface roughness length values by sector

Month	Surface roughness length (m) by sector (degrees)											
	0-30	30-60	60-90	90-120	120-150	150-180	180-210	210-240	240-270	270-300	300-330	330-0
Jan	0.022	0.011	0.016	0.053	0.042	0.018	0.012	0.011	0.036	0.028	0.039	0.037
Feb	0.022	0.011	0.016	0.053	0.042	0.018	0.012	0.011	0.036	0.028	0.039	0.037
Mar	0.041	0.051	0.056	0.098	0.109	0.066	0.055	0.052	0.09	0.068	0.075	0.075
Apr	0.041	0.051	0.056	0.098	0.109	0.066	0.055	0.052	0.09	0.068	0.075	0.075
May	0.063	0.099	0.056	0.098	0.109	0.066	0.055	0.101	0.09	0.068	0.075	0.075
Jun	0.063	0.099	0.099	0.132	0.166	0.116	0.105	0.101	0.133	0.1	0.1	0.102
Jul	0.063	0.099	0.099	0.132	0.166	0.116	0.105	0.101	0.133	0.1	0.1	0.102
Aug	0.063	0.099	0.099	0.132	0.166	0.116	0.105	0.101	0.133	0.1	0.1	0.102
Sep	0.054	0.099	0.099	0.132	0.166	0.116	0.105	0.1	0.131	0.095	0.093	0.095
Oct	0.054	0.099	0.099	0.132	0.166	0.116	0.150	0.1	0.131	0.095	0.093	0.095
Nov	0.054	0.099	0.099	0.132	0.166	0.116	0.105	0.1	0.131	0.095	0.093	0.095
Dec	0.022	0.011	0.016	0.053	0.042	0.018	0.012	0.011	0.036	0.028	0.039	0.037

Table A.2 Monthly Bowen ratio and albedo values (all sectors)

Month	Monthly value (all sectors)	
	Bowen ratio	Albedo
January	0.19	0.49
February	0.19	0.49
March	0.17	0.34
April	0.17	0.34
May	0.17	0.34
June	0.17	0.39
July	0.17	0.39
August	0.17	0.39
September	0.17	0.49
October	0.17	0.49
November	0.17	0.49
December	0.19	0.49

A.2.4 Meteorological inputs

Monitoring data from the BoM Maitland Airport AWS and BoM Williamtown RAAF AWS were combined with TAPM meteorological modelling outputs for input to AERMET. The following parameters were input as on-site data to AERMET:

- Wind speed and direction – BoM Maitland Airport AWS.
- Temperature (heights of 10 m and 50 m) - BoM Maitland Airport AWS (10 m) and TAPM (50 m).
- Relative humidity - BoM Maitland Airport AWS.
- Station level pressure - BoM Maitland Airport AWS and BoM Williamtown RAAF AWS.
- Solar insolation - BoM Maitland Airport AWS.
- Mixing depth - BoM Maitland Airport AWS.

The period of meteorological data input to AERMET was 1 January 2023 to 31 December 2023.

A.2.5 Upper air profile

Dure to the absence of necessary local upper air meteorological measurements, the hourly profile generated by TAPM at the BoM Maitland Airport AWS location was adopted. Using the temperature differences between levels, the TAPM-generated vertical temperature profile for each hour was adjusted relative to hourly surface (10 m) temperature observations from the BoM Maitland Airport AWS.

Attachment B

Emissions inventory background

B.1 Introduction

Particulate matter emissions were quantified through the application of accepted published emissions estimation factors, collated from a combination of United States Environmental Protection Agency (US-EPA) AP-42 Air Pollutant Emissions Factors and NPI emission estimation manuals, including:

- NPI Emissions Estimation Technique Manual for Combustion Engines (NPI 2008)
- NPI Emission Estimation Technique Manual for Mining (NPI 2012)
- US-EPA AP-42 Chapter 11.9, Table 11.9-4 – Wind erosion of exposed areas (US-EPA 1998)
- US-EPA AP-42 Chapter 11.9, Table 11.19.2-1 – Tertiary crushing (US-EPA 2004)
- US-EPA AP-42 Chapter 11.9, Table 11.19.2-1 – Screening (US-EPA 2004)
- US-EPA AP-42 Chapter 13.2.4 – Aggregate handling and storage piles (US-EPA 2006)
- US-EPA AP-42 Chapter 13.2.1 – Paved Roads (US-EPA 2011).

Particulate releases were quantified for TSP, PM_{10} and $PM_{2.5}$ as documented in subsequent sections.

B.2 Emissions inventory assumptions

Material parameters adopted within the emissions inventory are presented in Table B.1.

Table B.1 Assumed material parameters

Material / site area	Parameter	Value	Source
Site entry and exit haul roads	Silt loading (g/m^2)	0.33	EMM collected sample for similar waste recycling centre
Site internal haul roads between processing areas	Silt loading (g/m^2)	7.4	Default silt loading for Municipal solid waste landfill – Paved Roads AP-42 13.2.1
Raw and processed material	Moisture content (%)	2.1	Default moisture content for stone quarrying and processing
Soil	Moisture content (%)	14	Default moisture content for Municipal solid waste landfill - clay/ dirt mix

B.3 Onsite diesel combustion emissions

Emissions generated by onsite plant and equipment diesel consumption was quantified through the following assumptions:

- Project operations with annual diesel consumption rate of 3,377,400 L.
- The corresponding Euro V engines emissions standards for PM_{10} of 0.015 g/kWh was selected.
- The g/kWh emission standard was converted to g per litre of diesel by applying a scaling factor of 3, as per the notes for Table 35 in *NPI Emissions Estimation Technique Manual for Combustion Engines* (NPI 2018).
- The PM emission standard is assumed to correspond to PM_{10} with $PM_{2.5}$ emissions derived from the relationship between PM_{10} and $PM_{2.5}$ emission factors presented in Table 35 in NPI 2008 (91.7%).

B.4 Particulate matter emissions inventory

A summary of the emissions inventory for average day operations are presented in Table B.2.

Table B.2 Emissions inventory – average day

Source Name	Source type	Emissions estimate TSP (tpd)	Emissions estimate PM_{10} (tpd)	Emissions estimate $PM_{2.5}$ (tpd)	Activity Rate	Unit	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	EF Unit	Value	Parameter 1	Value	Parameter 2	Value	Parameter 3	Value	Parameter 4	Emission Controls	Reduction factor
Incoming material - site entrance to yard entrance	Paved haulage	0.000923	0.000177	0.000043	27	VKT per day	0.0339	0.0065	0.00158	kg/VKT	0.33	Road silt loading (g/m²)	170	Haul distance (m)	160	Loads per day	24.5	Ave Truck Weight (t)	Street sweeper and water cart (controlled silt loading)	
Incoming material - yard to processing shed tipping area	Paved haulage	0.002415	0.000464	0.000112	16	VKT per day	0.5751	0.1104	0.0267	kg/VKT	7.4	Road silt loading (g/m²)	100	Haul distance (m)	160	Loads per day	24.5	Ave Truck Weight (t)	Water flushing + sweeping + wind break	0.7375
Outgoing material - product stockpiles to yard exit	Paved haulage	0.003487	0.000669	0.000162	24	VKT per day	0.5535	0.1062	0.0257	kg/VKT	7.4	Road silt loading (g/m²)	150	Haul distance (m)	160	Loads per day	23.6	Ave Truck Weight (t)	Water flushing + sweeping + wind break	0.7375
Outgoing material - yard exit to site exit	Paved haulage	0.000784	0.000150	0.000036	24	VKT per day	0.0327	0.0063	0.0015	kg/VKT	0.33	Road silt loading (g/m²)	150	Haul distance (m)	160	Loads per day	23.6	Ave Truck Weight (t)	Street sweeper and water cart (controlled silt loading)	
Material transfers - processing shed to stockpiles	Paved haulage	0.001617	0.000310	0.000075	7	VKT per day	0.8285	0.1590	0.0385	kg/VKT	7.4	Road silt loading (g/m²)	100	Haul distance (m)	37	Loads per day	35	Ave Truck Weight (t)	Water flushing + sweeping + wind break	0.7375
Residual waste transfer - yard exit to shed	Paved haulage	0.000094	0.000018	0.000004	2	VKT per day	0.0489	0.0094	0.0023	kg/VKT	0.33	Road silt loading (g/m²)	130	Haul distance (m)	7	Loads per day	35	Ave Truck Weight (t)	Street sweeper and water cart (controlled silt loading)	
Residual waste transfer - shed to yard entrance	Paved haulage	0.000181	0.000035	0.000008	4	VKT per day	0.0489	0.0094	0.0023	kg/VKT	0.33	Road silt loading (g/m²)	250	Haul distance (m)	7	Loads per day	35	Ave Truck Weight (t)	Street sweeper and water cart (controlled silt loading)	
Material unloading (in shed)	Material handling	0.000369	0.000175	0.000026	1,500	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Water sprays + 3-sided enclosure	0.85
Material transfer to primary hopper (in shed)	Material handling	0.000274	0.000130	0.000020	1,115	Tonnes per day	0.0016	0.0008	0.0001	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Water sprays + 3-sided enclosure	0.85

Source Name	Source type	Emissions estimate TSP (tpd)	Emissions estimate PM_{10} (tpd)	Emissions estimate $PM_{2.5}$ (tpd)	Activity Rate	Unit	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	EF Unit	Value	Parameter 1	Value	Parameter 2	Value	Parameter 3	Value	Parameter 4	Emission Controls	Reduction factor
Material screening (in shed)	Processing	0.002252	0.000775	0.000005	2,119	Tonnes per day	0.0125	0.0043	0.0000	kg/tonne									Ducting + water sprays	0.915
Material crushing (in shed)	Processing	0.000333	0.000148	0.000027	1,450	Tonnes per day	0.0027	0.0012	0.00022	kg/tonne									Ducting + water sprays	0.915
Material conveying (in shed)	Material handling	0.000404	0.000191	0.000029	2,900	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Ducting + water sprays	0.915
Loading trucks to residual waste processing shed and metals processing	Material handling	0.000055	0.000026	0.000004	225	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Water sprays + 3-sided enclosure	0.85
Transfer to storage bins	Material handling	0.000219	0.000104	0.000016	890	Tonnes per day	0.0016	0.0008	0.0001	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Water sprays + 3-sided enclosure	0.85
Concrete unloading to external yard	Material handling	0.001395	0.000660	0.000100	1,215	Tonnes per day	0.0016	0.0008	0.0001	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Wind breaks	0.3
Concrete crusher loading (external)	Material handling	0.001395	0.000660	0.000100	1,215	Tonnes per day	0.0016	0.0008	0.0001	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Wind breaks	0.3
Concrete crusher (external)	Processing	0.001148	0.000510	0.000094	1,215	Tonnes per day	0.0027	0.0012	0.0002	kg/tonne									Water sprays + wind breaks	0.65
Concrete screening (external)	Processing	0.000893	0.000307	0.000002	1,215	Tonnes per day	0.0125	0.0043	0.0000	kg/tonne									Controlled with water + wind breaks	0.9412
Crushed concrete handling (external)	Material handling	0.001395	0.000660	0.000100	1,215	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Wind breaks	0.3
Soil unloading to external yard	Material handling	0.000004	0.000002	0.000000	53	Tonnes per day	0.0001	0.0001	0.00001	kg/tonne	2.98	Average wind speed (m/s)	14	Moisture content (%)					Wind breaks	0.3
Soil screen loading (external)	Material handling	0.000004	0.000002	0.000000	53	Tonnes per day	0.0001	0.0001	0.0000	kg/tonne	2.98	Average wind speed (m/s)	14	Moisture content (%)					Wind breaks	0.3
Soil screening (external)	Processing	0.000039	0.000013	0.000000	53	Tonnes per day	0.0125	0.0043	0.0000	kg/tonne									Controlled with water + wind breaks	0.9412

Source Name	Source type	Emissions estimate TSP (tpd)	Emissions estimate PM_{10} (tpd)	Emissions estimate $PM_{2.5}$ (tpd)	Activity Rate	Unit	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	EF Unit	Value	Parameter 1	Value	Parameter 2	Value	Parameter 3	Value	Parameter 4	Emission Controls	Reduction factor
Processed soil handling (external)	Material handling	0.000004	0.000002	0.000000	53	Tonnes per day	0.0001	0.0001	0.00001	kg/tonne	2.98	Average wind speed (m/s)	14	Moisture content (%)					Wind breaks	0.3
FEL movements - concrete/soil	Paved haulage	0.000831	0.000159	0.000039	6	VKT per day	0.5243	0.1006	0.0244	kg/VKT	7.4	Road silt loading (g/m²)	20	Haul distance (m)	151	Loads per day	22.35	Ave Truck Weight (t)	Water flushing + sweeping + wind break	0.7375
Unloading to storage bays - concrete and soil	Material handling	0.000624	0.000295	0.000045	1,268	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					3-sided enclosure	0.7
Unloading to storage bays - processing plant output	Material handling	0.000438	0.000207	0.000031	890	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					3-sided enclosure	0.7
Loading to product trucks - all material	Material handling	0.001463	0.000692	0.000105	1,275	Tonnes per day	0.0016	0.0008	0.0001	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Wind breaks	0.3
Material unloading (in shed)	Material handling	0.000036	0.000017	0.000003	222	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Shed enclosure	0.9
Material transfer (in shed)	Material handling	0.000036	0.000017	0.000003	222	Tonnes per day	0.0016	0.0008	0.0001	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Shed enclosure	0.9
Material conveying (in shed)	Material handling	0.000098	0.000046	0.000007	595	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Shed enclosure	0.9
Material screening (in shed)	Processing	0.000094	0.000032	0.000000	443	Tonnes per day	0.0125	0.0043	0.00003	kg/tonne									Shed enclosure + dust extraction	0.983
Material crushing/shredding (in shed)	Processing	0.000025	0.000011	0.000002	184	Tonnes per day	0.0027	0.0012	0.0002	kg/tonne									Shed enclosure + water sprays	0.95
Material pelletisation (in shed)	Processing	0.000060	0.000027	0.000005	222	Tonnes per day	0.0027	0.0012	0.0002	kg/tonne									Shed enclosure	0.9
Processing storage bunker loading (in shed)	Material handling	0.000036	0.000017	0.000003	222	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Shed enclosure	0.9
Loading to trucks for return haulage	Material handling	0.000036	0.000017	0.000003	222	Tonnes per day	0.0016	0.0008	0.00012	kg/tonne	2.98	Average wind speed (m/s)	2.1	Moisture content (%)					Shed enclosure	0.9

Source Name	Source type	Emissions estimate TSP (tpd)	Emissions estimate PM_{10} (tpd)	Emissions estimate $PM_{2.5}$ (tpd)	Activity Rate	Unit	TSP emission factor	PM_{10} emission factor	$PM_{2.5}$ emission factor	EF Unit	Value	Parameter 1	Value	Parameter 2	Value	Parameter 3	Value	Parameter 4	Emission Controls	Reduction factor
Wind erosion - storage bays south	Wind erosion	0.000053	0.000027	0.000004	0.26	Area (ha)	0.4000	0.2000	0.0300	kg/ha/hr	1265	Hours/year >5.4m/s							Water sprays + 3-sided enclosure	0.85
Wind erosion - storage bays north	Wind erosion	0.000012	0.000006	0.000001	0.06	Area (ha)	0.4	0.2000	0.0300	kg/ha/hr	1265	Hours/year >5.4m/s							Water sprays + 3-sided enclosure	0.85
Wind erosion - concrete stockpile	Wind erosion	0.000029	0.000015	0.000002	0.06	Area (ha)	0.400	0.200	0.030	kg/ha/hr	1265	Hours/year >5.4m/s							Water sprays + wind breaks	0.65
Diesel combustion - onsite plant	Diesel combustion	0.000507	0.000507	0.000464																
Diesel combustion - trucks	Diesel combustion	0.00000003	0.00000003	0.00000002																

Attachment C

Contour plots

creating opportunities

KEY

- Site boundary
- Residential receptor
- Other receptor

Average day Annual TSP µg/m³

- 1
- 5
- 10
- 25

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

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Predicted annual average TSP concentrations (µg/m³) – site-only increment- average day operations

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure C.1

EMM
creating opportunities

KEY

- Site boundary
- Residential receptor
- Other receptor

Average day 24 hr PM_{10} µg/m³

- 1
- 5
- 10
- 15
- 25

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

Maximum predicted 24-hour average PM_{10} concentrations (µg/m³) – site-only increment- average day operations

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure C.2

EMM
creating opportunities

Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

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Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

KEY

- Site boundary
- Residential receptor
- Other receptor

Busy day 24 hr PM_{10} $\mu g/m^3$

- 2
- 5
- 10
- 25
- 50

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

Maximum predicted 24-hour average PM_{10} concentrations ($\mu g/m^3$) – site-only increment- busy day operations

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure C.3

EMM
creating opportunities

Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

KEY

- Site boundary
- Residential receptor
- Other receptor

Average day Annual PM_{10} µg/m³

- 0.5
- 1
- 5

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

Predicted annual average PM_{10} concentrations (µg/m³) – site-only increment- average day operations

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure C.4

EMM
creating opportunities

Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

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KEY

- Site boundary
- Residential receptor
- Other receptor

Average day 24 hr $PM_{2.5}$ µg/m³

- 0.5
- 1
- 5

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

Maximum predicted 24-hour average $PM_{2.5}$ concentrations (µg/m³) – site-only increment- average day operations

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure C.5

creating opportunities

Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

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KEY

- Site boundary
- Residential receptor
- Other receptor

Busy day 24 hr $PM_{2.5}$ µg/m³

- 1
- 5
- 10
- 25

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

Maximum predicted 24-hour average $PM_{2.5}$ concentrations (µg/m³) – site-only increment- busy day operations

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure C.6

EMM
creating opportunities

Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

KEY
- Site boundary
- Residential receptor
- Other receptor

Average day Annual $PM_{2.5}$ µg/m³
- 0.1
- 0.5
- 1

Existing environment
- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

Predicted annual average $PM_{2.5}$ concentrations (µg/m³) – site-only increment- average day operations

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure C.7

EMM
creating opportunities

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Source: EMM (2025); DCSSS (2024); GA (2009); MetroMap (2025)

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KEY

- Site boundary
- Residential receptor
- Other receptor

Average day dust deposition g/m²/month

- 1
- 2
- 3

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Named waterbody

Predicted annual average dust deposition levels (g/m²/month) – site-only increment- average day operations

Kurri Kurri Integrated Resource Recovery Centre
Air Quality and Greenhouse Gas Assessment
Figure C.8

EMM
creating opportunities

Attachment D
Greenhouse gas emission calculations

EMM
creating opportunities

D.1 Diesel consumption

GHG emissions from diesel consumption were estimated using the following equation:

$$E_{ij} = \frac{Q_i \times EC_i \times EF_{ijoxec}}{1000}$$

Where:

E_{ij}	=	Emissions of GHG from diesel combustion	(t CO_2-e)
Q_i	=	Quantity of fuel	(kL)
EC_i	=	Energy content of fuel	(GJ/kL)[7]
EF_{ijoxec}	=	Emission factor (scope 1) for diesel consumption	(kg CO_2-e/GJ)[8]

GHG emission factors and energy content for diesel were sourced from the NGAF (AGDCCEEW 2024a). These are presented in Table D.1.

Table D.1 GHG emission factors – diesel combustion

Fuel type	Energy content (Gj/kL)	Scope 1 emission Factors (kg CO_2-e/GJ)			Scope 3 emission Factors (kg CO_2-e/GJ)
		CO_2	CH_4	N_2O	Combined
Stationary combustion of liquid fuels: diesel	38.6	69.9	0.1	0.2	17.3
Transport fuel emissions: HDV Euro IV+, diesel	38.6	69.9	0.07	0.4	17.3
Transport fuel emissions: car & LCV, petrol	34.2	67.4	0.02	0.2	17.2

7 GJ = gigajoules

8 kg CO_2-e/GJ = kilograms of carbon dioxide equivalents per gigajoule

D.2 Electricity use

GHG emissions associated with electricity consumption were estimated using the following equation:

$$E_{CO_2-e} = \frac{Q \times EF}{1000}$$

Where:

E_{CO2-e}	=	Emissions of GHG from electricity consumption	(t CO_2-e)
Q_i	=	Quantity of electricity	(kWh)[9]
EF	=	Emission factor (scope 2 or 3) for electricity consumption	(kg CO_2-e/kWh)[10]

The GHG emission factors for electricity use in NSW/ACT were sourced from AGDCCEEW (2024b) and are presented in Table D.2.

Table D.2 GHG emission factors – electricity use

Year	Emission Factors (kg CO_2-e/MWh)	
	Scope 2	Scope 3
2025	0.51	0.04
2026	0.47	0.03
2027	0.40	0.03
2028	0.34	0.02
2029	0.21	0.02
2030	0.15	0.01
2031	0.15	0.01
2032	0.13	0.01
2033	0.09	0.01
2034	0.09	0.01
2035+	0.07	0.01

9 kWh = kilowatt hours

10 kg CO_2-e/kWh = kilograms of carbon dioxide equivalents per kilowatt hour

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