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Waste Management Facility, Botany

Air Quality Impact Assessment

Addressee(s): Coombes Property Group

Site Address: 2-4 Hale Street, Botany

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Quality Control

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THE PROPOSAL	Final	Northstar	MD, GCG	MD
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Report Status

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Final Authority

This report must be regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below.



Martin Doyle

16 September 2024

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Non-Technical Summary

Northstar Air Quality Pty Ltd was engaged by EME Advisory Pty Ltd , on behalf of Coombes Property Group to perform an air quality impact assessment for the construction and operation of a waste transfer station facility to be located at 2-4 Hale Street, Botany NSW.

Construction phase activities will involve demolition, earthworks, construction works and associated vehicle traffic. Construction dust risks have been assessed using the published Guidance on the Assessment of Dust from Demolition and Construction, developed in the United Kingdom by the Institute of Air Quality Management, and adapted by Northstar Air Quality Pty Ltd for use in Australia. This methodology has been used in a similar context in numerous other similar air quality studies.

That assessment showed there to be a 'medium' risk of dust soiling impacts and a 'low' risk of health impacts associated with demolition, construction, trackout and construction traffic activities should no mitigation measures be applied. Earthworks phase activities are associated with low risks of dust soiling and negligible risks of health impacts. Correspondingly, a range of standard mitigation measures are proposed to ensure that short-term impacts associated with construction activities are minimised.

The prediction of potential impacts associated with operational activities has been performed in general accordance with the requirements of the NSW Environment Protection Authority 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' guidance document, using an approved and appropriate dispersion modelling technique. The estimation of emissions has been performed using referenced emission factors.

The findings of the operational phase assessment indicate that the operation of the Proposal is not predicted to result in any additional exceedances of relevant air quality criteria at any off-site receptor location. In addition to the proposed management measures, it is considered that good site management practices such as cleaning up any spillages would be sufficient to ensure that impacts are minimised during Proposal operation.

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1. INTRODUCTION

Northstar Air Quality Pty Ltd (Northstar) has been commissioned by EME Advisory Pty Ltd (EME) on behalf of Coombes Property Group (the Proponent), to perform an air quality impact assessment (AQIA) to support a State Significant Development (SSD) for the proposed construction and operation of a waste transfer station facility (the Proposal) located at 2-4 Hale Street, Botany NSW (the Proposal site).

This AQIA identifies and examines potential air quality risks and impacts associated with the proposed construction and operation of the Proposal and identifies mitigation and monitoring requirements commensurate with those anticipated risks and impacts to ensure that air quality objectives are achieved at all surrounding sensitive receptor locations.

1.1. Purpose of the Report

The purpose of this report is to undertake an assessment to understand the risks and potential impacts of emissions to air resulting from the construction and operation of the Proposal.

To allow assessment of the level of risk associated with the Proposal, this assessment has been performed with due reference to:

- *Protection of the Environment Operations Act 1997;*
- *Protection of the Environment Operations (Clean Air) Regulation 2022;*
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2022);
and
- *Guidance on the assessment of dust from demolition and construction* (IAQM, 2023).

2. THE PROPOSAL

2.1. Environmental Setting

The Proposal site is located on Hale Street, Botany on Lot 1 of Deposited Plan (DP) 562374 in the Local Government Area (LGA) of Bayside. A map showing the location of the Proposal site is provided in Figure 1.

2.2. Overview

The Proponent is proposing to develop a construction and demolition (C&D) waste management facility which is proposed to accept up to 300 000 tonnes per year ($t\cdot yr^{-1}$) of C&D waste. The Proposal would operate as a waste transfer station for the receipt, basic sorting, and recycling with aggregation of material for bulk transport to an advanced resource recovery facility owned by the Proponent, where more advanced sorting and recycling would be undertaken. Waste would be targeted from the City of Sydney and the southern Sydney region, including the Botany area.

Waste would be sorted at the Proposal site into four waste types:

- Bulky and heavier materials;
- Brick and concrete;
- Metal; and
- Light mixed waste material.

The sorting activities would take place in a fully enclosed warehouse, which would include unloading, sorting, stockpiling and reloading for dispatch to other facilities. Outdoor activities would be limited to incoming and outgoing truck movements, weighbridge activities and vehicle washdown.

The equipment involved in processing the waste includes one front end loader (FEL), one excavator and two zero swing excavators.

It is anticipated the facility will operate 24 hours per day, seven days per week in order to allow the facility to capture waste generated from any construction activities undertaken outside of standard construction hours.

A summary of the proposed operations is provided in Table 1.

The anticipated layout of the Proposal site is provided in Figure 2.

Table 1 Summary of proposed operations

Parameter	Proposed
Receipt, stockpiling, sorting and dispatch	24-hour 7 days a week Daytime period (7 am to 6 pm) Nighttime period (6 pm to 7 am)
Transport of material in-site^(a)	
Average haulage truck capacity	10.7 t
Average annual vehicles	61 800 no.
Peak daily vehicles ^(b)	206 no.
Equipment	Skip bin truck Truck and dog/semi-trailer/ B-double
Material receipt, stockpiling and pre-sorting	
Annual throughput	300 000 t·yr ⁻¹
Peak daily throughput ^(b)	1 000 t·day ⁻¹
Equipment	1 × front end loader 2 × zero swing excavators 1 × excavator
Sorting and stockpiling	
Annual brick and concrete throughput	60 000 t·yr ⁻¹
Peak daily brick and concrete throughput ^(b)	200 t·day ⁻¹
Annual light waste throughput	114 000 t·yr ⁻¹
Peak daily light waste throughput ^(b)	380 t·day ⁻¹
Annual metal throughput	12 000 t·yr ⁻¹
Peak daily metal throughput ^(b)	40 t·day ⁻¹
Annual heavy waste throughput	114 000 t·yr ⁻¹
Peak daily heavy waste throughput ^(b)	380 t·day ⁻¹
Equipment	1 × front end loader 2 × zero swing excavators 1 × excavator
Transport of processed material off-site	
Average haulage truck capacity	23.6 t
Annual brick and concrete vehicle trips	1 800 no.
Peak daily brick and concrete vehicle trips ^(b)	6 no.
Annual light waste vehicle trips	5 400 no.
Peak daily light waste vehicle trips ^(b)	18 no.
Annual metal vehicle trips	900 no.
Peak daily metal trips ^(b)	3 no.
Annual heavy waste vehicle trips	3 300 no.
Peak daily heavy waste trips ^(b)	11 no.
Equipment	Brick and concrete - truck and dog – 35 t Light material – walking floor semi-trailer – 21 t Heavy material – truck and dog – 35 t Metal – semi trailer – 15 t

Parameter	Proposed
Storage capacity^(c)	
Tip zone	0.124 ha
Brick and concrete	0.012 ha
Light waste	0.028 ha
Metal	0.006 ha
Heavy waste	0.037 ha

Notes: (a) 80 % of truck movement will happen during the daytime period (7 am-6 pm). 20 % of the truck movement during the evening/night (6pm-7am).

(b) Peak daily calculations have been undertaken on a 300 day work year rather than 365 days to provide a more conservative analysis.

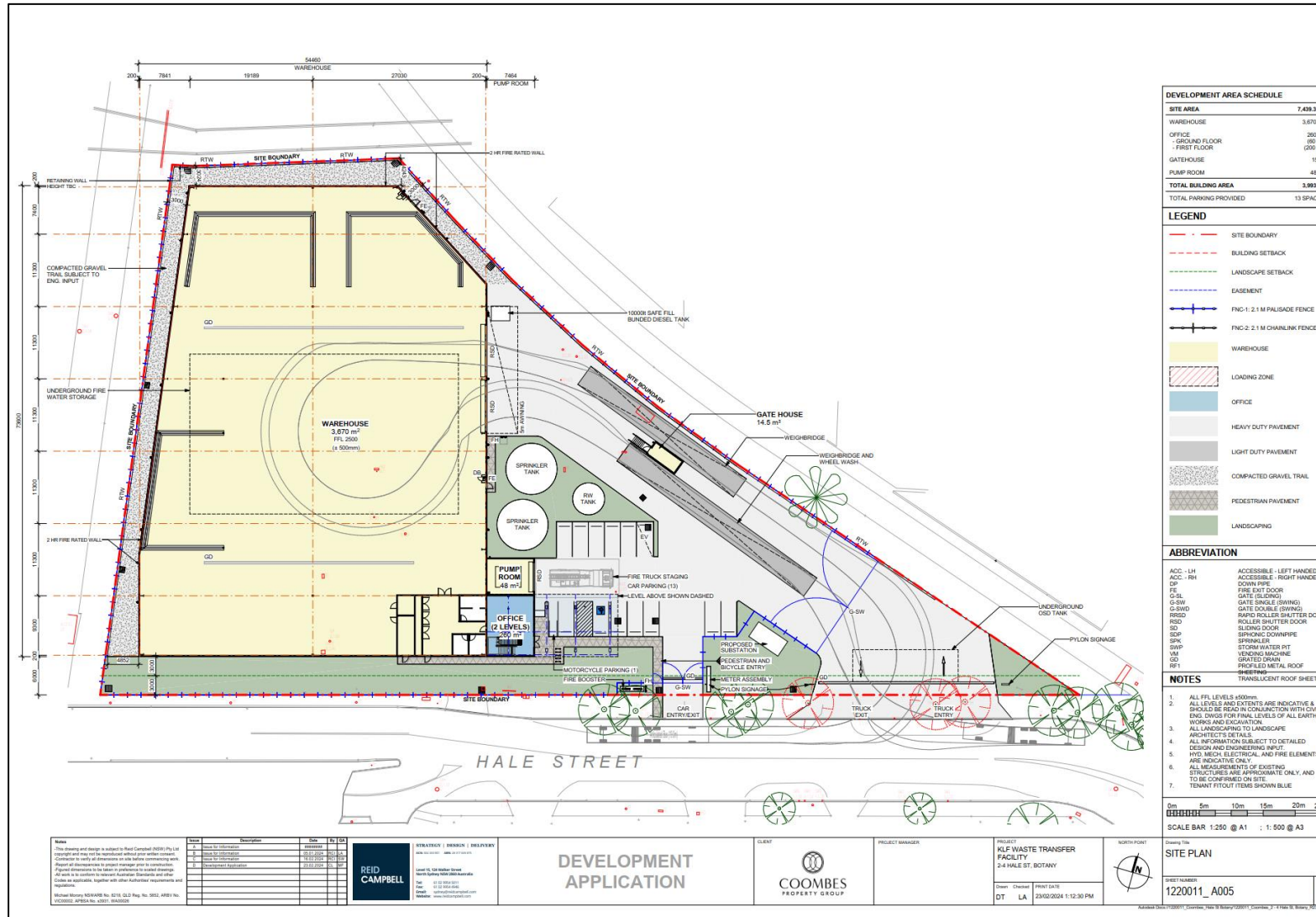
(c) Storage areas are located internal to the building and are enclosed.

Figure 1 Site location



Source: Northstar

Figure 2 Site layout



Source: Reid Campbell Pty Ltd

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2.3. Identification of Emissions to Atmosphere

2.3.1. Construction Phase

Construction of the Proposal would involve demolition of the existing structures, earthworks, construction of a warehouse development, ancillary offices, car parking areas, and associated infrastructure. These activities will generate emissions of 'construction dust', which is particulate matter that is typically of larger aerodynamic diameter. The effects of construction dust are more commonly experienced as nuisance dust effects rather than health effects.

An indicative list of plant and equipment that may be used during the construction of the Proposal includes:

- Excavators;
- Front end loaders;
- Graders;
- Light vehicles;
- Heavy vehicles;
- Drills;
- Pneumatic and or power tools;
- Cranes;
- Commercial vans; and
- Cherry pickers.

A summary of the assessment of the potential air quality risks resulting from construction activities is presented in Section 6 and the full risk assessment is provided in Appendix E.

2.3.2. Operational Phase

During the operation of the Proposal, the following activities are anticipated to result in potential emissions to air:

- Heavy vehicle movements around the Proposal site;
- Unloading of waste materials;
- Movement of materials around the site;
- Storage of materials;
- Loading of trucks; and
- Emissions from vehicle and equipment exhaust.

The specific pollutants associated with the abovementioned activities are:

- Total suspended particulates (TSP);
- Particulate matter with an aerodynamic diameter of less than 10 micrometres (PM_{10}); and,
- Particulate matter with an aerodynamic diameter of less than 2.5 micrometres ($PM_{2.5}$).

As previously discussed in Section 2.2, the waste to be accepted at the Proposal site consists largely of C&D waste.

Emissions associated with the transport, unloading, handling and storage of materials at the Proposal site have been considered in association with potential emissions to air of particulate matter only. Assessment of the potential impacts upon local air quality resulting from those activities is presented in Section 6.

3. LEGISLATION, REGULATION AND GUIDANCE

3.1. Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations* (POEO) Act 1997 sets the statutory framework for managing air quality in NSW, including establishing the licensing scheme for major industrial premises and a range of air pollution offences and penalties.

Schedule 1, Part 1 of the POEO Act provides definitions for scheduled activities, and the associated threshold activity rates. For the Proposal, the thresholds relevant to 'Waste Storage' (clause 42) are most relevant. Specifically, the most applicable sections of clause 42 for the Proposal are as follows:

"42 Waste Storage

(1) This clause applies to waste storage, meaning the receiving from off site and storing (including storage for transfer) of waste.

(1A) Waste is taken to be stored at premises for the purposes of this clause even if the waste is only being transferred at those premises between units of rolling stock, motor vehicles or trailers...

... 3 The activity to which this clause applies is declared to be a scheduled activity if—...

...(d) more than the following amounts of waste is received per year from off site—

(i) in the case of premises in the regulated area—6,000 tonnes,

(ii) in the case of premises outside the regulated area—12,000 tonnes."

Section 2.2 indicates that the Proposal would facilitate an annual throughput of up to 300 000 t·yr⁻¹ of C&D waste. Correspondingly, should the Proposal gain approval the operations would be defined as a scheduled activity under the POEO Act, and will require an Environmental Protection License (EPL).

Additionally, Part 5.4 of the POEO Act outlines several requirements associated with air pollution. These requirements generally relate to the appropriate maintenance of plant and equipment in an efficient condition and dealing with materials in a manner as to not cause air pollution, including odour.

3.2. Protection of the Environment Operations (Clean Air) Regulation 2022

The *Protection of the Environment Operations* (POEO) (Clean Air) Regulation 2022 (POEO CAR) sets requirements and standards of concentration for emissions to air for both scheduled and non-scheduled activities.

Under the POEO CAR, specific concentration standards are outlined in Schedule 2. For scheduled premises, Part 2, Division 3 details these standards concerning general activities and plant.

Table 2 presents the relevant standards of concentrations (i.e. emissions limits) that are referenced in consideration of the Proposal site, as categorised as a scheduled premises (refer Section 3.1).

Table 2 POEO (Clean Air) Regulation – standards of concentrations

Air impurity	Activity	Standard of concentration
Scheduled activities - Part 2, Division 3		
Solid particles (total)	Any crushing, grinding, separating, or materials handling activity	20 mg·m ⁻³

Further to the requirements in Table 2, Part 4 Clause 15 of the POEO CAR requires that motor vehicles do not emit excessive air impurities which may be visible for a period of no more than 10 seconds when determined in accordance with the relevant standard.

All vehicles, plant, and equipment to be used either at the Proposal site or to transport materials to and from the Proposal site would be maintained regularly and in accordance with manufacturers' requirements, where these vehicles are under the operational control of the operator.

3.3. NSW EPA Impact Assessment Criteria

State air quality guidelines adopted by the NSW EPA are published in the '*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*' (the Approved Methods (NSW EPA, 2022)) which has been consulted during the preparation of this assessment report.

The Approved Methods lists the statutory methods that are to be used to model and assess emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the Proposal. The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC, WHO and ANZECC). Where relevant to this AQIA (coincident with the potential emissions identified in Section 2.3), the criteria have been adopted as set out in Section 7.1 of the Approved Methods which are presented in Table 3.

Table 3 NSW EPA impact assessment criteria

Pollutant	Averaging period	Units	Criterion	Notes
Particulates (as PM ₁₀)	24 hours	$\mu\text{g}\cdot\text{m}^{-3}$ ^(A)	50	Numerically equivalent to the AAQ NEPM ^(B) standards and goals.
	1 year	$\mu\text{g}\cdot\text{m}^{-3}$	25	
Particulates (as PM _{2.5})	24 hours	$\mu\text{g}\cdot\text{m}^{-3}$	25	
	1 year	$\mu\text{g}\cdot\text{m}^{-3}$	8	
Particulates (as TSP)	1 year	$\mu\text{g}\cdot\text{m}^{-3}$	90	
Particulates (as dust deposition)	1 year ^(C)	$\text{g}\cdot\text{m}^{-2}\cdot\text{month}^{-1}$	2	Assessed as insoluble solids as defined by AS 3580.10.1
	1 year ^(D)	$\text{g}\cdot\text{m}^{-2}\cdot\text{month}^{-1}$	4	

Notes: (A): micrograms per cubic metre of air
 (B): National Environment Protection (Ambient Air Quality) Measure
 (C): Maximum increase in deposited dust level
 (D): Maximum total deposited dust level

4. EXISTING CONDITIONS

4.1. Surrounding Land Sensitivity

4.1.1. Land Use Zoning

The Proposal site is zoned IN1 – General Industrial under the provisions of SEPP (Transport and Infrastructure) 2021. The land immediately adjacent to the west and south of the Proposal site is also zoned IN1, with IN2 Light Industrial land zoning to the east, and SP2 Infrastructure Sewerage to the north.

The nearest residential area, zoned R2 Low density residential is located approximately 390 metres (m) to the east-northeast of the Proposal site.

4.1.2. Discrete Receptor Locations

Air quality assessments typically use a desk-top mapping study to identify ‘discrete receptor locations’, which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors, refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed. Typically, these locations are identified as residential properties, although other sensitive land uses may include schools, medical centres, places of employment, recreational areas or ecologically sensitive locations.

To ensure that the selection of discrete receptors for the AQIA are reflective of the locations in which the population of the area surrounding the Proposal site reside, population density data has been examined. Population density data based on the 2021 census have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre (km²) grid, covering mainland Australia (ABS, 2022). Using a Geographical Information System (GIS), the locations of sensitive receptor locations have been confirmed with reference to their population densities.

For clarity, the ABS use the following categories to analyse population density (persons·km⁻²):

- Very high > 8 000
- High > 5 000
- Medium > 2 000
- Low > 500
- Very low < 500
- No population 0

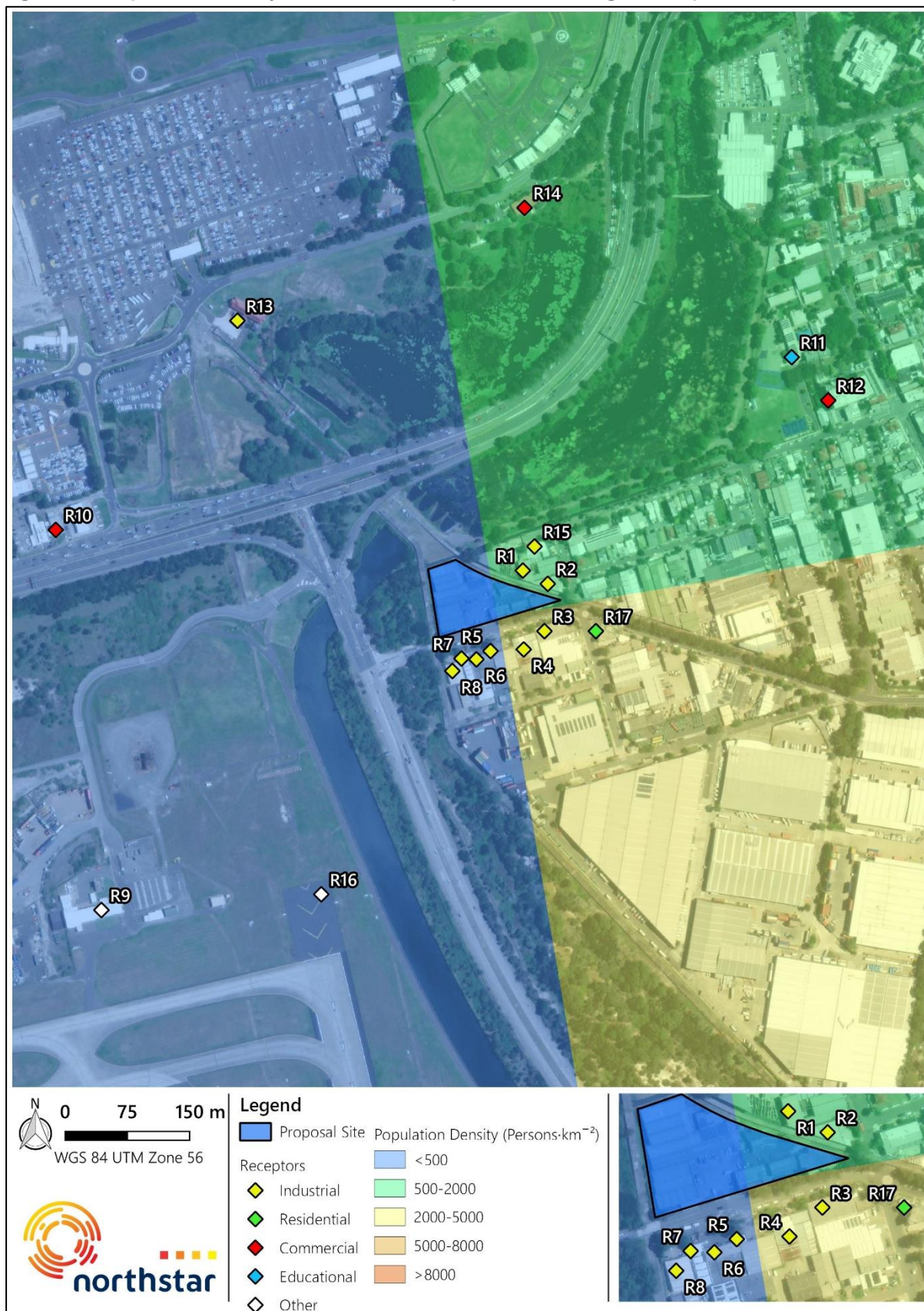
The Proposal site is contained in an area of very low population density, which would be expected given the industrial nature of the surrounding area. The population density of the area surrounding the Proposal site is presented in Figure 3.

Sensitive locations surrounding the Proposal site have been identified and these receptors have been adopted for use within this AQIA as presented in Table 4. The identified sensitive receptors are also illustrated in Figure 3.

Table 4 Receptor locations used in the study

Receptor ID	Address	Land use	Coordinates (UTM)	
			mE	mS
R1	Bay Street, Botany	Industrial	332 828	6 242 418
R2	McFall Street, Botany	Industrial	332 858	6 242 402
R3	Luland Street, Botany	Industrial	332 854	6 242 345
R4	Hale Street, Botany	Industrial	332 829	6 242 323
R5	Hale Street, Botany	Industrial	332 789	6 242 321
R6	Hale Street, Botany	Industrial	332 772	6 242 311
R7	Hale Street, Botany	Industrial	332 754	6 242 312
R8	Hale Street, Botany	Industrial	332 743	6 242 297
R9	Sydney Airport Fire Station	Fire station	332 320	6 242 009
R10	Butler Road, Mascot	Commercial	332 265	6 242 467
R11	Botany Public School	Educational	333 152	6 242 675
R12	Bay Street, Botany	Commercial	333 196	6 242 623
R13	Ross Smith Avenue, Mascot	Industrial	332 484	6 242 719
R14	Ross Smith Avenue, Mascot	Commercial	332 830	6 242 855
R15	McFall Street, Botany	Industrial	332 842	6 242 47
R16	Sydney Airport	Airport	332 585	6 242 028
R17	Luland Street, Botany	Residential	332 916	6 242 345

Figure 3 Population density and sensitive receptors surrounding the Proposal site



Source: Northstar

4.2. Meteorology

The meteorology experienced within an area can govern the generation (in the case of wind-dependent emission sources), dispersion, transport, and eventual fate of pollutants in the atmosphere. The meteorological conditions surrounding the Proposal site have been characterised using data collected by the Australian Government Bureau of Meteorology (BoM) at surrounding Automatic Weather Stations (AWS).

To provide a characterisation of the meteorology which would be expected at the Proposal site, a meteorological modelling exercise has also been performed. A summary of the inputs and outputs of the meteorological modelling assessment, including validation of those outputs is presented in Appendix B, and summarised in Section 5.2.1.

A number of AWS have been identified proximate to the Proposal site. A summary of the relevant AWS is provided in Table 5 below (listed by proximity).

Table 5 Details of meteorological monitoring surround the Proposal site

Site name	Source	Approximate location		Approximate distance
		mE	mS	km
Sydney Airport AWS – station #06037	BoM	331 173	6 242 272	1.6
Kurnell AWS – station #066043	BoM	334 796	6 235 969	6.7
Little Bay AWS – station #066051	BoM	338 368	6 238 360	6.9
Canterbury Racecourse – station #066194	BoM	325 572	6 246 697	8.4

The meteorological conditions measured at Sydney Airport AWS are presented in Appendix B.

Data from Sydney Airport AWS for the period 2018-2022 (the most recent five years of completed data) have been analysed for use in this study. The wind roses presented in Appendix B indicate that from 2018 to 2022, winds at Sydney Airport AWS show generally similar wind distribution patterns across the years assessed, with predominant north-easterly wind directions with southerly and north-westerly components also evident.

The majority of wind speeds experienced at the Sydney Airport AWS between 2018 and 2022 are generally in the range 1.5 meters per second ($\text{m}\cdot\text{s}^{-1}$) to $8 \text{ m}\cdot\text{s}^{-1}$ with the highest wind speeds (greater than $8 \text{ m}\cdot\text{s}^{-1}$) occurring from most directions. Winds of this speed are common and occur during 20.1 % of the observed hours during the years while calm winds ($< 0.5 \text{ m}\cdot\text{s}^{-1}$) are rare occurring during 1.2 % of hours on average across the years 2018-2022.

An analysis of the correlation coefficients between each year for wind speed, wind direction and particulate matter data distribution was performed to select a representative year for the meteorological modelling (refer Appendix B). Following this analysis, the year 2020 was selected as the most representative year for further assessment.

To provide a characterisation of the meteorology which would be expected at the Proposal site, a meteorological modelling exercise has also been performed. A summary of the inputs and outputs of the meteorological modelling assessment, including validation of those outputs is presented in Appendix B.

4.3. Background Air Quality

The air quality experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional and global). The relative contributions of sources at each of these scales to the air quality at a location, will vary based on a wide number of factors including the type, location, proximity and strength of the emission source(s), prevailing meteorology, land uses and other factors affecting the emission, dispersion and fate of those pollutants.

When assessing the impact of any particular source of emissions on the potential air quality at a location, the impact of all other sources of an individual pollutant should also be assessed. These 'background' (sometimes called 'baseline') air quality conditions will vary depending on the pollutants to be assessed and can often be characterised by using representative air quality monitoring data.

Three AQMS have been identified proximate to the Proposal site, operated by NSW Department of Planning and Environment (NSW DPE). These locations (listed by proximity) are briefly summarised in Table 6.

Table 6 Closest AQMS to the Proposal site

AQMS location	Distance to site (km)	2020 data	Measurements		
			PM ₁₀	PM _{2.5}	TSP
Randwick AQMS	4.9	✓	✓	✓	✗
Earlwood AQMS	6.0	✓	✓	✓	✗
Rozelle AQMS	9.2	✓	✓	✓	✗

The closest representative AQMS with data available for the year 2020 (consistent with the meteorological modelling) is noted to be located at Randwick. Correspondingly, PM data from Randwick AQMS for the year 2020 have been adopted for use in this assessment.

Appendix C provides a detailed assessment of the background air quality monitoring data used in this AQIA.

Randwick AQMS recorded eleven days where particulate matter concentrations were above the national standard in 2020. This was predominantly driven by widespread bushfires and dust storm events occurring across NSW in 2020 (NSW DPIE, 2021).

It is noted that none of the AQMS identified in Table 6 measure concentrations of TSP. This pollutant is of relevance to the expected emissions from the Proposal. Other sources of data have been adopted to allow representation of the TSP environment in the area surrounding the Proposal site, and a full discussion is provided in Appendix C.

The impact assessment criteria used for deposited dust (see Table 3) are presented as (i) a cumulative deposition rate of $4 \text{ g}\cdot\text{m}^{-2}\cdot\text{month}^{-1}$ and (ii) a discrete deposition rate of $2 \text{ g}\cdot\text{m}^{-2}\cdot\text{month}^{-1}$. In lieu of a background deposition rate to derive a cumulative rate, the incremental impact assessment criterion ($2 \text{ g}\cdot\text{m}^{-2}\cdot\text{month}^{-1}$) will be used. This is a commonly adopted approach when background deposition rates are not available.

A summary of the air quality monitoring data and assumptions used to produce this AQIA are presented in Table 7.

Table 7 Summary of background air quality used in the AQIA

Pollutant	Ave period and units	Measured value	Notes
Particulates (as TSP)	Annual $\mu\text{g}\cdot\text{m}^{-3}$	40.1	Estimated on a TSP:PM ₁₀ ratio of 2.0551 : 1
Particulates (as PM ₁₀)	24-hour $\mu\text{g}\cdot\text{m}^{-3}$	Daily Varying	The 24-hour maximum PM ₁₀ concentration in 2020 was $137.3 \mu\text{g}\cdot\text{m}^{-3}$
	Annual $\mu\text{g}\cdot\text{m}^{-3}$	19.5	
Particulates (as PM _{2.5})	24-hour $\mu\text{g}\cdot\text{m}^{-3}$	Daily Varying	The 24-hour maximum PM _{2.5} concentration in 2020 was $114.8 \mu\text{g}\cdot\text{m}^{-3}$
	Annual $\mu\text{g}\cdot\text{m}^{-3}$	7.6	
Particulates (as dust deposition)	Annual $\text{g}\cdot\text{m}^{-2}\cdot\text{month}^{-1}$	2.0	Difference in NSW EPA maximum allowable and incremental impact criterion

Note: Reference should be made to Appendix C

4.4. Topography

The Proposal site is located within an area which has a relatively flat surface terrain with little height variation. The elevation of the Proposal site is approximately 5 m Australian Height Datum (AHD). The topography between the Proposal site and the nearest identified sensitive receptor locations is relatively consistent with elevation variances of less than 10 m within the immediate locality. In dispersion modelling terms, the topography is relatively uncomplicated, and does not need to be explicitly accounted for in the dispersion modelling exercise.

The topography surrounding the Proposal site is presented in Figure 4.

Figure 4 Topography surrounding the Proposal site



Source: Northstar

4.5. Potential Cumulative Air Quality Impacts

A desktop review has been performed to identify any facilities with a potential similar emissions profile to the Proposal that may cumulatively impact with the Proposal at the sensitive receptor locations outlined in Section 4.1.2. Another waste management facility was identified, located adjacently to the Proposal site as follows:

- Wanless Waste Management Botany, located at 1 Bay Street, Botany approximately 10 m to the northeast of the Proposal site.

It is noted that the type of waste received at Wanless Waste Management Botany (Wanless) is unknown and correspondingly, a comparison of the emissions profile of the Proposal and the abovementioned facility cannot be estimated.

Additionally, it is noted that no publicly available documentation could be found regarding potential air quality impacts on the local environment associated with Wanless. Experience in performing assessments for developments of this nature indicates that emissions during the operational phase may be similar to those assessed for the Proposal, depending on the types of waste received at Wanless. This AQIA considers a number of emission control methods proposed for the operational phase of the Proposal and it is expected that these would minimise the risk of cumulative impacts with Wanless being experienced at sensitive receptor locations.

Given the lack of information regarding air quality data associated with the Wanless, a quantitative assessment of emissions to air generated from the facility is not achievable and correspondingly, cumulative impacts have been considered through the adoption of an appropriate background air quality dataset as described in Section 4.3.

5. APPROACH TO ASSESSMENT

5.1. Construction Phase

Construction phase activities have the potential to generate short-term emissions of particulates. Generally, these are associated with uncontrolled (or 'fugitive') emissions and are typically experienced by neighbours as amenity impacts, such as dust deposition and visible dust plumes, rather than associated with health-related impacts. Localised engine-exhaust emissions from construction machinery and vehicles may also be experienced but given the scale of the proposed works, fugitive dust emissions would have the greatest potential to give rise to downwind air quality impacts.

Modelling of dust from construction Proposals is generally not considered appropriate as there is a lack of reliable emission factors from construction activities upon which to make predictive assessments, and the rates would vary significantly, depending upon local conditions. In lieu of a modelling assessment, the construction-phase impacts associated with the Proposal have been assessed using a risk-based assessment procedure. The advantage of this approach is that it determines the activities that pose the greatest risk, which allows the Construction Environmental Management Plan (CEMP) to focus controls to manage that risk appropriately and reduce the impact through proactive management.

For this risk assessment, Northstar has adapted a methodology presented in *Guidance on the Assessment of Dust from Demolition and Construction* developed in the United Kingdom by the Institute of Air Quality Management (IAQM, 2023). Reference should be made to Appendix E for the methodology.

Briefly, the adapted method uses a six-step process for assessing dust impact risks from construction activities, and to identify key activities for control as outlined in Appendix E.

5.2. Operational Phase

5.2.1. Dispersion Modelling

A dispersion modelling assessment has been performed using the NSW EPA approved CALPUFF atmospheric dispersion model. The modelling has been performed in CALPUFF 2-dimensional (2-D) mode. Given the flat (uncomplex) terrain (refer Section 4.4) and (importantly) the proximity of the receptors to the Proposal site, a detailed assessment using a 3-D meteorological dataset is not warranted.

An assessment of the impacts of the operation of activities at the Proposal site will be performed which characterises the likely day-to-day operation of the Proposal, approximating average operational characteristics which are appropriate to assess against longer term (annual average) criteria for particulate

matter. The likely peak activities at the Proposal site will also be characterised to allow comparison of potential impacts against shorter term (24-hour) criteria for particulate matter.

The modelling scenarios will provide a prediction of the air quality emissions and the prediction impacts of the operation of activities at the Proposal site. Added to these predicted impacts are background air quality concentrations (where available and discussed in Section 4.3 and Appendix C) which represent background air quality conditions which may be expected within the area surrounding the Proposal site, without the impacts of the Proposal itself.

The following provides a description of the determination of appropriate emissions of air pollutants resulting from the operation of the Proposal.

5.2.2. Emissions Estimation

This assessment has estimated emissions through the application of direct measurements associated with similar processes and adopted factors which appropriately represent the processes under assessment.

Appendix D provides the full emissions inventory for the Proposal.

5.2.2.1. Vehicle Movements

This assessment has adopted emission factors for movement of trucks on paved site roads contained within the US EPA AP-42 emission factor compendium (US EPA, 1995 and updates) to represent the emission of particulate matter resulting from the operations occurring at the Proposal site.

The adopted emission factors are appropriate for use in Australia and are routinely adopted in the assessment of operations of this nature.

Emissions of particulate matter resulting from the movement of materials on paved roads have been estimated using the emission factors presented in 13.2.1 (Paved Roads) of AP-42, (US EPA, 2011).

The emission factor on page 13.2.1.3 of AP-42 (US EPA, 2011) has been adopted for the operations of vehicles on paved roads:

$$EF_{(g.VKT^{-1})} = k(sL)^{0.91}(W \times 0.907185)^{1.02}$$

where:

$EF_{(g.VKT^{-1})}$ = emission factor (g per vehicle kilometre travelled)

k = particle size multiplier (dimensionless)

sL = road surface silt loading ($\text{g}\cdot\text{m}^{-2}$)

W = average weight (tons) of vehicles travelling the road multiplied by 0.907185 to convert to metric tonnes

The particle size multipliers for TSP, PM_{10} and $\text{PM}_{2.5}$ (k) are provided in (US EPA, 2011) as 3.23, 0.62 and 0.15, respectively.

The quality rating for this emission factors are A for TSP, A for PM_{10} , D for $\text{PM}_{2.5}$.

The silt content of paved roads at the Proposal site has been assumed to 7.4 %, which is considered to be a reasonable proxy for the Proposal site, while the silt content of the public roads surrounding the Proposal site (subjected to regular cleaning) has been assumed to be 1.1 %. It is noted that US EPA suggest a ubiquitous baseline silt content of 0.6 % for paved roads (US EPA, 2011). Correspondingly, the adopted assumption of 1.1 % is considered to be conservative.

Additionally, information provided by the Proponent indicates that the weighted average vehicle weights on the paved road at the Proposal site would be approximately 10.7 tonnes (t) for inbound vehicles and 23.6 t for outbound vehicles.

5.2.2.2. Materials Handling

Emissions associated with all materials handling activities have been characterised using the factor outlined in AP-42 for Batch Drop processes (Section 13.2.4.3) (USEPA, 2006a). For clarity, the materials handling activities for the Proposal include:

- Truck loading / unloading;
- Sorting / pre-sorting; and,
- Stockpile loading.

It is considered that the adopted emission factor provides a conservative approximation of material loading activities, in the absence of industry, or activity specific emission:

$$EF (kg \cdot \text{tonne}^{-1}) = k(0.0016) \frac{\left(\frac{U (m \cdot s^{-1})}{2.2}\right)^{1.3}}{\left(\frac{M (\%)}{2}\right)^{1.4}}$$

where:

$EF_{TSP} (kg \cdot \text{tonne}^{-1})$ = emission factor for total suspended particles

$EF_{PM_{10}} (kg \cdot \text{tonne}^{-1})$ = emission factor for total suspended particles

k_{TSP} = 0.74 for particles less than 30 micrometres aerodynamic diameter

$k_{PM_{10}} = 0.35$ for particles less than 10 micrometres aerodynamic diameter

$k_{PM_{2.5}} = 0.053$ for particles less than 2.5 micrometres aerodynamic diameter

U = mean wind speed ($m \cdot s^{-1}$)

M = material moisture content (% by weight)

The quality rating for this application is rated U (no rating).

It is noted that this factor is not directly applicable to the expected operations at the Proposal site but provides a conservative approximation of the likely impacts resulting from this activity. Adoption of such factors is a commonly adopted approach in Australia, in the absence of industry specific emission factors.

5.2.2.3. Wind Erosion

Emissions of particulate matter resulting from the wind erosion of exposed areas have been estimated using the emission factors presented in Section 11.9-4 of AP-42 (Western Surface Coal Mining) (US EPA, 1998).

The emission factors within Table 11.9-4 have been adopted for the operations outlined above. The emission factor applies to the materials: seeded land, stripped overburden and graded overburden, which is conservatively adopted in the absence of activity specific factors. The emission factor is:

$$EF_{TSP} (\text{tonne} \cdot (\text{hectare} \cdot \text{year})^{-1}) = 0.85$$

where:

$EF_{TSP} (\text{tonne} \cdot (\text{hectare} \cdot \text{year})^{-1})$ = emission factor for total suspended particulate matter.

PM_{10} and $PM_{2.5}$ emission factors are not available in AP-42 although have been taken to be 50 % of TSP for PM_{10} and, 7.5 % of TSP for $PM_{2.5}$ as per AP-42 section (13.2.5) for industrial wind erosion.

The quality rating for this emission factors is C.

This factor has been applied to the exposed surfaces associated with the following areas at the Proposal site:

- Tip zone;
- Brick and concrete storage bay;
- Light waste storage bay;
- Heavy waste storage bay; and,
- Metal storage bay.

5.2.3. Emissions Controls

Emission controls are employed at the Proposal site. The application of these controls results in quantifiable reductions in the quantity of particulate matter being emitted as part of the Proposal operation.

A summary of the emission reduction measures that would be adopted as part of the Proposal operation is presented in Table 8. These emission reductions are reflected in the *National Pollution Inventory Emission Estimation Technique Manual for Mining, Version 3.1* (NPI, 2012) and the *NSW Coal Mining Benchmarking Study: International Best Practice Measures to Prevent and/or Minimise Emissions of Particulate Matter from Coal Mining* (Katestone Environmental, 2011).

Table 8 Summary of emission control methods adopted as part of Proposal site

Emission control method	Control efficiency (%)	Activities control method applied to	Reference
Activities performed indoors	70	- Truck loading / unloading; - Sorting / pre-sorting - Stockpile loading - Stockpile wind erosion	(NPI, 2012)
Three sided enclosures around storage piles	75	Stockpile wind erosion	(Katestone Environmental, 2011)
Water misting system	50	- Truck loading / unloading; - Sorting / pre-sorting - Stockpile loading - Vehicle movements inside the warehouse. - Stockpile wind erosion	(NPI, 2012)

6. CONSTRUCTION PHASE AIR QUALITY RISK ASSESSMENT

The methodology adapted by Northstar from IAQM *Guidance on the assessment of dust from demolition and construction* (IAQM, 2023) has been used to assess construction phase risk. The methodology and the full risk assessment are provided in Appendix E.

Briefly, the adapted method uses a six-step process for assessing dust impact risks from construction activities as a function (product) of receptor sensitivity and potential impact magnitude and identifies key activities for control (refer Section 5.1).

6.1. Risk (Pre-Mitigation)

Given the sensitivity of the identified receptors is classified as low for dust soiling, and medium for health effects, and the dust emission magnitudes for the various construction phase activities as presented in Appendix E, the resulting risk of air quality impacts (without mitigation) is as presented in Table 9.

Table 9 Risk of air quality impacts from construction activities

Impact	Sensitivity of area	Dust emission magnitude					Preliminary risk				
		Demolition	Earthworks	Construction	Trackout	Const. traffic	Demolition	Earthworks	Construction	Trackout	Const. traffic
Dust soiling	High	Med.	Small	Med.	Med.	Med.	Med.	Low	Med.	Med.	Med.
Human health	Low	Med.	Small	Med.	Med.	Med.	Low	Neg.	Low	Low	Low

Note: Med. = Medium, Neg. = Negligible

The risks summarised in Table 9 show that there is a medium risk of dust soiling impacts associated with demolition, construction, trackout and construction traffic activities. All other construction phase activities are associated with low and negligible risks of dust soiling and health impacts if no mitigation measures were to be applied to control emissions associated with construction-phase activities.

The risk assessment therefore provides recommendations for construction phase mitigation, commensurate with those identified risks as provided in Appendix E.

6.2. Risk (Post Mitigation)

For almost all construction activity, the adapted methodology notes that the aim should be to prevent significant effects on receptors through the use of effective mitigation and experience shows that this is normally possible.

Given the size of the Proposal site, the distance to sensitive receptors and the activities to be performed, residual impacts associated with fugitive dust emissions from the Proposal would be anticipated to be 'negligible', should the implementation of the mitigation measures outlined in Appendix E be performed appropriately.

6.3. Air Quality Monitoring – Construction Phase

Based on the findings of the construction phase risk assessment, it is not considered that any air quality monitoring would be required during the construction phase. Daily site inspections under the Construction Environmental Management Plan (CEMP) would allow the identification of any issues, which should be rectified as soon as practicable.

7. OPERATIONAL PHASE AIR QUALITY IMPACT ASSESSMENT

This section presents the results of the dispersion modelling assessment and uses the following terminology:

- **Incremental impact** – relates to the concentrations predicted due to the operation of the Proposal in isolation.
- **Cumulative impact** – relates to the incremental concentrations predicted due to the operation of the Proposal PLUS the background air quality concentrations discussed in Section 4.3.

The results are presented in this manner to allow examination of the likely impact of the Proposal in isolation and the contribution to air quality impacts in a broader sense.

In the presentation of results, the tables included shaded cells which represent the following:

Model prediction	Pollutant concentration / deposition rate less than the relevant criterion	Pollutant concentration / deposition rate equal to, or greater than the relevant criterion
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7.1. Particulate Matter

7.1.1. Annual Average TSP, PM₁₀ and PM_{2.5}

The predicted annual average particulate matter concentrations (as TSP, PM₁₀ and PM_{2.5}) resulting from the operations at the Proposal site are presented in Table 10.

Table 10 Predicted annual average TSP, PM₁₀ and PM_{2.5} concentrations

Receptor	Annual average concentration (µg·m ⁻³)								
	TSP			PM ₁₀			PM _{2.5}		
	Incr.	Bg.	Cumul.	Incr.	Bg.	Cumul.	Incr.	Bg.	Cumul.
Criterion	90			25			8		
Max. % of criterion	5.6	44.6	50.1	5.6	78.0	83.6	3.4	95.0	98.4
R1	5.0	40.1	45.1	1.4	19.5	20.9	0.3	7.6	7.9
R2	3.4	40.1	43.5	0.9	19.5	20.4	0.2	7.6	7.8
R3	3.4	40.1	43.5	1.0	19.5	20.5	0.2	7.6	7.8
R4	2.9	40.1	43.0	0.9	19.5	20.4	0.2	7.6	7.8
R5	3.3	40.1	43.4	1.0	19.5	20.5	0.2	7.6	7.8
R6	2.6	40.1	42.7	0.8	19.5	20.3	0.2	7.6	7.8
R7	2.5	40.1	42.6	0.8	19.5	20.3	0.2	7.6	7.8
R8	1.8	40.1	41.9	0.6	19.5	20.1	0.1	7.6	7.7
R9	<0.1	40.1	40.2	<0.1	19.5	19.6	<0.1	7.6	7.7
R10	<0.1	40.1	40.2	<0.1	19.5	19.6	<0.1	7.6	7.7
R11	<0.1	40.1	40.2	<0.1	19.5	19.6	<0.1	7.6	7.7
R12	<0.1	40.1	40.2	<0.1	19.5	19.6	<0.1	7.6	7.7
R13	<0.1	40.1	40.2	<0.1	19.5	19.6	<0.1	7.6	7.7
R14	<0.1	40.1	40.2	<0.1	19.5	19.6	<0.1	7.6	7.7
R15	2.1	40.1	42.2	0.6	19.5	20.1	0.1	7.6	7.7
R16	0.2	40.1	40.3	<0.1	19.5	19.6	<0.1	7.6	7.7
R17	1.1	40.1	41.2	0.4	19.5	19.9	<0.1	7.6	7.7

Note: Incr = Incremental impact, Bg = Background, Cumul = Cumulative Impact

7.1.2. Particulate Matter - Annual Average Dust Deposition Rates

Table 11 (overleaf) presents the predicted annual average dust deposition rates due to the operation of the Proposal.

Table 11 Predicted annual average dust deposition

Receptor	Annual average dust deposition (g·m ⁻² ·month ⁻¹)		
	Incr.	Bg.	Cumul.
Criterion	2	-	4
Max. % of criterion	52.4	-	76.2
R1	1.0	2.0	3.0
R2	0.7	2.0	2.7
R3	0.6	2.0	2.6
R4	0.4	2.0	2.4
R5	0.5	2.0	2.5
R6	0.3	2.0	2.3
R7	0.3	2.0	2.3
R8	0.2	2.0	2.2
R9	<0.1	2.0	2.1
R10	<0.1	2.0	2.1
R11	<0.1	2.0	2.1
R12	<0.1	2.0	2.1
R13	<0.1	2.0	2.1
R14	<0.1	2.0	2.1
R15	0.4	2.0	2.4
R16	<0.1	2.0	2.1
R17	0.2	2.0	2.2

Note: Incr = Incremental impact, Bg = Background, Cumul = Cumulative Impact

7.1.3. Particulate Matter - Maximum 24-hour PM₁₀ and PM_{2.5}

Presented in Table 12 (overleaf) are the maximum 24-hour average PM₁₀ and PM_{2.5} concentrations predicted to occur at the nearest sensitive receptors as a result of the operation of the Proposal. No background concentrations are included within this table.

The predicted incremental concentrations of PM₁₀ and PM_{2.5} are demonstrated to be minor.

Table 12 Predicted maximum incremental 24-hour PM₁₀ and PM_{2.5} concentrations

Receptor	Maximum 24-hour average concentration (µg·m ⁻³)	
	PM ₁₀	PM _{2.5}
Criterion	50	25
Max. % of criterion	26.7	9.9
R1	13.4	2.5
R2	9.0	1.8
R3	4.6	0.9
R4	4.9	0.9
R5	5.5	1.0
R6	5.7	1.1
R7	7.0	1.3
R8	5.9	1.1
R9	0.9	0.2
R10	0.7	0.1
R11	0.7	0.1
R12	0.8	0.1
R13	0.5	<0.1
R14	0.4	<0.1
R15	7.2	1.3
R16	1.0	0.2
R17	2.7	0.5

Table 13 and Table 14 present the predicted maximum 24-hour average PM₁₀ and PM_{2.5} concentrations resulting from the operation of the Proposal, with background included.

Results are presented for the receptor at which the highest incremental PM₁₀ and PM_{2.5} impacts have been predicted, and for the receptors at which the highest cumulative impacts (increment plus background) have been predicted. These may be different receptors than those at which the highest incremental impacts are predicted.

The left side of the tables show the predicted concentration on days with the highest cumulative impact (principally driven by the highest background concentrations), and the right side shows the total predicted concentration on days with the highest predicted incremental concentrations with the contemporaneous background values to derive the respective cumulative predictions.

Contour plots of the predicted maximum incremental 24-hour average PM₁₀ and PM_{2.5} resulting from the Proposal are presented in Figure 5 and Figure 6.

Table 13 Summary of contemporaneous impact and background – PM₁₀

Date	24-hour average PM ₁₀ concentration (µg·m ⁻³) – R1			Date	24-hour average PM ₁₀ concentration (µg·m ⁻³) – R1		
	Incr.	Bg.	Cumul.		Incr.	Bg.	Cumul.
08-01-20	0.6	137.3	137.9	19-01-20	13.4	14.6	28.0
04-01-20	0.1	74.7	74.8	21-01-20	9.9	20.3	30.2
23-01-20	0.1	74.2	74.3	12-03-20	9.4	10.9	20.3
24-01-20	0.7	66.8	67.5	20-01-20	7.7	20.3	28.0
12-01-20	0.5	63.4	63.9	03-02-20	7.1	28.1	35.2
05-01-20	0.5	63.0	63.5	29-06-20	6.5	9.7	16.2
25-01-20	<0.1	63.0	63.1	24-04-20	6.3	30.1	36.4
01-01-20	0.7	56.8	57.5	28-02-20	6.0	30.5	36.5
17-01-20	1.4	51.5	52.9	14-01-20	5.9	21.2	27.1
11-01-20	0.5	47.7	48.2	17-02-20	5.6	10.3	15.9
These data represent the highest Cumulative Impact 24-hour PM ₁₀ predictions (outlined in red) as a result of the operation of the Proposal				These data represent the highest Incremental Impact 24-hour PM ₁₀ predictions (outlined in blue) as a result of the operation of the Proposal.			

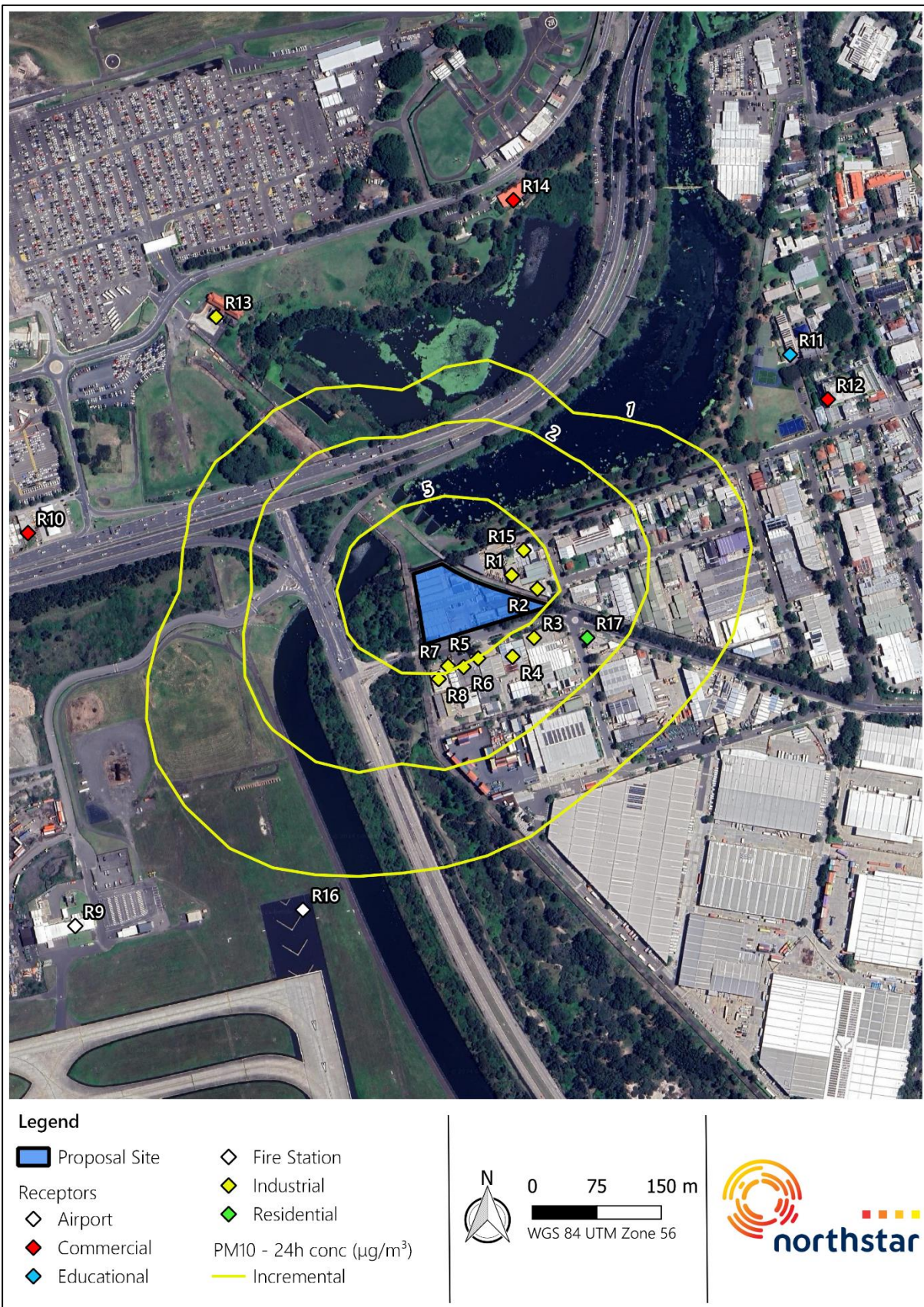
Note: Incr = Incremental impact, Bg = Background, Cumul = Cumulative Impact

Table 14 Summary of contemporaneous impact and background – PM_{2.5}

Date	24-hour average PM _{2.5} concentration (µg·m ⁻³) – R1			Date	24-hour average PM _{2.5} concentration (µg·m ⁻³) – R1		
	Incr.	Bg.	Cumul.		Incr.	Bg.	Cumul.
08-01-20	0.1	114.8	114.9	19-01-20	2.5	7.1	9.6
12-01-20	0.1	43.2	43.3	21-01-20	1.8	8.8	10.6
17-01-20	0.3	39.3	39.6	12-03-20	1.7	2.1	3.8
04-01-20	<0.1	34.9	35.0	20-01-20	1.4	8.2	9.6
05-01-20	0.1	31.7	31.8	03-02-20	1.3	14.9	16.2
30-08-20	<0.1	31.4	31.5	29-06-20	1.2	3.5	4.7
01-01-20	0.2	27.9	28.1	24-04-20	1.2	6.7	7.9
11-01-20	0.1	25.3	25.4	28-02-20	1.1	8.4	9.5
16-01-20	0.4	23.6	24.0	14-01-20	1.1	5.7	6.8
02-01-20	0.1	23.2	23.3	17-02-20	1.1	1.7	2.8
These data represent the highest Cumulative Impact 24-hour PM _{2.5} predictions (outlined in red) as a result of the operation of the Proposal.				These data represent the highest Incremental Impact 24-hour PM _{2.5} predictions (outlined in blue) as a result of the operation of the Proposal.			

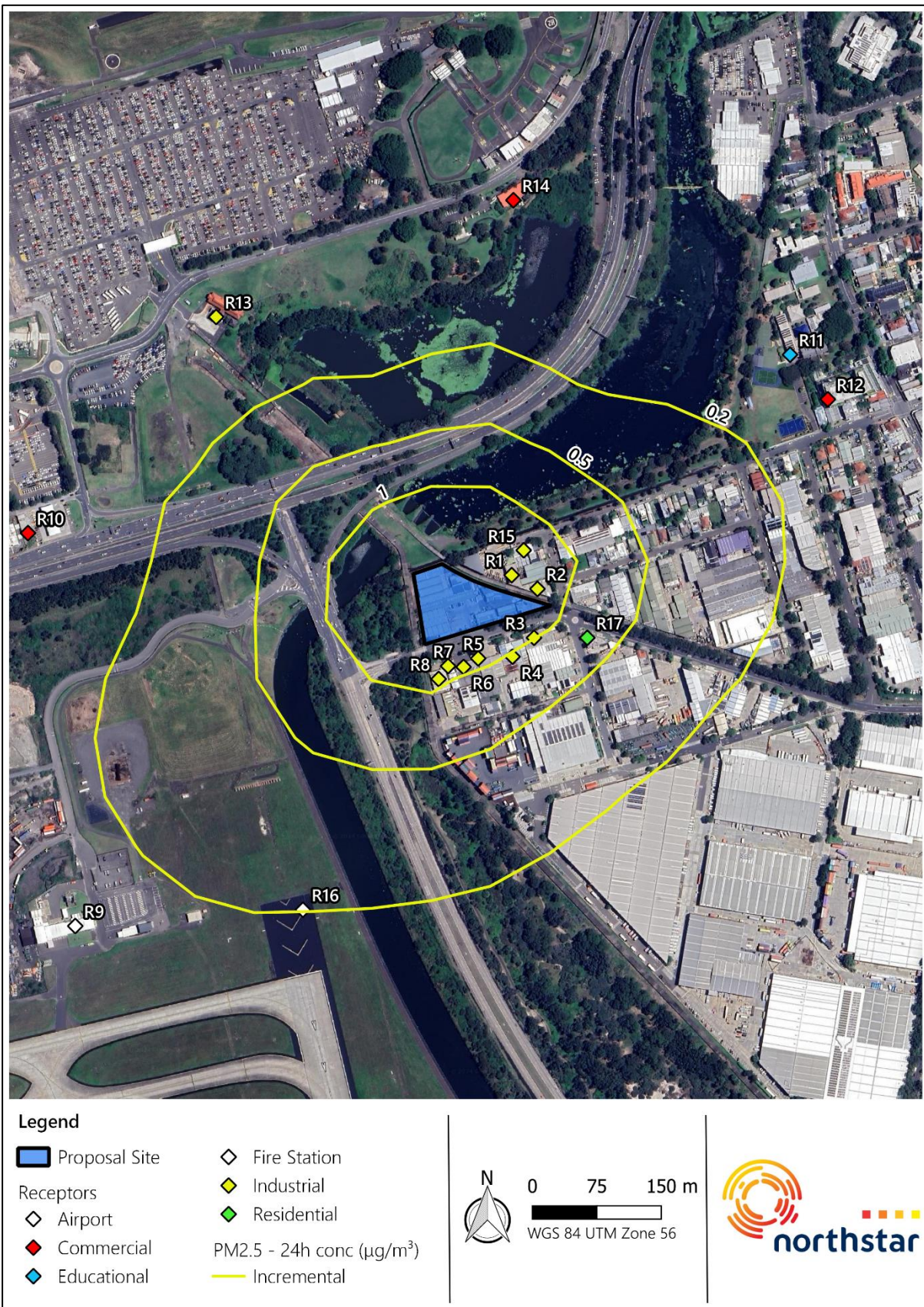
Note: Incr = Incremental impact, Bg = Background, Cumul = Cumulative Impact

Figure 5 Predicted maximum incremental 24-hour PM₁₀ impacts



Source: Northstar

Figure 6 Predicted maximum incremental 24-hour PM_{2.5} impacts



Source: Northstar

8. DISCUSSION & CONCLUSION

Northstar has been commissioned by EME Advisory on behalf of Coombes Property Group, to perform an AQIA for the proposed establishment and operation of a waste transfer station at the Proposal site. Provided below is a summary discussion of the construction phase and operational phase assessment and the respective conclusions.

8.1. Construction Phase

8.1.1. Air Quality Impacts

Construction phase activities would involve demolition, earthworks, construction works and associated vehicle traffic. The associated risks of impacts have been assessed using the published *Guidance on the Assessment of Dust from Demolition and Construction*, developed in the UK by the IAQM, and adapted by Northstar for use in Australia. This methodology has been used in a similar context in numerous other similar AQIA studies.

That assessment showed there to be a 'medium' risk of dust soiling impacts associated with demolition, construction, trackout and construction traffic activities. All other construction phase activities are associated with 'low' and 'negligible' risks of dust soiling and health impacts if no mitigation measures were to be applied to control emissions associated with construction-phase activities.

8.1.2. Mitigation

A number of mitigation methods commensurate with the assessed construction phase air quality risks are provided in Appendix E. The identified mitigation measures are anticipated to be implemented in the Construction Environmental Management Plan (CEMP).

Should these measures be implemented, the risk associated with construction phase works is anticipated to be negligible.

8.2. Operational Phase

8.2.1. Air Quality Impacts

A dispersion modelling assessment has been performed in accordance with the requirements of the Approved Methods guidance document to determine the likely air quality impacts upon surrounding receptor locations. Activity rates associated with average and peak daily operational conditions have been used to determine the potential impact and compared against annual and 24-hour criteria, respectively.

The potential air quality impacts at all the identified receptor locations are presented in Section 6 which documents those predictions as:

- **Incremental impact** – relates to the concentrations predicted as a result of the operation of the Proposal in isolation.
- **Cumulative impact** – relates to the concentrations predicted as a result of the operation of the Proposal PLUS the background air quality concentrations discussed in Section 4.3.

The operation of the Proposal is not anticipated to result in any additional exceedances of the relevant air quality criteria. The management measures proposed are shown to act to minimise impacts on surrounding receptor locations.

It is noted that a number of the background values of 24-hour average PM_{10} and 24-hour average $PM_{2.5}$, adopted as part of the contemporaneous assessment (refer Section 7.1.3), are already in exceedance of the relevant NSW EPA criteria. As discussed in Section 4.3, these exceedances were predominantly influenced by regional events including widespread bushfire and dust storm events occurring in NSW in 2020 (NSW DPIE, 2021). The results presented in Table 13 and Table 14 indicate that particulate matter emissions generated from the Proposal are demonstrated to not result in any additional exceedances of the relevant criteria.

It is noted that the Proposal is located in close proximity to Sydney Airport. Regarding the potential for PM impacts resulting from the Proposal to influence runway visibility at Sydney Airport, high concentrations of particulate matter, particularly $PM_{2.5}$, are well known to result in a reduction in runway visual range (RVR), which has the potential to impact upon aircraft operations. However, research presented in a recent research paper (Luan, Guo, Guo, & Zhang, 2018) indicates that at daily average $PM_{2.5}$ concentrations of $< 25 \mu g \cdot m^{-3}$, visibility is generally > 10 km which is more than sufficient for normal aerodrome operations. The Civil Aviation Safety Authority (CASA) consider "low visibility" (when runway lights are required to be illuminated) to be < 800 m (CASA, 2016). The research (Luan, Guo, Guo, & Zhang, 2018) reported RVR of < 1000 m associated with $PM_{2.5}$ concentrations of $> 300 \mu g \cdot m^{-3}$.

Maximum incremental 24-hour $PM_{2.5}$ concentrations of $0.2 \mu g \cdot m^{-3}$ were predicted at the closest location of the Sydney Airport runway to the Proposal site which would not be anticipated to measurably reduce RVR.

Furthermore, given the non-buoyant nature of the emission sources at the Proposal site, a reduction in visual range at heights greater than ground level is not anticipated to occur.

8.2.2. Mitigation

Based on the findings of the operational phase air quality impact assessment, it is considered that the level of activity being performed at the Proposal site would result in the achievement of all air quality criteria for particulate matter. Accounting for the background air quality assumptions, the assessment does not predict any additional exceedances of the respective criteria.

It is considered that, in addition to the management measures outlined, good site management practices such as cleaning up any spillages would be sufficient to ensure that off-site impacts are minimised.

8.2.3. Management

The Proponent will implement and maintain a complaints log that would record any air quality related complaints associated with the activities performed at the Proposal site. The complaints procedure would (as a minimum) record the number and details of complaints received regarding any air quality impacts and any action taken in response to the complaint.

The complaint procedure and associated complaint forms would be maintained in a proper fashion by Proponent and would be made available for inspection by Council / NSW EPA upon request. An example of a complaint record is provided in Appendix F which may be adopted or adapted for this purpose.

8.2.4. Monitoring

The results presented in this AQIA indicate that there would be no predicted exceedances of the adopted air quality criteria resulting from the operations at the Proposal site. It is not anticipated that any air quality monitoring would be required to be performed.

8.3. Conclusion

Based upon the information and assumptions presented in this AQIA, it is predicted that the construction and operational phases of the Proposal would not result in any exceedances of the relevant air quality criteria. It is considered that the implementation of the construction and operational phase mitigation methods and good site management practices would be sufficient to ensure that impacts associated with the Proposal are minimised.

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APPENDIX A

Commonly used units and abbreviations

Units Used in the Report

Units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units.

Commonly used SI units

The following units are commonly used in Northstar reports.

Symbol	Name	Quantity
SI base units		
K	Kelvin	thermodynamic temperature
kg	kilogram	mass
m	metre	length
mol	mole	amount of substance
s	seconds	time
Non-SI units mentioned in the SI or accepted for use		
°	degree	plane angle
d	day	time
h	hour	time
ha	hectare	area
J	joule	energy
L	litre	volume
min	minute	time
N	newton	force or weight
t	tonne	mass
V	volt	electrical potential
W	watt	power

Multiples of SI and non-SI units

The following prefixes are added to unit names to produce multiples and sub-multiples of units:

Prefix	Symbol	Factor	Prefix	Symbol	Factor
T	tera-	10^{12}	p	pico-	10^{-12}
G	giga-	10^9	n	nano-	10^{-9}
M	mega-	10^6	μ	micro-	10^{-6}
k	kilo-	10^3	m	milli-	10^{-3}
h	hecto-	10^2	c	centi-	10^{-2}
da	deca-	10^1	d	deci-	10^{-1}

In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol. For example:

- 50 micrograms per cubic metre would be presented as $50 \mu\text{g}\cdot\text{m}^{-3}$ and not $50 \mu\text{g}/\text{m}^3$; and,

- 0.2 kilograms per hectare per hour would be presented as $0.2 \text{ kg}\cdot\text{ha}^{-1}\cdot\text{hr}^{-1}$ and not 0.2 kg/ha/hr .

Commonly used SI-derived and non-SI units

$\text{g}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$	gram per square metre per second	rate of mass deposition per unit area
$\text{g}\cdot\text{s}^{-1}$	gram per second	rate of mass emission
$\text{kg}\cdot\text{ha}^{-1}\cdot\text{hr}^{-1}$	kilogram per hectare per hour	rate of mass deposition per unit area
$\text{kg}\cdot\text{m}^{-3}$	kilogram per cubic metre	density
$\text{L}\cdot\text{s}^{-1}$	litres per second	volumetric rate
m^2	square metre	area
m^3	cubic metre	volume
$\text{m}\cdot\text{s}^{-1}$	metre per second	speed and velocity
$\text{mg}\cdot\text{m}^{-3}$	milligram per cubic metre	mass concentration per unit volume
$\text{mg}\cdot\text{Nm}^{-3}$	milligram per normalised cubic metre (of air)	mass concentration per unit volume
$\mu\text{g}\cdot\text{m}^{-3}$	microgram per cubic metre	mass concentration per unit volume
$\text{mg}\cdot\text{m}^{-3}$	milligram per cubic metre	mass concentration per unit volume
Pa	pascal	pressure
ppb	parts per billion (1×10^{-9})	volumetric concentration
pphm	parts per hundred million (1×10^{-5})	volumetric concentration
ppm	parts per million (1×10^{-6})	volumetric concentration

Commonly used abbreviations

Abbreviation	Term
ABS	Australian Bureau of Statistics
ACT	Australian Commonwealth Territory
AGL	above ground level
AHD	Australian height datum
APC	air pollution control
AQI	air quality index
AQIA	air quality impact assessment
AQMS	air quality monitoring station
AQRA	air quality risk assessment
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AS/NZS	Australian Standard / New Zealand Standard
AWS	automatic weather station
BCA	Building Code of Australia
BGL	below ground level
BOM	Bureau of Meteorology
CEMP	construction environment management plan
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation

Abbreviation	Term
DEM	digital elevation model
EETM	emission estimation technique manual
EPA VIC	Environmental Protection Authority Victoria
EPBC	Environment Protection and Biodiversity Conservation Act
FIBC	flexible intermediate bulk container
GIS	geographical information system
IAQM	UK Institute of Air Quality Management
IBC	intermediate bulk container
ID	internal diameter
LLV	low level waste
LoM	life of mine
MSDS	Material Safety Data Sheet
NCAA	National Clean Air Agreement
NEPM	National Environment Protection Measure
NH ₃	ammonia
NO	nitric oxide
NO _x	oxides of nitrogen
NO ₂	nitrogen dioxide
NORM	naturally occurring radioactive material
NSW	New South Wales
NSW DPE	New South Wales Department of Planning and Environment
NSW EPA	New South Wales Environment Protection Authority
NT	Northern Territory
OEMP	operational environmental management plan
O ₃	ozone
Pb	lead
PM	particulate matter
PM ₁₀	particulate matter with an aerodynamic diameter of 10 µm or less
PM _{2.5}	particulate matter with an aerodynamic diameter of 2.5 µm or less
ROM	run of mine
SA	South Australia
SEPP	State Environmental Protection Policy
SO _x	oxides of sulphur
SO ₂	sulphur dioxide
SRTM3	Shuttle Radar Topography Mission
SVOC	semi-volatile organic compound
TAPM	The Air Pollution Model
TAS	Tasmania
TEU	twenty-foot equivalent unit
TSP	total suspended particulates
TVOC	total volatile organic compounds

Abbreviation	Term
TWA	time weighted average
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VIC	Victoria
VLLW	very low level waste
VOC	volatile organic compound

APPENDIX B

Meteorology

As discussed in Section 4.2, a meteorological modelling exercise has been performed to characterise the meteorology of the Proposal site in the absence of site-specific measurements. The meteorological monitoring has been based on measurements acquired from surrounding automatic weather stations (AWS) operated by the Australian Government Bureau of Meteorology (BoM).

A summary of the relevant monitoring sites is provided in Table B1.

Table B1 Details of the meteorological monitoring surrounding the Proposal site

Site name	Source	Approximate location		Approximate distance
		mE	mS	km
Sydney Airport AWS – station #06037	BoM	331 173	6 242 272	1.6
Kurnell AWS – station #066043	BoM	334 796	6 235 969	6.7
Little Bay AWS – station #066051	BoM	338 368	6 238 360	6.9
Canterbury Racecourse – station #066194	BoM	325 572	6 246 697	8.4

As outlined in Section 4.2, meteorological conditions at Sydney Airport AWS have been examined to determine a ‘typical’ or representative dataset for use in dispersion modelling. Annual wind roses for the most recent years of data (2018 to 2022) are presented in Figure B1. The annual wind speed frequency distribution for the five-year period is presented in Figure B2.

The correlation coefficient between each year and the five-year period for the distribution of wind speed, wind direction, PM_{10} and $PM_{2.5}$ are summarised in Table B2. The correlation coefficients were ranked and aggregated to select the representative year for the meteorological modelling. The rankings are also presented in Table B2.

The wind roses indicate that from 2018 to 2022, winds at Sydney Airport AWS show generally similar wind distribution patterns across the years assessed, with predominant westerly wind directions evident.

The majority of wind speeds experienced at the Sydney Airport AWS between 2018 and 2022 are generally in the range 1.5 meters per second ($m \cdot s^{-1}$) to $5.5 m \cdot s^{-1}$ with the highest wind speeds (greater than $8 m \cdot s^{-1}$) occurring from most directions. Winds of this speed are common and occur during 20.1 % of the observed hours during the years while calm winds ($< 0.5 m \cdot s^{-1}$) are rare occurring during 1.2 % of hours on average across the years 2018-2022.

Figure B1 Annual wind roses – Sydney Airport AWS (2018 – 2022)

Sydney Airport AWS - 2018 to 2022

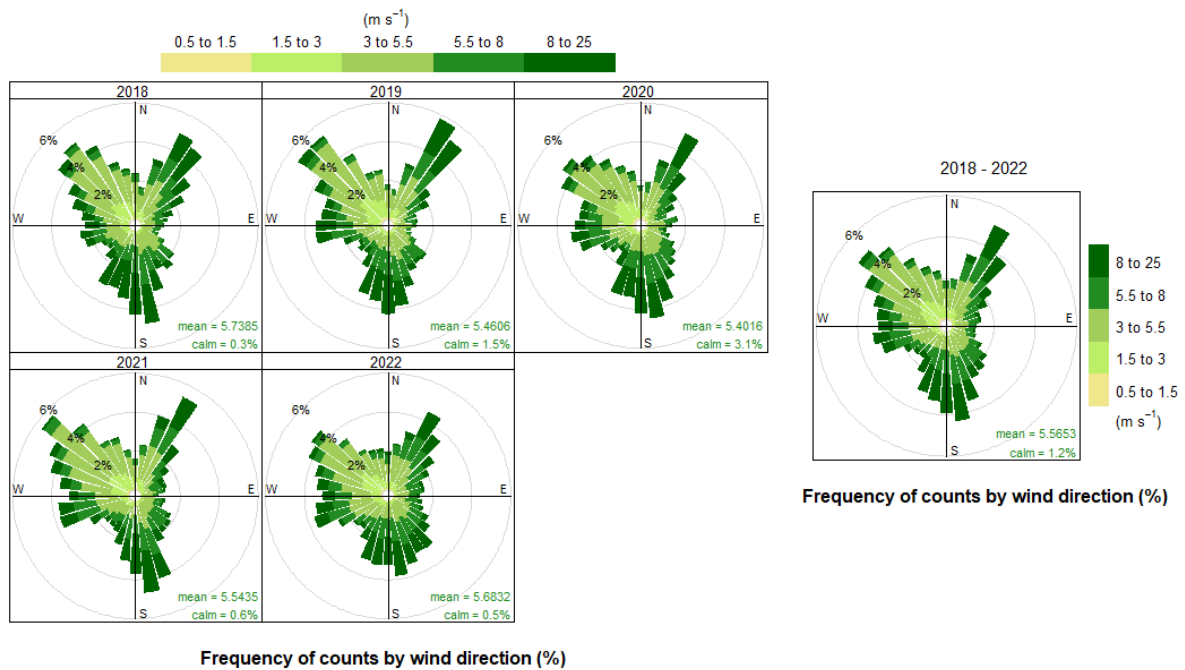


Figure B2 Annual wind speed and direction distributions – Sydney Airport AWS (2018 – 2022)



Table B2 Correlation coefficient analysis – Sydney Airport AWS and Randwick AQMS (2018 – 2022)

Parameter	Wind speed		Wind direction		PM ₁₀		PM _{2.5}		Aggregated rank
	Corr.	Rank	Corr.	Rank	Corr.	Rank	Corr.	Rank	
2018	0.988	5	0.922	5	0.951	4	0.969	3	4.5
2019	0.998	2	0.956	2	0.964	3	0.829	5	3
2020	0.995	3	0.970	1	0.998	1	0.995	1	1
2021	0.999	1	0.941	3	0.988	2	0.993	2	2
2022	0.994	4	0.927	4	0.947	5	0.911	4	4.5
2018-2022	1	-	1	-	1	-	1	-	-

Note: Corr. = correlation

Wind speed observations for each year correlated well against the wind speed over the five-year period, with each year having a correlation coefficient greater than 0.98. The year 2021 is the highest ranked for correlation against the wind speed over the five-year period.

Wind direction observations for each year are well correlated against the wind direction over the five-year period, with each year having a correlation coefficient greater than of 0.92. The year 2020 is the highest ranked for correlation against the wind direction over the five-year period.

PM concentrations for each year are also reasonably well correlated against PM concentrations over the five-year period. Each year resulted in having a correlation coefficient greater than 0.82. The year 2020 is the highest rank for both PM₁₀ and for PM_{2.5}.

The correlation coefficient analysis indicates that 2020 is the most appropriate representative year for meteorological modelling. Correspondingly, 2020 has been adopted for use for meteorological modelling as it provides the more recent meteorological data of the two years.

Meteorological Processing

The BoM data adequately covers the issues of data quality assurance; however, it is limited by its location compared to the Proposal site. To address these uncertainties, a multi-phased assessment of the meteorology data has been performed.

In absence of any measured onsite meteorological data, site representative meteorological data for this Proposal was generated using The Air Pollution Model (TAPM, v 4.0.5) meteorological model in a format suitable for using in the CALPUFF dispersion model (refer Section 5.1).

Meteorological modelling using TAPM has been performed to predict the meteorological parameters required for CALPUFF. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rainwater and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

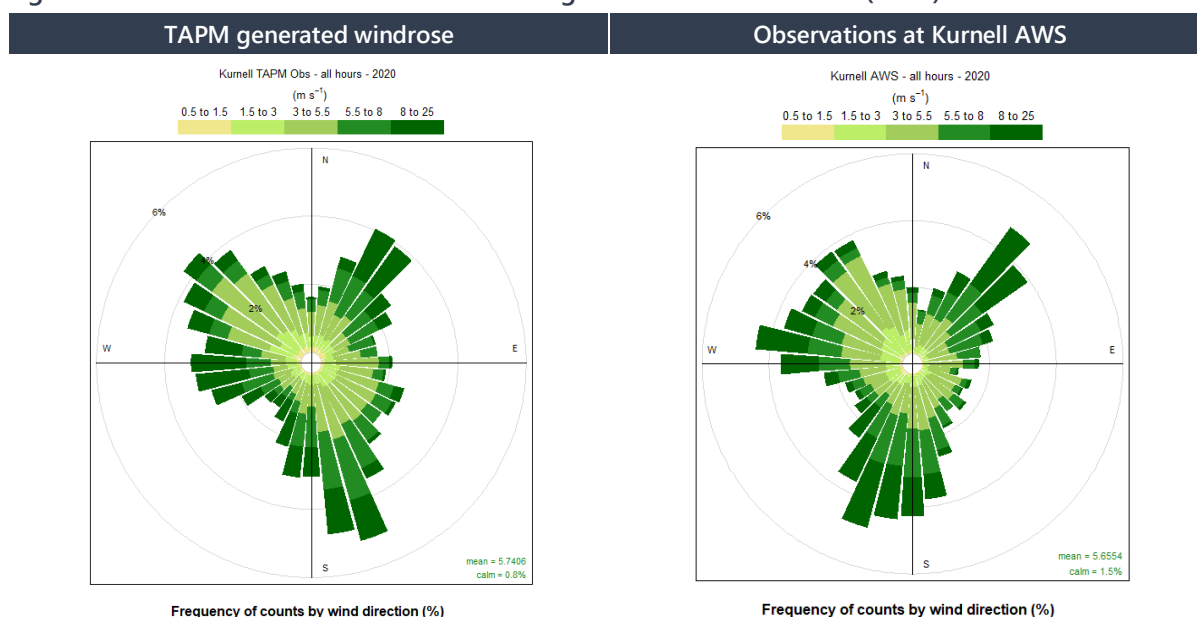
It is noted that an initial TAPM modelling run provided wind roses which did not validate well against observations at Sydney Airport AWS. Given the poor validation, that initial TAPM modelling run has not been used in this AQIA. Subsequently, a second TAPM run was performed which used observations at Sydney Airport AWS to 'nudge' model predictions towards those observations, and this has been used in this AQIA. Given the additional AWS proximate to the Proposal site, validation has been performed against observations at Kurnell AWS as presented in Figure B3. These data generally compare well which provides confidence that the meteorological conditions modelled as part of this assessment are appropriate.

The parameters used in TAPM modelling are presented in Table B3.

Table B3 TAPM meteorological parameters

TAPM v 4.0.5	
Modelling period	1 January 2020 to 31 December 2020
Centre of analysis	435 484 mE, 6 476 085 mS (UTM Coordinates)
Number of grid points	25 x 25 x 25
Number of grids (spacing)	5 (30 km, 10 km, 3 km, 1 km, 0.3 km)
Terrain	AUSLIG 9 second DEM
Data assimilation	Taree Airport AWS

Figure B3 Modelled and observed meteorological data – Kurnell AWS (2020)

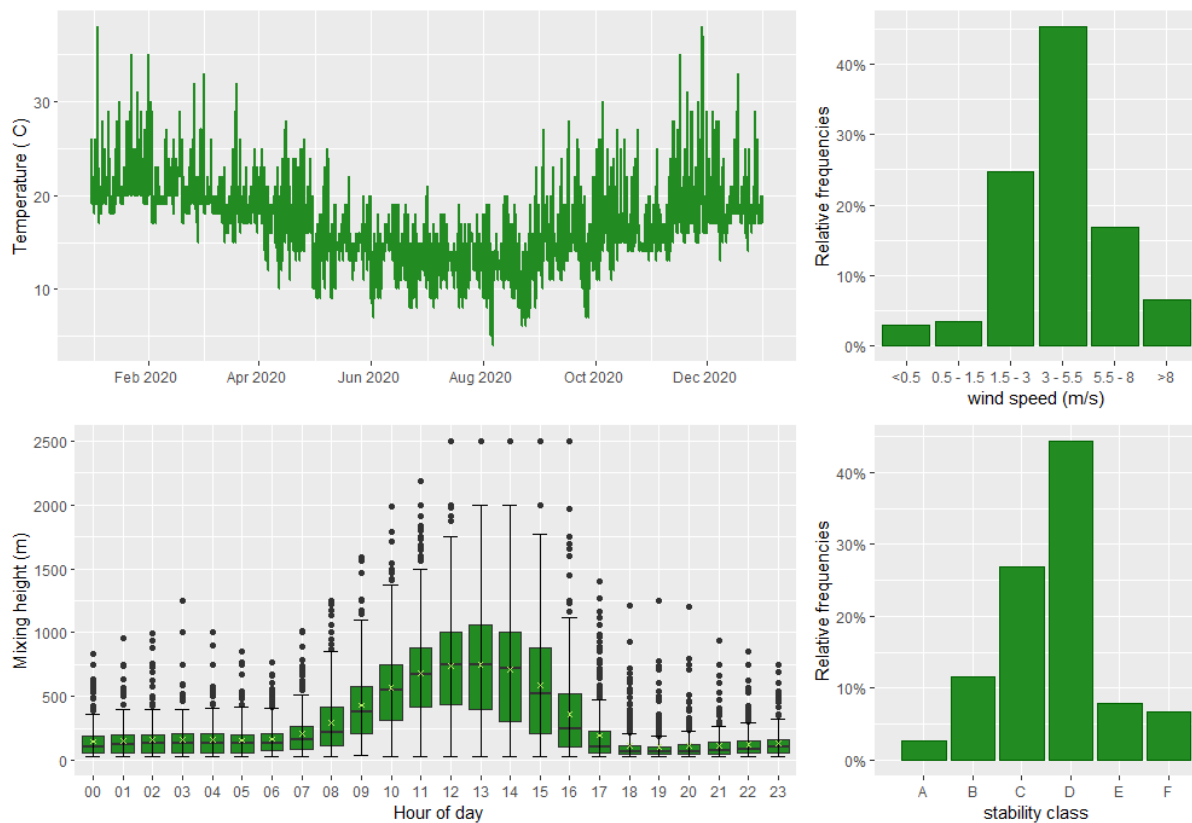


As generally required by the NSW EPA the following provides a summary of the modelled meteorological dataset. Given the nature of the pollutant emission sources at the Proposal site, detailed discussion of the humidity, evaporation, cloud cover, katabatic air drainage and air recirculation potential of the Proposal site has not been provided. Details of the predictions of wind speed and direction, mixing height and temperature at the Proposal site are provided below.

Diurnal variations in maximum and average mixing heights predicted by TAPM at the Proposal site during 2020 period are illustrated in Figure B4.

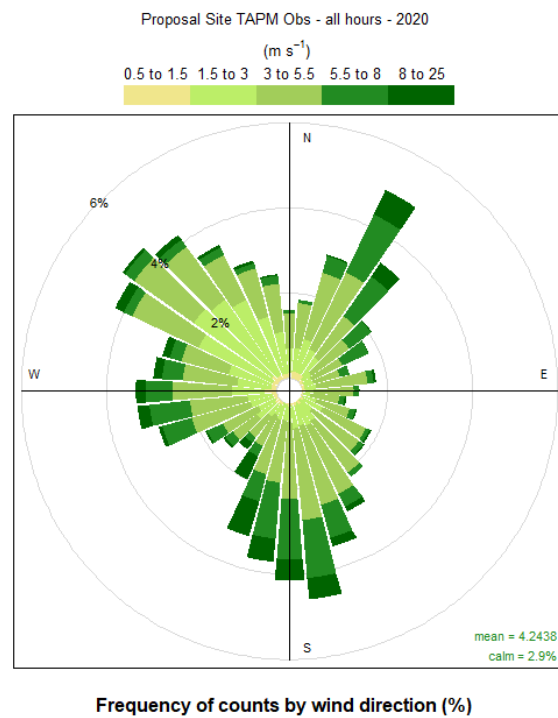
As expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and growth of the convective mixing layer.

Figure B4 Predicted mixing height, wind speed and stability class frequency at the Proposal site (2020)



The modelled wind speed and direction at the Proposal site during 2020 are presented in Figure B5.

Figure B5 Predicted wind speed and direction – Proposal site (2020)



APPENDIX C

Background Air Quality

Air quality is not monitored at the Proposal site and therefore air quality monitoring data measured at a representative location has been adopted for the purposes of this AQIA. Determination of data to be used as a location representative of the Proposal site and during a representative year can be complicated by factors which include:

- The sources of air pollutant emissions around the Proposal site and representative AQMS; and
- The variability of particulate matter concentrations (often impacted by natural climate variability).

Air quality monitoring is performed by the NSW Department of Planning and Environment at air quality monitoring stations (AQMS) surrounding the Proposal site. Details of the monitoring performed at these AQMS is presented in Table C1.

Table C1 NSW DPE AQMS surrounding the Proposal site

AQMS location	Distance to site (km)	2020 data	Measurements		
			PM ₁₀	PM _{2.5}	TSP
Randwick AQMS	4.9	✓	✓	✓	✗
Earlwood AQMS	6.0	✓	✓	✓	✗
Rozelle AQMS	9.2	✓	✓	✓	✗

Given the availability of data and its proximity to the Proposal site, data from Randwick AQMS is considered to be the most representative air quality dataset and has correspondingly been adopted for use in this assessment. Particulate matter data for the period 2018 to 2022 has been analysed. The annual frequency distribution for the five-year period is presented in Figure C1.

The results of the correlation coefficient analysis provided in Appendix B indicates that meteorological and PM data measured in 2020 is the most appropriate dataset for use within this study.

Concentrations of TSP are not measured at any AQMS surrounding the Proposal site. An analysis of co-located measurements of TSP and PM₁₀ in the Lower Hunter (1999 to 2011), Illawarra (2002 to 2004), and Sydney Metropolitan (1999 to 2004) regions is presented in Figure C2. The analysis concludes that, on the basis of the measurements collected in all regions between 1999 to 2011, the derivation of a broad TSP:PM₁₀ ratio of 2.0551 : 1 (i.e. PM₁₀ represents ~49% of TSP) from the Sydney Metropolitan location is appropriate. In the absence of any more specific information, this ratio has been adopted within this AQIA, resulting in a background annual average TSP concentration of 40.1 µg·m⁻³ being adopted.

Summary statistics for the selected data are presented in Table C2.

Figure C1 Annual distribution at Randwick AQMS for PM₁₀ (2018 – 2022)

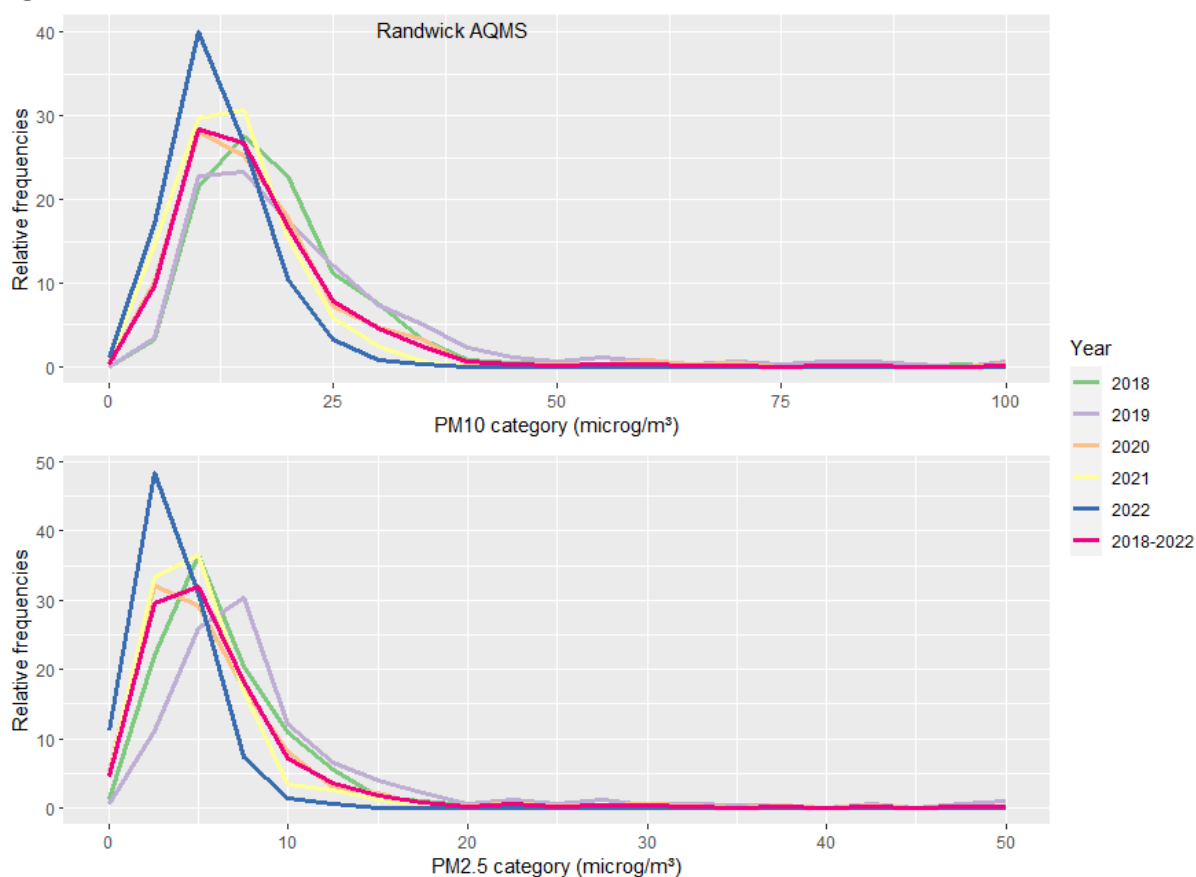


Figure C2 Co-located TSP and PM₁₀ measurements – Lower Hunter, Sydney Metro and Illawarra

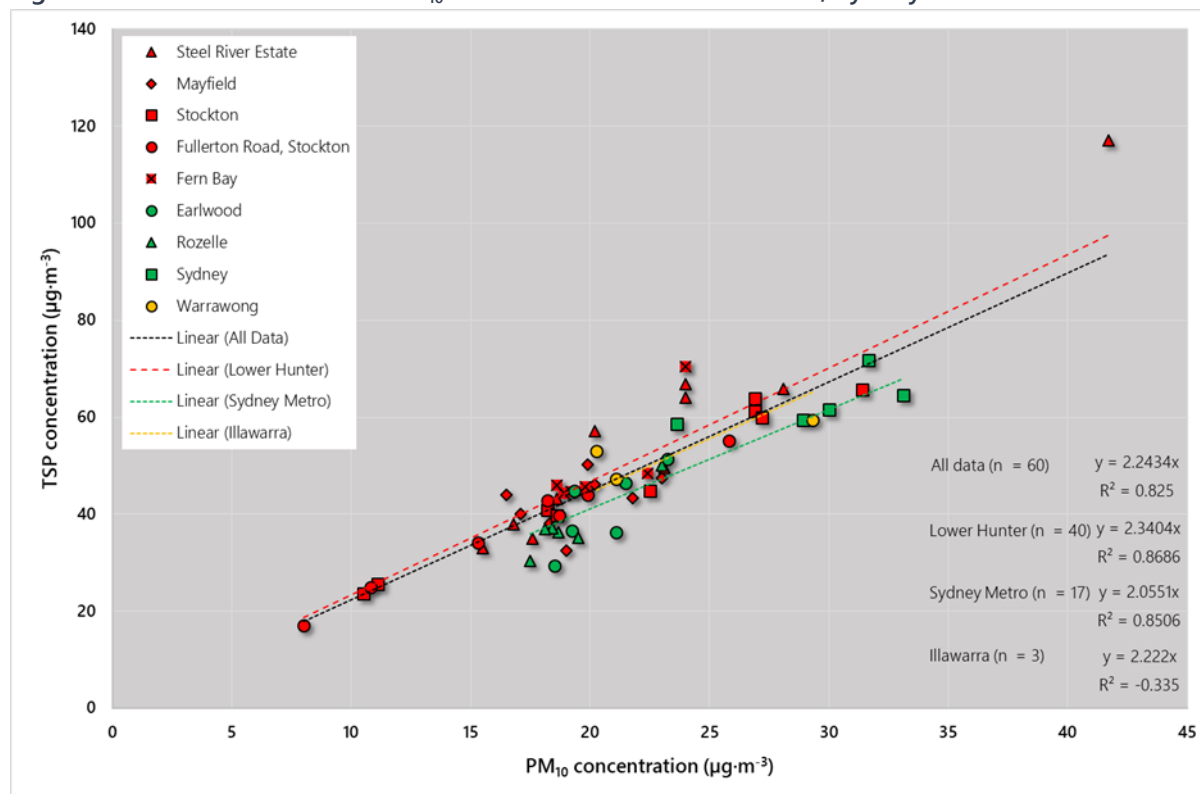


Table C2 Background air quality statistics – Randwick AQMS (2021)

Pollutant	TSP ($\mu\text{g}\cdot\text{m}^{-3}$)	PM ₁₀ ($\mu\text{g}\cdot\text{m}^{-3}$)	PM _{2.5} ($\mu\text{g}\cdot\text{m}^{-3}$)
Averaging period	Annual	24-Hour	24-Hour
Data Points (number)	363	363	337
Mean	40.1	19.5	7.6
Standard deviation	-	11.9	7.9
<i>Skew</i> ¹	-	4.0	8.4
<i>Kurtosis</i> ²	-	29.3	103.1
Minimum	-	4.8	0.5
Percentiles			
25 th	-	12.8	4.2
50 th	-	16.6	6.0
75 th	-	22.9	8.6
90 th	-	30.7	12.3
95 th	-	37.4	15.9
97 th	-	39.8	21.7
98 th	-	55.5	26.0
99 th	-	64.7	33.7
Maximum	-	137.3	114.8
Data Capture (%)	-	99.2	92.1

Notes: 1: Skew represents an expression of the distribution of measured values around the derived mean. Positive skew represents a distribution tending towards values higher than the mean, and negative skew represents a distribution tending towards values lower than the mean. Skew is dimensionless.

2: Kurtosis represents an expression of the value of measured values in relation to a normal distribution. Positive skew represents a more peaked distribution, and negative skew represents a distribution more flattened than a normal distribution. Kurtosis is dimensionless.

Graphs presenting the daily varying PM₁₀ and PM_{2.5} data recorded at Randwick AQMS in 2020 are presented in Figure C3 and Figure C4 respectively.

Figure C3 PM₁₀ concentrations –Randwick AQMS (2020)

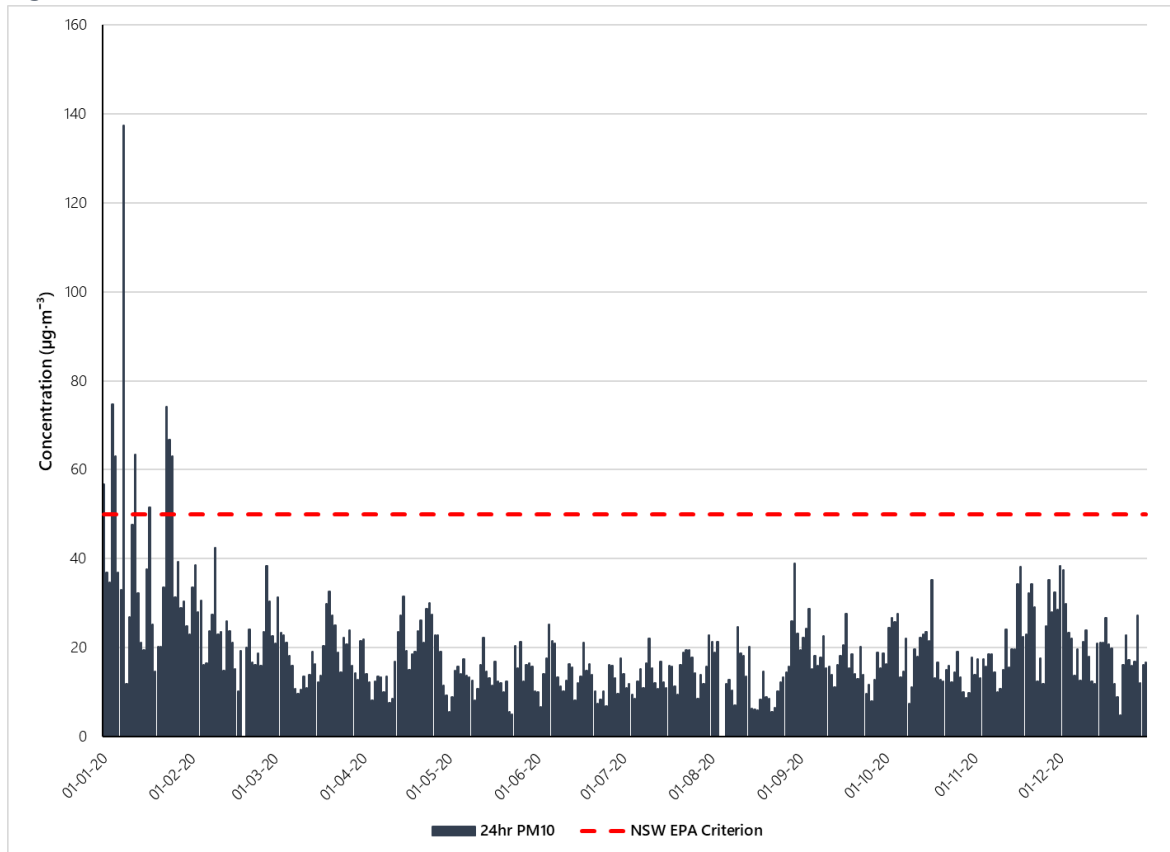
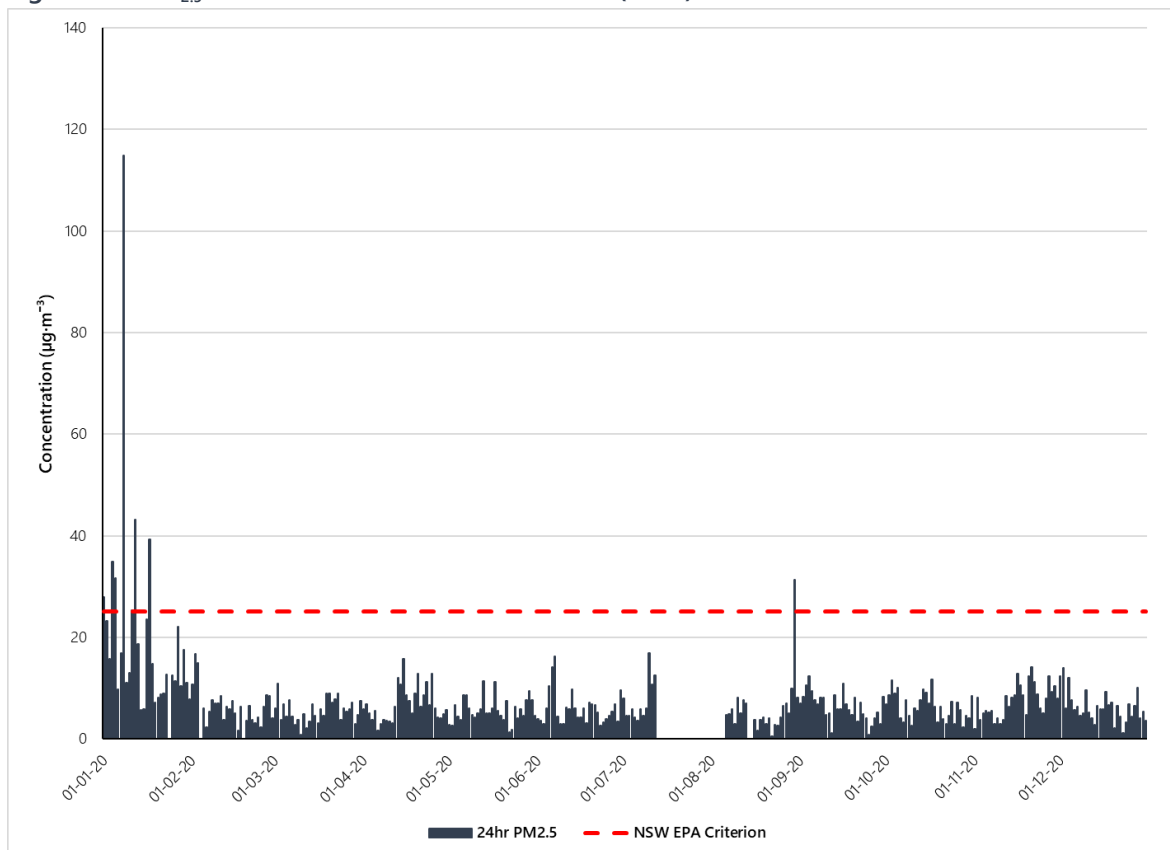


Figure C4 PM_{2.5} concentrations –Randwick AQMS (2020)



APPENDIX D

Emissions Inventory

Table D1 24-hour emissions inventory

Description	Emission Factor	Emission rate						Emission Controls	Controlled emissions (kg.day-1)		
		TSP	PM10	PM2.5	Units	Activity Rate	Units		TSP	PM10	PM2.5
Permitted waste unloading	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	1,000	t	indoor 70% + 50% misting	0.419	0.198	0.030
Tipped, spread, turned and inspected	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	1,000	t	indoor 70% + 50% misting	0.419	0.198	0.030
Unaccepted loads loading	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	-	t	indoor 70% + 50% misting	-	-	-
Accepted load stockpiled for sorting	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	1,000	t	indoor 70% + 50% misting	0.419	0.198	0.030
Pre-sorting	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	1,000	t	indoor 70% + 50% misting	0.419	0.198	0.030
Stockpiled into bay 2	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	380	t	indoor 70% + 50% misting	0.159	0.075	0.011
Stockpiled into bay 3	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	40	t	indoor 70% + 50% misting	0.017	0.008	0.001
Stockpiled into bay 4	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	380	t	indoor 70% + 50% misting	0.159	0.075	0.011
Loading 1 for dispatch	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	200	t	indoor 70% + 50% misting	0.084	0.040	0.006
Loading 2 for dispatch	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	380	t	indoor 70% + 50% misting	0.159	0.075	0.011
Loading 3 for dispatch	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	40	t	indoor 70% + 50% misting	0.017	0.008	0.001
Loading 4 for dispatch	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	380	t	indoor 70% + 50% misting	0.159	0.075	0.011
Inbound inside daytime vehicles	AP-42 Paved roads - Section 13.2.1	2.2E-01	4.3E-02	1.0E-02	kg-VKT-1	12	VKT	misting 50%	1.350	0.259	0.063
Inbound outside daytime vehicles	AP-42 Paved roads - Section 13.2.1	3.9E-02	7.6E-03	1.8E-03	kg-VKT-1	26	VKT		1.032	0.198	0.048
Inbound inside night time vehicles	AP-42 Paved roads - Section 13.2.1	2.2E-01	4.3E-02	1.0E-02	kg-VKT-1	3	VKT	misting 50%	0.338	0.065	0.016
Inbound outside night time vehicles	AP-42 Paved roads - Section 13.2.1	3.9E-02	7.6E-03	1.8E-03	kg-VKT-1	7	VKT		0.258	0.050	0.012
Outbound inside vehicles	AP-42 Paved roads - Section 13.2.1	5.0E-01	9.6E-02	2.3E-02	kg-VKT-1	3	VKT	misting 50%	0.856	0.164	0.040
Outbound outside vehicles	AP-42 Paved roads - Section 13.2.1	8.8E-02	1.7E-02	4.1E-03	kg-VKT-1	7	VKT		0.655	0.126	0.030
Tip zone wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.12	ha	indoor 70%, misting 50%	0.043	0.022	0.003
Brick and concrete stockpile wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.01	ha	indoor 70%, 3-sided 75%, misting 50%	0.001	0.001	0.000
Light waste stockpile wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.03	ha	indoor 70%, 3-sided 75%, misting 50%	0.002	0.001	0.000
Metal stockpile wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.01	ha	indoor 70%, 3-sided 75%, misting 50%	0.001	0.000	0.000
Heavy waste stockpile wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.04	ha	indoor 70%, 3-sided 75%, misting 50%	0.003	0.002	0.000

Table D2 Annual emissions inventory

Description	Emission Factor	Emission rate				Activity Rate	Units	Emission Controls	Controlled emission (kg.yr-1)		
		TSP	PM10	PM2.5	Units				TSP	PM10	PM2.5
Permitted waste unloading	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	300,000	t	indoor 70% + 50% misting	125.722	59.463	9.004
Tipped, spread, turned and inspected	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	300,000	t	indoor 70% + 50% misting	125.722	59.463	9.004
Unaccepted loads loading	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	-	t	indoor 70% + 50% misting	-	-	-
Accepted load stockpiled for sorting	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	300,000	t	indoor 70% + 50% misting	125.722	59.463	9.004
Pre-sorting	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	300,000	t	indoor 70% + 50% misting	125.722	59.463	9.004
Stockpiled into bay 2	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	114,000	t	indoor 70% + 50% misting	47.775	22.596	3.422
Stockpiled into bay 3	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	12,000	t	indoor 70% + 50% misting	5.029	2.379	0.360
Stockpiled into bay 4	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	114,000	t	indoor 70% + 50% misting	47.775	22.596	3.422
Loading 1 for dispatch	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	60,000	t	indoor 70% + 50% misting	25.144	11.893	1.801
Loading 2 for dispatch	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	114,000	t	indoor 70% + 50% misting	47.775	22.596	3.422
Loading 3 for dispatch	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	12,000	t	indoor 70% + 50% misting	5.029	2.379	0.360
Loading 4 for dispatch	AP-42 - Batch drop - Section 13.2.4.3	2.8E-03	1.3E-03	2.0E-04	kg-t-1	114,000	t	indoor 70% + 50% misting	47.775	22.596	3.422
Inbound inside daytime vehicles	AP-42 Paved roads - Section 13.2.1	2.2E-01	4.3E-02	1.0E-02	kg-VKT-1	3,629	VKT	misting 50%	405.008	77.742	18.808
Inbound outside daytime vehicles	AP-42 Paved roads - Section 13.2.1	3.9E-02	7.6E-03	1.8E-03	kg-VKT-1	7,862	VKT		309.708	59.449	14.383
Inbound inside night time vehicles	AP-42 Paved roads - Section 13.2.1	2.2E-01	4.3E-02	1.0E-02	kg-VKT-1	907	VKT	misting 50%	101.252	19.435	4.702
Inbound outside night time vehicles	AP-42 Paved roads - Section 13.2.1	3.9E-02	7.6E-03	1.8E-03	kg-VKT-1	1,966	VKT		77.427	14.862	3.596
Outbound inside vehicles	AP-42 Paved roads - Section 13.2.1	5.0E-01	9.6E-02	2.3E-02	kg-VKT-1	1,026	VKT	misting 50%	256.922	49.316	11.931
Outbound outside vehicles	AP-42 Paved roads - Section 13.2.1	8.8E-02	1.7E-02	4.1E-03	kg-VKT-1	2,223	VKT		196.467	37.712	9.124
Tip zone wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.12	ha	indoor 70%, misting 50%	15.837	7.919	1.188
Brick and concrete stockpile wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.01	ha	indoor 70%, 3-sided 75%, misting 50%	0.388	0.194	0.029
Light waste stockpile wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.03	ha	indoor 70%, 3-sided 75%, misting 50%	0.908	0.454	0.068
Metal stockpile wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.01	ha	indoor 70%, 3-sided 75%, misting 50%	0.199	0.099	0.015
Heavy waste stockpile wind erosion	AP-42 - Wind erosion of exposed areas - annual - Table 11.9-4	8.5E+02	4.3E+02	6.4E+01	kg-ha-1-yr-1	0.04	ha	indoor 70%, 3-sided 75%, misting 50%	1.166	0.583	0.087

APPENDIX E

Construction Phase Air Quality Risk Assessment

Provided below is a summary of the risk assessment methodology used in this assessment. It is based upon IAQM (2023) *Guidance on the assessment of dust from demolition and construction* (version 2.1) and adapted by Northstar Air Quality.

Adaptions to the Published Methodology Made by Northstar Air Quality

The adaptions made by Northstar Air Quality from the IAQM published methodology are:

- **PM₁₀ criterion:** an amended criterion representing the annual average PM₁₀ criterion relevant to Australia rather than the UK;
- **Nomenclature:** a change in nomenclature from "receptor sensitivity" to "land use value" to avoid misinterpretation of values attributed to "receptor sensitivity" and "sensitivity of the area" which may be assessed as having different values;
- **Construction traffic:** the separation of construction vehicle movements as a discrete risk assessment profile from those associated with the 'on-site' activities of demolition, earthworks and construction. The IAQM methodology considers four risk profiles of: "demolition", "earthworks", "construction" and "trackout". The adaption by Northstar Air Quality introduces a fifth risk assessment profile of "construction traffic" to the existing four risk profiles; and,
- **Tables:** minor adjustments in the visualisation of some tables.

Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located:

- more than 250 m from the boundary of the site;
- more than 50 m from the route used by construction vehicles on public roads; and
- more than 250 m from the site entrance.

This step is noted as having deliberately been chosen to be conservative and would require assessments for most developments.

Table E1 overleaf presents the identified discrete sensitive receptors, with the corresponding estimated screening distances as compared to the screening criteria.

Table E1 Construction phase impact screening criteria distances

Rec	Location	Land use	Screening distance (m)		
			Boundary (250m)	Site entrance (250m)	Construction route (50m)
R1	Bay Street, Botany	Industrial	21	49	49
R2	McFall Street, Botany	Industrial	14	26	26
R3	Luland Street, Botany	Industrial	30	31	19
R4	Hale Street, Botany	Industrial	44	58	34
R5	Hale Street, Botany	Industrial	34	85	24
R6	Hale Street, Botany	Industrial	38	104	29
R7	Hale Street, Botany	Industrial	32	118	23
R8	Hale Street, Botany	Industrial	43	136	35
R9	Sydney Airport Fire Station	Fire station	523	647	429
R10	Butler Road, Mascot	Commercial	451	595	147
R11	Botany Public School	Educational	404	423	422
R12	Bay Street, Botany	Commercial	402	422	422
R13	Ross Smith Avenue, Mascot	Industrial	377	504	259
R14	Ross Smith Avenue, Mascot	Commercial	432	479	479
R15	McFall Street, Botany	Industrial	53	72	72
R16	Sydney Airport	Airport	340	439	275
R17	Luland Street, Botany	Residential	56	70	63

With reference to Table E1, sensitive receptors are noted to be within the screening distance thresholds and therefore require further risk assessment as summarised in Table E2.

Table E2 Application of step 1 screening

Construction Impact	Screening Criteria	Step 1 Screening	Comments
Demolition	250 m from boundary 250 m from site entrance	Not screened	Receptors identified within the screening distance
Earthworks	250 m from boundary 250 m from site entrance	Not screened	Receptors identified within the screening distance
Construction	250 m from boundary 250 m from site entrance	Not screened	Receptors identified within the screening distance
Trackout	250 m from site entrance	Not screened	Receptors identified within the screening distance
Construction Traffic	50 m from roadside	Not screened	Receptors identified within the screening distance

Step 2 – Risk from Construction Activities

Step 2 of the assessment provides “dust emissions magnitudes” for each of the dust generating activities; demolition, earthworks, construction, and track-out (the movement of site material onto public roads by vehicles) and construction traffic.

The magnitudes are: Large; Medium; or Small, with suggested definitions for each category as follows:

Table E3 Dust emission magnitude activities

Activity	Large	Medium	Small
Demolition			
total building volume*	>75 000 m ³	12 000 m ³ to 75 000 m ³	<12 000 m ³
demolition height	>12 m AGL	6 m and 12 m AGL	<6 m AGL
onsite crushing	yes	no	no
onsite screening	yes	no	no
demolition of materials with high dust potential	yes	yes	no
demolition timing	any time of the year	any time of the year	wet months only
Earthworks			
total area	>110 000 m ²	18 000 m ² to 110 000 m ²	<18 000m ²
soil types	potentially dusty soil type (e.g. clay which would be prone to suspension when dry due to small particle size)	moderately dusty soil type (e.g. silt)	soil type with large grain size (e.g. sand)
heavy earth moving vehicles	>10 heavy earth moving vehicles active at any time	5 to 10 heavy earth moving vehicles active at any one time	<5 heavy earth moving vehicles active at any one time
formation of bunds	>6m AGL	4m to 8m AGL	<4m AGL
Construction			
total building volume	75 000 m ³	12 000 m ³ to 75 000 m ³	<12 000 m ³
concrete batching	yes	yes	no
sandblasting	yes	no	no
materials	concrete	concrete	metal cladding or timber
Trackout (within 100 m of construction site entrance)			
outward heavy vehicles movements per day	>50	20 to 50	<20
surface materials	high potential	moderate potential	low potential
unpaved road length	>100 m	50 m to 100 m	<50 m
Construction traffic (from construction site entrance to construction vehicle origin)			
Demolition traffic - total building volume	>75 000 m ³	12 000 m ³ to 75 000 m ³	<12 000 m ³
Earthworks traffic	>110 000 m ²	18 000 m ² to 110 000 m ²	<18 000m ²

Activity	Large	Medium	Small
total area			
Earthworks traffic soil types	potentially dusty soil type (e.g. clay which would be prone to suspension when dry due to small particle size)	moderately dusty soil type (e.g. silt)	soil type with large grain size (e.g. sand)
Construction traffic total building volume	75 000 m ³	12 000 m ³ to 75 000 m ³	<12 000 m ³
Total traffic outward heavy vehicles movements per day	>50	20 to 50	<20

The footprint of the Proposal site (the area affected) is estimated as being approximately 7 435 m² (0.7 hectares [ha]) in area.

The Proposal would involve the demolition of the existing structures, construction of the warehouse development as outlined in Section 2.2 and illustrated in Figure 2. A desktop review of the existing structures at the Proposal site indicate that total volume of those structures may exceed 20 000 m³.

Based on review of layouts provided in Figure 2, the proposed building is assumed to be between 12 000 m³ and 75 000 m³ (threshold for medium dust emission magnitude [refer Table E3]). Given the volume of construction to be performed, it is expected that the number of vehicle movements to service the Proposal site each day would be between 20 and 50 movements (threshold for medium dust emission magnitude for trackout [refer Table E3]).

Based upon the above assumptions and the assessment criteria presented in Table E3, the dust emission magnitudes are as presented in Table E4.

Table E4 Construction phase impact categorisation of dust emission magnitude

Activity	Dust emission magnitude
Demolition	Medium
Earthworks and enabling works	Small
Construction	Medium
Track-out	Medium
Construction traffic routes	Medium

Step 3 – Sensitivity of the Area

Step 3 of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:

- The specific sensitivities that identified land use values have to dust deposition and human health impacts;
- The proximity and number of those receptors locations;
- In the case of PM₁₀, the local background concentration; and
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.

Land Use Value

Individual receptor locations may be attributed different land use values based on the land use of the land, and may be classified as having high, medium or low values relative to dust deposition and human health impacts (ecological receptors are not addressed using this approach).

Essentially, land use value is a metric of the level of amenity expectations for that land use.

The IAQM method provides guidance on the land use value with regard to dust soiling and health effects and is shown in the table below. It is noted that user expectations of amenity levels (dust soiling) are dependent on existing deposition levels.

Table E5 IAQM guidance for categorising land use value

Value	High land use value	Medium land use value	Low land use value
Health effects	Locations where the public are exposed over a time period relevant to the air quality objective for PM ₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM ₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where human exposure is transient.
	Examples: Residential properties, hospitals, schools and residential care homes.	Examples: Office and shop workers, but would generally not include workers occupationally exposed to PM ₁₀ .	Examples: Public footpaths, playing fields, parks and shopping street.
Dust soiling	Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land.	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	Examples: Dwellings, museums, medium and long term car parks and car showrooms.	Examples: Parks and places of work.	Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.

Sensitivity of the Area

The assessed land use value (as described above) is then used to assess the sensitivity of the area surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM₁₀ concentration (in the case of potential health impacts) and other site-specific factors.

Additional factors to consider when determining the sensitivity of the area include:

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant, the season during which the works would take place;
- any conclusions drawn from local topography;
- duration of the potential impact, as a receptor may become more sensitive over time; and
- any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

Sensitivity of the Area - Health Impacts

For high land use values, the method takes the existing background concentrations of PM₁₀ (as an annual average) experienced in the area of interest into account, and professional judgement may be used to determine alternative sensitivity categories, taking into account the following:

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local / seasonal meteorological data;
- any conclusions drawn from local topography; and
- duration of the potential impact, as a receptor may become more sensitive over time; and any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

The existing background annual average PM₁₀ concentrations, as measured at Randwick AQMS (in 2020 was 19.5 µg·m⁻³), which, along with the land use value calculated above, classifies the sensitivity of the area as high for dust health impacts and high for dust soiling effects.

Table E6 IAQM guidance for categorising the sensitivity of an area of dust health effects

Land use value	Annual mean PM ₁₀ concentration (µg·m ⁻³)	Number of receptors ^(a)	Distance from the source (m) ^(b)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28 – 32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24 – 28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	≤24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28 - 32-	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24 – 28	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	≤24	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Note: (a) Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m), noting that only the highest level of area sensitivity from the table needs to be considered. In the case of high sensitivity areas with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

(b) With regard to potential 'construction traffic' impacts, the distance criteria of <20m and <50m from the source (roadside) are used (i.e. the first two columns only). Any locations beyond 50m may be screened out of the assessment (as per Step 1) and the corresponding sensitivity is negligible'.

Sensitivity of the Area - Dust Soiling

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in Table E7.

Table E7 IAQM guidance for categorising the sensitivity of an area to dust soiling effects

Land use values	Number of receptors ^(a)	Distance from the source (m) ^(b)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

- Note:**
- (a) Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered.
 - (b) With regard to potential 'construction traffic' impacts, the distance criteria of <20m and <50m from the source (roadside) are used (i.e. the first two columns only). Any locations beyond 50m may be screened out of the assessment (as per Step 1) and the corresponding sensitivity is negligible'.

Step 4 - Risk Assessment (Pre-Mitigation)

The matrices shown for each activity determine the risk category with no mitigation applied.

Table E8 Risk of dust impacts from demolition activities

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Demolition)		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table E9 Risk of dust impacts from earthworks

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Earthworks)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table E10 Risk of dust impacts from construction activities

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Construction)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table E11 Risk of dust impacts from trackout (within 100m of construction site entrance)

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Trackout)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Table E12 Risk of dust impacts from construction traffic (from construction site entrance to origin)

Sensitivity of Area	Pre-Mitigated Dust Emission Magnitude (Construction Traffic)		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Given the sensitivity of the identified receptors is classified as low for dust soiling and medium health effects, and the dust emission magnitudes for the various construction phase activities as shown in Table E4, the resulting risk of air quality impacts (without mitigation) is as presented in Table E13.

Table E13 Risk of air quality impacts from construction activities

Impact	Sensitivity of area	Dust emission magnitude					Preliminary risk				
		Demolition	Earthworks	Construction	Trackout	Const. traffic	Demolition	Earthworks	Construction	Trackout	Const. traffic
Dust soiling	High	Med.	Small	Med.	Med.	Med.	Med.	Low	Med.	Med.	Med.
Human health	Low	Med.	Small	Med.	Med.	Med.	Low	Neg.	Low	Low	Low

Note: Med. = Medium, Neg. = Negligible

The risks summarised in Table E13 show that there is a medium risk of dust soiling impacts associated with demolition, construction, trackout and construction traffic activities. All other construction phase activities are associated with low and negligible risks of dust soiling and health impacts if no mitigation measures were to be applied to control emissions associated with construction-phase activities.

The risk assessment therefore provides recommendations for construction phase mitigation, commensurate with those identified risks.

Step 5 – Identify Mitigation

Once the risk categories are determined for each of the relevant activities, site-specific management measures can be identified based on whether the site is a low, medium or high risk site.

The identified mitigation measures are presented as follows:

N = not required (although they may be implemented voluntarily)

D = desirable (to be considered as part of the CEMP, but may be discounted if justification is provided);

H = highly recommended (to be implemented as part of the CEMP and should only be discounted if site-specific conditions render the requirement invalid or otherwise undesirable).

Table E14 represents a selection of recommended mitigation measures recommended by the IAQM methodology for construction activities commensurate with the risks identified in Table E13.

Table E14 Site-specific management measures

Identified mitigation		Unmitigated risk
1	Communications	Medium
1.1	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	H
1.2	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	H
1.3	Display the head or regional office contact information.	H
1.4	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the relevant regulatory bodies.	H
2	Site management	Medium
2.1	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	H
2.2	Make the complaints log available to the local authority when asked.	H
2.3	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.	H
2.4	Hold regular liaison meetings with other high-risk construction sites within 500 m of the site boundary, to ensure plans are coordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.	N
3	Monitoring	Medium
3.1	Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary.	D
3.2	Carry out regular site inspections to monitor compliance with the dust management plan / CEMP, record inspection results, and make an inspection log available to the local authority when asked.	H
3.3	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H
4	Preparing and maintaining the site	Medium
4.1	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H
4.2	Erect solid screens or barriers around dusty activities or the site boundary that they are at least as high as any stockpiles on site.	H

Identified mitigation		Unmitigated risk
4.3	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	H
4.4	Avoid site runoff of water or mud.	H
4.5	Keep site fencing, barriers and scaffolding clean using wet methods.	H
4.6	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below	H
4.7	Cover, seed or fence stockpiles to prevent wind erosion	H
5	Operating vehicle/machinery and sustainable travel	Medium
5.1	Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable	H
5.2	Ensure all vehicles switch off engines when stationary - no idling vehicles	H
5.3	Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable	H
5.4	Impose and signpost a maximum-speed-limit of 25 km·h ⁻¹ on surfaced and 15 km·h ⁻¹ on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate	D
5.5	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	N
5.6	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	D
6	Operations	Medium
6.1	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems	H
6.2	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate	H
6.3	Use enclosed chutes and conveyors and covered skips	H
6.4	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate	H
6.5	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	H
7	Waste management	Medium
7.1	Avoid bonfires and burning of waste materials.	H
8	Measures specific to demolition	Medium
8.1	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).	D
8.2	Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where	H

Identified mitigation		Unmitigated risk
	it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.	
8.3	Avoid explosive blasting, using appropriate manual or mechanical alternatives.	H
8.4	Bag and remove any biological debris or damp down such material before demolition.	H
9	Measures specific to earthworks	Low
9.1	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	N
9.2	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	N
9.3	Only remove the cover in small areas during work and not all at once	N
10	Measures specific to construction	Medium
10.1	Avoid scabbling (roughening of concrete surfaces) if possible	D
10.2	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place	H
10.3	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	D
10.4	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust	D
11	Measures specific to trackout	Medium
11.1	Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site.	H
11.2	Avoid dry sweeping of large areas.	H
11.3	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	H
11.4	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	H
11.5	Record all inspections of haul routes and any subsequent action in a site log book.	H
11.6	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	H
11.7	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	H
11.8	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	H
11.9	Access gates to be located at least 10 m from receptors where possible.	H

Step 6 – Risk Assessment (post-mitigation)

Following Step 5, the residual impact is then determined.

The objective of the mitigation is to manage the construction phase risks to an acceptable level, and therefore it is assumed that application of the identified mitigation would result in a low or negligible residual risk (post mitigation).

Given the size of the Proposal site, the distance to sensitive receptors and the activities to be performed, residual impacts associated with fugitive dust emissions from the Proposal would be anticipated to be 'negligible', should the implementation of the mitigation measures outlined above be performed appropriately.

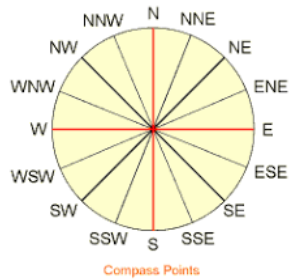
APPENDIX F

Example Complaint Record

Complainant Contact Details	
Date and time complaint received	
Contact details for complainant	
Complaint Details	
Date and time start	/ / : am pm
Date and time stop	/ / : am pm
Location(s) of the impact	
Description of the impact	
Prevailing weather conditions at the time of the complaint	
General description (dry, rain, windy, still etc)	
Temperature	
General wind direction <i>see note 1</i>	
General wind strength <i>see note 2</i>	
Operational details, actions, resolution	
Operations during complaint	
Identified causes	
Actions taken	
Cause resolved	☐ Yes ☐ No
Follow up required	☐ Yes ☐ No
Complainant informed of outcome	☐ Yes ☐ No
Signed	
Date	/ /

Notes

1. Wind Direction.



2. Wind Strength

Scale		Description
0	Calm	Calm. Smoke rises vertically
1	Light air	Wind motion visible on smoke
2	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	Gentle breeze	Leaves and smaller twigs in constant motion
4	Moderate breeze	Dust and loose paper raised. Small branches move
5	Fresh breeze	Moderate branches move. Small trees begin to sway.
6	Strong breeze	Large branches in motion. Overhead wires whistle. Umbrella use is difficult. Empty rubbish bins tip.
7+	Near gale	Wind effects greater than above

air quality | environment | sustainability

air quality	Northstar specialises in all aspects of air quality, dust, and odour management, covering monitoring, modelling and assessment, due diligence and process specification, licencing and regulatory advice, peer review and expert witness.
environment	Our team has extensive experience in environmental management, covering environmental policy and management plans, licencing, compliance reporting, auditing, data, and spatial analysis.
sustainability	We look beyond compliance to add value and identify opportunities. Our services range from sustainability strategies, ecologically sustainable development reporting and assessment, to bespoke greenhouse gas and energy estimation and reporting.

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