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Kings Park Metal Resource Facility

Air Quality Impact Assessment

Addressee(s):	Sell & Parker Pty Ltd
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Quality Control

Study	Status	Prepared	Checked	Authorised
INTRODUCTION	Final	Northstar	MD, SF, HR	GCG
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LEGISLATION, REGULATION AND GUIDANCE	Final	Northstar	MD, SF, HR	GCG
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Final Authority

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

G. Graham **6th August 2020**

Non-Technical Summary

Sell and Parker purchase, sell and recycle all types of ferrous and non-ferrous metals. Their facilities are located strategically throughout NSW and Australia. S&P currently own and operate a resource recovery facility at 23-43 and 45 Tattersall Road, Kings Park. This resource recovery facility currently operates under approval State Significant Development 5041 and three associated modifications.

Sell and Parker is seeking approval to increase the throughput limit of the resource recovery facility from 350 000 to 600 000 tonnes per annum. Approval for the Proposal is sought as State Significant Development under Part 4, Division 4.7 of the *Environmental Planning and Assessment 1979* (EP&A Act).

Northstar Air Quality has been engaged to perform an air quality impact assessment to support the Environmental Impact Statement for the proposed throughput increase.

This air quality impact assessment has been performed in accordance with the State Environmental Assessment Requirements and the NSW Environment Protection Authority guidance "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*".

Using a range of site-specific data regarding the type and nature of activities to be performed on site, emissions to air have been estimated in accordance with the relevant guidance, and the dispersion of emissions has been modelled using approved atmospheric dispersion modelling techniques. The corresponding impacts have been predicted at a number of receptor locations representing community exposure and at industrial locations, as discrete impacts and as cumulative impacts which account for general prevailing air quality conditions considered to be representative of the site.

The impact prediction does not predict any additional exceedances of the relevant air quality and odour assessment criteria, as published in NSW Environment Protection Authority guidance "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*". It is noted that over some periods of the year used for the modelling exercise, the general prevailing background air quality conditions adopted from the monitoring network operated by NSW Department of Planning, Industry and Environment were already in exceedance of the impact assessment criterion. In such circumstances, the guidance provided in "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*" requires the demonstration of no additional exceedances of the criteria, and this assessment demonstrates compliance with that requirement.

The air quality impact assessment also considers the potential impacts of the operation of the neighbouring Autorecyclers Pty Ltd operations at a proposed increased throughput of 130 000 tonnes per year. The report assesses the potential aggregated impacts with those emissions, and the assessment does not predict any exceedance of the relevant air quality and odour assessment criteria, as published in NSW Environment Protection Authority guidance "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*".

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Units Used in the Report

All units presented in the report follow International System of Units (SI) conventions, unless derived from references using non-SI units. 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 expressed as 50 $\mu g \cdot m^{-3}$ and not 50 $\mu g/m^3$.

Common Abbreviations

Abbreviation	Term
ABS	Australian Bureau of Statistics
AHD	Australian height datum
AQIA	air quality impact assessment
AQMS	air quality monitoring station
BoM	Bureau of Meteorology
CO	carbon monoxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEC	Department of Environment and Conservation
DPI&E	Department of Planning, Industry and Environment
EETM	emission estimation technique manual
EPA	Environmental Protection Authority
EPL	Environment Protection Licence
m^{-2}	per square metre
m^{-3}	per cubic metre

Abbreviation	Term
$mg \cdot m^{-3}$	milligram per cubic metre of air
$mg \cdot Nm^{-3}$	milligram per normalised cubic metre of air
$\mu g \cdot m^{-3}$	microgram per cubic metre of air
mE	metres East
$month^{-1}$	per month
mS	metres South
NCAA	National Clean Air Agreement
NEPM	National Environment Protection Measure
NO	nitric oxide
NO_X	oxides of nitrogen
NO_2	nitrogen dioxide
O_3	ozone
OLM	ozone limiting method
OU	odour unit
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
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
TAPM	The Air Pollution Model
TSP	total suspended particulates
US EPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VKT	vehicle kilometres travelled

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1. INTRODUCTION

On behalf of Sell & Parker Pty Ltd, Arcadis Australia Pty Ltd (Arcadis) has engaged Northstar Air Quality Pty Ltd (Northstar) to perform an Air Quality Assessment (AQIA) for the proposed expansion of the existing resource recovery facility (RRF). The applicant is seeking approval to increase the throughput limit of the RRF from 350 000 to 600 000 tonnes per annum (tpa) (the Proposal).

1.1. Project Background

Sell and Parker (S&P) purchase, sell and recycle all types of ferrous and non-ferrous metals. Their facilities are located strategically throughout NSW and Australia. S&P currently own and operate a resource recovery facility (RRF) at 23-43 and 45 Tattersall Road, Kings Park (the Proposal site). This RRF currently operates under approval SSD 5041 and three associated modifications (the Original Approval)[1].

- Original Approval: https://www.planningportal.nsw.gov.au/major-projects/project/5191

S&P is seeking approval to increase the throughput limit of the RRF from 350 000 to 600 000 tonnes per annum (tpa) (the Proposal). Approval for the Proposal is sought as State Significant Development (SSD) under Part 4, Division 4.7 of the *Environmental Planning and Assessment 1979* (EP&A Act).

The existing infrastructure at the Proposal site has the capacity to accommodate an increased throughput without altering the approved operational hours or requiring any construction works on the Proposal site.

The Proposal would assist in achieving the higher recycling contamination standards prescribed by China's National Sword Policy as well as further reducing the volume of scrap metal that goes to landfill.

1.2. Key Terms

The key terms are outlined in **Table 1**.

Table 1 Terminology

Term	Description
The Original Approval	The approved Environmental Impact Assessment for SSD 5041 (and subsequent modifications)
The Proposal	The proposal for which approval is being sought, namely the expansion of Kings Park metal recycling and processing facility
The Proposal site	The Sell and Parker Premises at 23-43 and 45 Tattersall Road, Kings Park NSW. The area at which the Proposal would be located incorporates the following lots:

[1] Original Approval: https://www.planningportal.nsw.gov.au/major-projects/project/5191

Term	Description
	• Lot 2, DP 550522 • Lot 5, DP 7086.

1.3. Referenced Guidance

To allow assessment of the level of risk associated with the Proposal in relation to air quality, the AQIA has been performed with due reference to:

- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW EPA, 2017);
- Technical Framework - Assessment and Management of Odour from Stationary Sources in NSW (NSW DEC, 2006);
- Technical Notes - Assessment and Management of Odour from Stationary Sources in NSW (NSW DEC, 2006);
- *Protection of the Environment Operations Act* 1997; and
- Protection of the Environment Operations (Clean Air) Regulation 2010.

1.4. Secretary's Environmental Assessment Requirements

NSW Department of Planning, Industry and Environment (DPIE), issued the Planning Secretary's Environmental Assessment Requirements (SEARs) for the Proposal in December 2019. **Table 2** below identifies the SEARs relevant to this AQIA report and the relevant sections of the report in which they have been addressed.

Table 2 Secretary's Environmental Assessment Requirements (SSD 10396)

Agency / Issue	Requirement	Addressed
Blacktown City Council / Environmental Health	a) An air quality assessment must be conducted by a suitably qualified expert in line with the Approved methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW (EPA 2011) which includes:	This report
Air Quality Impact Assessment	• All processes and scenarios that could result in air pollution and/or generation of odour, this must also include worst case scenarios	Section 2.2 and 5.2
	• An assessment of the air quality impacts arising from the project on surrounding sensitive receptors (particularly dust and odour)	Sections 4.1.1 and 6
	• Provide an air quality management plan that includes details of the various methods that will be employed to control pollutants during the operational phase of the development	Section 7.3
	• The accumulative impact of this proposal along with adjacent development, particularly to the west of the site.	Section 7.2

Agency / Issue	Requirement	Addressed
NSW EPA / Air Pollution	Impact on the amenity of surrounding community from smoke, odour, particulates and dust and measures to be implemented to minimise or prevent these emissions including:	This report
	• The feasibility of semi-encapsulation of oxy-cutting activities to manage particulate emissions;	Section 7.1
	• A cumulative assessment of environmental impacts; and	Sections 6 and 7.2
	• Evidence that existing approved infrastructure can accommodate increased throughput – in particular the Emissions Collection System	Section 7.2
NSW EPA / Description of the Proposal	• Identify all sources or potential sources of air emissions from the development *Note: emissions can be classified as either: point (e.g. emissions from stack or vent) or fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works)*	Section 2.2 and 5.2 and Appendix C
	• Provide details of the project that are essential for predicting and assessing air impacts including:	
	A) the quantities and physio-chemical parameters (e.g. concentration, moisture content, bulk density, particle sizes etc) of materials to be used, transported, produced or stored	Section 5.2 and Appendix C
	B) an outline of procedures for handling, transport, production and storage	Section 7
	C) The management of solid, liquid and gaseous waste streams with potential to generate emissions to air.	Section 7
NSW EPA / The location	• Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals.	Section 4.2
	Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.	Figure 5
	• Describe surrounding buildings that may affect plume dispersion.	Section 2.2 and 5.1
	• Provide and analyse site representative data on following meteorological parameters: a) temperature and humidity b) rainfall, evaporation and cloud cover c) wind speed and direction d) atmospheric stability class e) mixing height (the height that emissions will be ultimately mixed in the atmosphere) f) katabatic air drainage g) air re-circulation.	Section4.3 and Appendix B

Agency / Issue	Requirement	Addressed
NSW EPA / The environmental issues	*Describe baseline conditions*	Section 4
	• Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data.	Sections 4.4 and 4.3 Appendices A and B
	Assess impacts	
	• Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.	Sections 2.2 and 5.2
	• Estimate the resulting ground level concentrations of all pollutants. Where necessary (e.g. potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the EPA. Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.	Section 6
	• Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations.	Section 6
	• For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate. Note: With dust and odour, it may be possible to use data from existing similar activities to generate emission rates.	Section 0 and Appendix C
	• Reference should be made to relevant guidelines e.g. Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2016); Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DEC, 2007); Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006); Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006); Load Calculation Protocol for use by holders of NSW Environment Protection Licences when calculating Assessable Pollutant Loads (DECC, 2009).	Section 1.3
	Describe management and mitigation measures	
	• Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.	Section 7

2. THE PROPOSAL

The following provides a description of the context, location, and scale of the Proposal, and a description of the processes and development activities on site. It also identifies the potential for emissions to air associated with the Proposal.

2.1. Proposal Site

The Proposal site is situated within the Blacktown Local Government Area (LGA) approximately 40 kilometres (km) north-west of the Sydney Central Business District (CBD) and around 3 km from Blacktown CBD. The local area is characterised by general industrial development.

Access is from Tattersall Road, to which the Proposal site has approximately 240 metres (m) of frontage. Tattersall Road is a two-lane road which connects to Sunnyholt Road to the east, and Vardys Road to the north-west, both of which are four lanes. Sunnyholt Road connects in turn to the M7, 1.2 km to the north of the Tattersall Road intersection. The area of the Proposal site is approximately 6.4 hectares (ha).

The location of the Proposal site is shown in **Figure 1**. An aerial view of the Proposal site is shown in **Figure 2**.

2.2. Proposal Description

The Proposal would be considered SSD under Clause 23 (waste and resource management facilities) of Schedule 1 of the State Environmental Planning Policy (State and Regional Development) 2011, and therefore requires the preparation of an EIS prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) No. 10396 (see **Section 1.4**).

The Proposal is to increase the maximum scrap metal processing throughput at the Proposal site from 350 000 to 600 000 tpa.

The existing infrastructure at the Proposal site has the capacity to accommodate the increased throughput. The Proposal would not require any construction works and would not change the mix of materials currently received at the RRF (i.e. it is an operational approval only). However, adjustments to site management practices would be required in terms of internal vehicle movements and stacking locations to allow the increased throughput.

The Proposal would utilise existing road infrastructure, other utility installations and stormwater discharge points.

The operation of the Proposal site would employ approximately 80 full time employees at the RRF. The approved operational hours for the existing RRF are outlined in **Table 3**.

Figure 1 Location of the Proposal site

Figure 1 – Location of the Proposal site

Source: Arcadis

Figure 2 The Proposal site

Source: Arcadis

Table 3 Approved operational hours

Activity	Day	Hours
Oxy-acetylene torch cutting	Monday to Saturday	9 am to 3 pm
	Sunday and public holidays	Nil
Maintenance and cleaning	Monday to Saturday	9 pm to 6 am
	Sunday	24 hours
All other activities	Monday to Saturday	6 am to 9 pm
	Sunday and Public Holidays	Nil

The hours of operations at the RRF would not change as a result of the Proposal.

2.2.1. Construction

As noted above, the Proposal would utilise existing approved infrastructure. Therefore, no construction activities would be required as part of the Proposal.

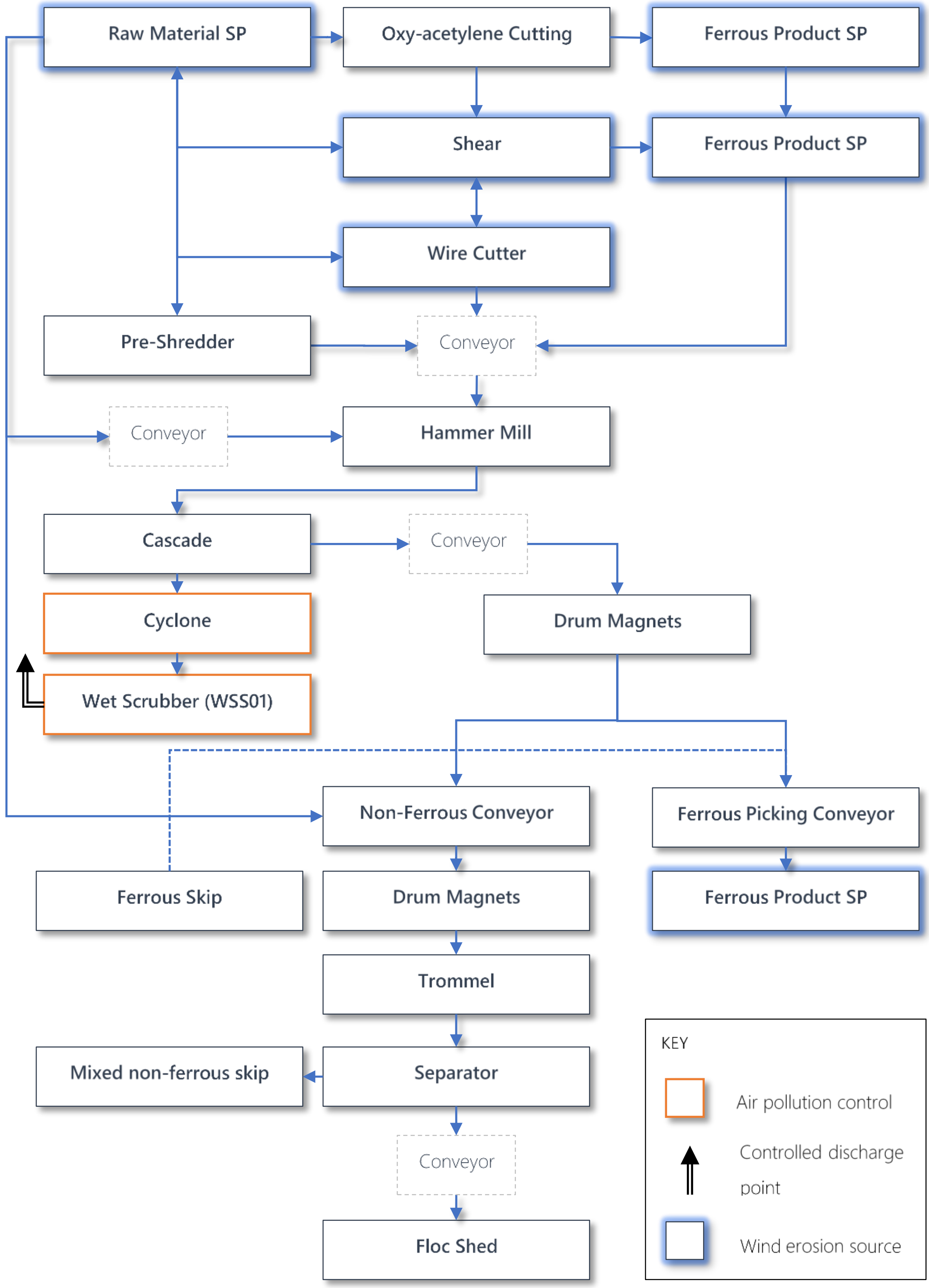
2.2.2. Operation

The Proposal would facilitate an increased throughput limit from 350 000 to 600 000 tpa of scrap metal.

Reference has been made to ERM (2015) Waste Metal Recovery, Processing and Recycling Facility Expansion – 45 and 23-43 Tattersall Road, Kings Park, Blacktown – Air Quality Assessment (ERM, 2015). That assessment report forms part of the Original Approval and is based upon a scrap metal processing throughput of 350 000 tpa. That report has been used as the basis of assumptions of segregated material flow through the processes operated at the Proposal site, which have been increased on a *pro-rata* basis, with the exception of the Hammermill which is conservatively assumed to be operating at the emission concentration limit imposed through the Environmental Protection Licence (see **Section 3.1**).

It is understood that the scrap metal processing is generally in accordance with the stylised flow diagram presented in **Figure 3**.

Figure 3 Process flow diagram



Source: Northstar

2.2.3. Plant and Equipment

The existing plant and equipment would be utilised as part of the Proposal. Therefore, there would be no changes to the inventory of plant and equipment.

2.2.4. Identified Potential Emissions to Air

The existing processes operated at the Proposal site have the potential for emissions of particulates, which may be emitted at various particle size ranges. In terms of air quality studies, these may be categorised as total suspended particulates (TSP), particles with a mean aerodynamic diameter of 10 microns and 2.5 micron or less, (PM_{10} and $PM_{2.5}$ respectively).

The operations performed at the Proposal site are regulated by NSW EPA under the Protection of the Environment Operations (POEO) Act (1997) through an Environment Protection Licence (EPL 11555). This is discussed further in **Section 3**. EPL 11555 includes requirements for monitoring of various metals and TSP.

Reference is also made to the previous assessment reports for the Original Approval. This presents data relating to emissions from various sources including oxides of nitrogen (NO_X as NO_2) and odour.

2.3. Proximate Sources

As required under the SEARs for the Proposal (see **Section 1.4**) the AQIA is required to assess ***"…the accumulative impact of this proposal along with adjacent development, particularly to the west of the site."***

The land to the west and immediately adjacent to the Proposal site is occupied by Autorecyclers Pty Ltd. Currently, that activity has an approved throughput limit of 30 000 tpa and is currently shredding around 9 000 t of cars per year. In 2019, Autorecyclers Pty Ltd made an application for an increase to 130 000 tpa which is understood to be currently under consideration for planning approval. As part of the application, an EIS was submitted, supported by an AQIA (TAS, 2019). Reference has been made to the location of the air quality receptors adopted in that AQIA and the results of the assessment of impacts commensurate with an annual throughput of 130 000 tpa. Consideration of receptor locations is presented in **Section 4.1.1** and the potential for cumulative impacts of the Proposal with that assessed as part of the Autorecyclers Pty Ltd application is presented in **Section 7.2**.

A search of the NSW EPA EPL database[2] does not show any EPL issued for any activity at that location or held by Autorecyclers Pty Ltd.

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[2] https://apps.epa.nsw.gov.au/prpoeoapp/default.aspx

3. LEGISLATION, REGULATION AND GUIDANCE

3.1. Protection of the Environment Operations Act

The activities performed at the Proposal site are regulated by NSW EPA under the *Protection of the Environment Operations Act 1997* and the Protection of the Environment Operations (Clean Air) Regulation 2010 through Environmental Protection Licence (EPL) 11555[3]. EPL 11555 contains various conditions of operations to manage environmental impacts, including hours of operation, throughput rates and emission concentration limits. Of relevance to this AQIA, EPL 11555 includes emission limits for metals (type 1 and type 2) and solid particles from the Hammermill Wet Scrubber Stack (licenced emission point 'EPA-3').

Table 4 EPL 11555 air concentration limits

Pollutant	Units of measure	100 percentile concentration limit	Reference conditions
Type 1 and Type 2 substances in aggregate	milligrams per cubic metre	1	Dry, 273 K, 101.3 kPa
Solid particles	milligrams per cubic metre	20	Dry, 273 K, 101.3 kPa

EPL 11555 Condition L5 conditions the hours of operation of the oxy-acetylene torch to 09:00-15:00 and between 06:00-21:00 for all other activities, consistent with the hours of operation presented in **Table 3**.

EPL 11555 Condition O3 relates to the management of dust:

O3 Dust

O3.1 All operations and activities occurring at the premises must be carried out in a manner that will minimise emission of dust from the premises.

O3.2 The licensee must manage stockpiles of scrap metal and processed material to ensure air emissions are minimised.

O3.3 All areas on the premises must be maintained, at all times, in a condition which effectively minimises the emission of wind-blown or traffic-generated dust.

O3.4 The licensee must ensure that no material, including sediment or oil, is tracked onto public roads from the premises.

O3.5 Ambient real time PM10 Dust Monitors must be installed and operated in accordance with the information supplied to the EPA in the report by ERM, Waste Metal Recovery, Processing and Recycling Facility 45 and 23-43 Tattersall Road, Kings Park, Blacktown, Air Quality Assessment, Sell & Parker Pty Ltd, September 2015.

O3.6 The licensee must keep a legible record of when dust generating activities are reduced or ceased as a result of the dust monitoring required by Condition O3.4 including:

a) the date and time that dust generating activities were reduced or ceased; and

b) what activities were reduced or ceased. These records must be made available to the EPA on request.

[3] https://apps.epa.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=186196&SYSUID=1&LICID=11555

3.2. Ambient Air Quality Standards

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, 2017), which has been consulted during the preparation of this AQIA.

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 National Health and Medical Research Council (NHMRC), National Environment Protection Council (NEPC), Department of Environment (DoE), World Health Organisation (WHO), and Australian and New Zealand Environment and Conservation Council (ANZECC)). Where relevant to this AQIA (coincident with the potential emissions), the criteria have been adopted as set out in Section 7.1 of the Approved Methods (NSW EPA, 2017) which are presented in **Table 5** below.

Table 5 NSW EPA air quality standards and goals

Pollutant	Averaging period	Units	Criterion	Notes
Nitrogen dioxide (NO_2)	1 hour	$\mu g \cdot m^{-3}$ [(a)]	246	Numerically equivalent to the AAQ NEPM[(b)] standards and goals.
	1 year	$\mu g \cdot m^{-3}$	62	
Particulates (as PM_{10})	24 hours	$\mu g \cdot m^{-3}$	50	
	1 year	$\mu g \cdot m^{-3}$	25	
Particulates (as $PM_{2.5}$)	24 hours	$\mu g \cdot m^{-3}$	25	
	1 year	$\mu g \cdot m^{-3}$	8	
Particulates (as TSP)	1 year	$\mu g \cdot m^{-3}$	90	
Particulates (as dust deposition)	1-year [(c)]	$g \cdot m^{-2} \cdot month^{-1}$	2	Assessed as insoluble solids as defined by AS 3580.10.1
	1-year [(d)]	$g \cdot m^{-2} \cdot month^{-1}$	4	
Lead	1 year	$\mu g \cdot m^{-3}$	0.5	
Copper dusts and mists	1 hour	$mg \cdot m^{-3}$	0.018	
Iron oxide fumes	1 hour	$mg \cdot m^{-3}$	0.09	
Manganese and compounds	1 hour	$mg \cdot m^{-3}$	0.018	
Chromium (VI)	1 hour	$mg \cdot m^{-3}$	0.00009	

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

3.3. Odour

It is noted that odorous materials are not accepted at the Proposal site, but a number of activities performed have the potential to give rise to odour emissions (ERM, 2015).

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management but are generally not intended to achieve "no odour", but manage odour impacts to an acceptable level.

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour detection threshold (ODT) and defines one odour unit (OU). An odour goal of less than 1 OU would (by definition) result in no odour impact being detectable in laboratory conditions. In practice, the character of an odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions.

Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 OU to 10 OU (or greater) depending on a combination of the following factors:

- **Odour quality:** whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- **Population sensitivity:** any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it contains.
- **Background level:** whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- **Public expectation:** whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.
- **Source characteristics:** whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily using control equipment than diffuse sources. Point sources tend to be located in urban areas, while diffuse sources are more prevalent in rural locations.
- **Health effects:** whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

Experience gained through odour assessments from proposed and existing facilities in NSW indicates that an odour performance goal of 7 OU is likely to represent the level below which "offensive" odours should not occur (for an individual with a 'standard sensitivity' to odours). Therefore, the Odour Technical Framework (DECC, 2006) recommends that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 OU. In modelling and assessment terms, this is expressed as the 99th percentile value, as a nose response time average (approximately one second).

Odour assessment criteria need to consider the range in sensitivities to odours within the community to provide additional protection for individuals with a heightened response to odours. This is addressed in the Technical Framework (DECC, 2006) by setting a population dependant odour assessment criterion, and in this way, the odour assessment criterion allows for population size, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity. A summary of odour performance goals for various population densities, as referenced in the Odour Technical Notes (DECC, 2006) is shown in **Table 6** This table shows that in situations where the population of the affected community lies between 125 and 500 people, an odour assessment criterion of 4 OU at the nearest residence (existing or any likely future residences) is to be used. For isolated residences, an odour assessment criterion of 7 OU is appropriate.

Table 6 NSW EPA Technical Framework odour criteria

Population of Affected Community	Impact Assessment Criteria for Complex Mixture of Odours (99th percentile 1-second OU)
Urban area (≥2000)	2.0
500 – 2000	3.0
125 – 500	4.0
30 – 125	5.0
10 – 30	6.0
Single residence (≤2)	7.0

Source: The Odour Technical Notes, DECC 2006

It is the view of the NSW EPA that the odour criterion which is applicable in Metropolitan Sydney is 2 OU. Given that this is the most stringent criterion, any intensification in residential development in an area would not result in a change to that criterion.

It is noted that the odour assessment criteria outlined in **Table 6** are a **design** tool rather than a **regulatory** tool. The benchmark for operational facilities is not the odour assessment criteria outlined above but whether the emission of odour is *'offensive'*, or being prevented or minimised using best management practices.

The *Protection of the Environment (Operations) Act* 1997 (POEO) is applicable to scheduled activities in NSW and emphasises the importance of preventing 'offensive odour'.

For reference, "offensive odour" is defined within the POEO Act as:

> *an odour:*
>
> *(a) that, by reason of its strength, nature, duration, character or quality, or the time at which it is emitted, or any other circumstances:*
>
> > *(i) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
> >
> > *(ii) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted, or*
>
> *(b) that is of a strength, nature, duration, character or quality prescribed by the regulations or that is emitted at a time, or in other circumstances, prescribed by the regulations.*

Further to the discussion of factors that determine whether an odorous mixture may be determined to lead to a nuisance, and the impact assessment criterion determined above, numerous papers and articles identify the disconnect between those two drivers that help regulate odour (as referenced in (Graham, Lawrence, & Doyle, 2013)). The description provided in the POEO Act may be summarised as a function of five broad factors, called the FIDOL factors, namely:

- **Frequency:** indicates how often an odour is experienced. Exposure to relatively pleasant odours (such as a bakery, for example) may be perceived to be a nuisance (or 'offensive odour') if it is experienced too frequently., and conversely, a more unpleasant odour may be tolerated if it is experienced hardly ever.
- **Intensity:** indicates the relative strength of the odour;
- **Duration:** in parallel to frequency, duration is an important factor representing the length of time of which an odour exposure is observed;
- **Offensiveness:** indicates how pleasant / unpleasant an odour is to the population. Whilst individuals may express a personal opinion of acceptance to specific odours, it is generally accepted that some odours are more unpleasant than others due to their chemical composition and also a hazard identification function. The relative scale of typical pleasantness / unpleasantness is described as the odour's hedonic tone.
- **Location:** indicates the relationship between the odour experienced and the general perception of amenity that would be expected at that location. An odour that may be tolerated at an industrial site may be less tolerated at a healthcare centre, for example.

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4. EXISTING CONDITIONS

4.1. Surrounding Land Sensitivity

4.1.1. 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.

It is important to note that the selection of discrete receptor locations, is not intended to represent a fully inclusive selection of all sensitive receptors across the study area. The location selected should be considered to be representative of its broader location and may be reasonably assumed to be representative of the immediate environs. In some instances, several viable receptor locations may be identified in a small area, for example a school neighbouring a medical centre. In this instance the receptor closest to the potential sources to be modelled would generally be selected and would be used to assess the risk to other sensitive land uses in the area.

It is further noted that in addition to the identified 'discrete' receptor locations, the entire modelling area is gridded with 'uniform' receptor locations (see **Section 4.1.2**) that are used to plot out the predicted impacts, and as such the accidental non-inclusion of a location that is sensitive to changes in air quality does not render the AQIA invalid, or otherwise incapable of assessing those potential risks.

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 2016 census, have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre (km^2) grid, covering mainland Australia (ABS, 2017). 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

Using ABS data in a GIS, the population density of the area surrounding the Proposal site are presented in **Figure 4**.

Figure 4 Population density and sensitive receptors surrounding the Proposal site

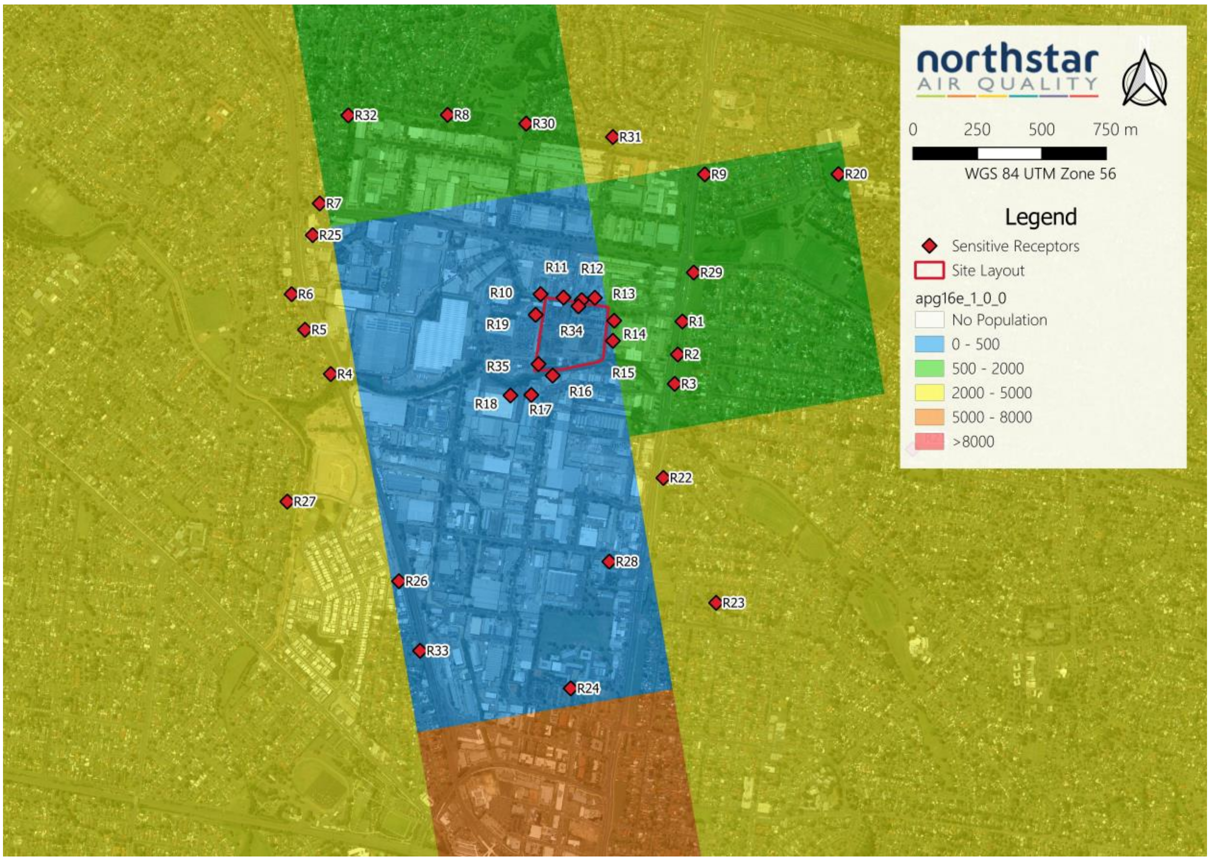


Image courtesy of Google Maps and data sourced from the ABS

The Proposal site and receptors are located in areas of 'very low', 'low' and 'medium' population densities, which would be expected given the largely industrial activities of the immediate area.

In accordance with the requirements of the NSW EPA, several receptor have been identified and the receptors adopted for use within this AQIA are presented in **Table 7** and illustrated in **Figure 4**.

Table 7 includes 35 receptor locations that have been used in this study. To facilitate intra-study assessment and comparison, receptors used in (ERM, 2015) and (TAS, 2019) have been incorporated. It is noted that receptors R10-R19 are fence-line receptor locations designed to represent the maximum off-site pollutant concentrations and are not representative of typical community exposure locations. Receptors R1-4, R6-8, R22 and R28-R33 are used to evaluate the potential cumulative impact with the proposed expansion of the neighbouring Autorecyclers Pty Ltd, as introduced in **Section 2.3** and discussed in **Section 7.2**. R34 and R35 are the locations of the two on-site air quality monitoring stations (named "out station" and "in station" respectively). These receptor locations are not representative of exposure locations but are used as part of the discussion in **Section 7**.

Table 7 Receptor locations used in the study

Rec	Address	Land use	Location (UTM)		Northstar 2020	ERM 2015	TAS 2019
			mE	mS			
R1	1 Anthony Street, Blacktown	Residential	306 993	6 263 656	✓	✓	✓
R2	2 Redwood Street, Blacktown	Residential	306 975	6 263 528	✓	✓	✓
R3	191-209 Sunnyholt, Road Blacktown	Nature Reserve	306 963	6 263 414	✓	✓	✓
R4	5 Chedley Place, Marayong	Residential	305 627	6 263 452	✓	✓	✓
R5	12 Railway Road, Marayong	Residential	305 527	6 263 624	✓	✓	
R6	28 Railway Road, Marayong	Residential	305 475	6 263 762	✓	✓	✓
R7	12 Cobham Street, Kings Park	Residential	305 584	6 264 114	✓	✓	✓
R8	65 Faulkland Crescent, Kings Park	Residential	306 081	6 264 458	✓	✓	✓
R9	32 Elsom Street, Kings Langley	Residential	307 080	6 264 227	✓	✓	
R10	62 Tattersall Road Kings Park	Industrial	306 442	6 263 762	✓	✓	
R11	50 Tattersall Road Kings Park	Industrial	306 531	6 263 749	✓	✓	
R12	38 Tattersall Road Kings Park	Industrial	306 602	6 263 739	✓	✓	
R13	32 Tattersall Road Kings Park	Industrial	306 653	6 263 748	✓	✓	
R14	21 Tattersall Road Kings Park	Industrial	306 728	6 263 659	✓	✓	
R15	21 Tattersall Road Kings Park	Industrial	306 723	6 263 581	✓	✓	
R16	34 Forge Street Blacktown	Industrial	306 489	6 263 446	✓	✓	
R17	24 Forge Street Blacktown	Industrial	306 406	6 263 371	✓	✓	
R18	48 Bessemer Street Blacktown	Industrial	306 325	6 263 369	✓	✓	
R19	57 Tattersall Road Kings Park	Industrial	306 423	6 263 682	✓	✓	
R20	56 Isaac Smith Parade, Kings Langley	Nature Reserve	307 599	6 264 228	✓		
R21	87 Turner Street, Blacktown	School	307 887	6 263 160	✓		
R22	2 Stephen Street, Blacktown	Residential	306 919	6 263 049	✓		✓
R23	24 Bedford Road, Blacktown	Nature Reserve	307 124	6 262 564	✓		
R24	19 Fifth Avenue ,Blacktown	School	306 559	6 262 232	✓		
R25	1 Bowmans Road, Kings Park	Commercial	305 557	6 263 991	✓		
R26	30 Ironwood Crescent, Blacktown	Residential	305 892	6 262 648	✓		
R27	Noel Street, Marayong	Nature Reserve	305 458	6 262 957	✓		
R28	90 Sunnyholt Road Blacktown	School	306 709	6 262 724	✓		✓
R29	305 Vardys Road Blacktown	Residential	307 037	6 263 846	✓		✓
R30	29 Camorta Close Kings Park	Residential	306 386	6 264 424	✓		✓
R31	7 Camorta Close Kings Park	Residential	306 723	6 264 372	✓		✓
R32	49 Cobham Street Kings Park	Residential	305 695	6 264 456	✓		✓
R33	5 Springfield Avenue Blacktown	Residential	305 974	6 262 378	✓		✓

Rec	Address	Land use	Location (UTM)		Northstar 2020	ERM 2015	TAS 2019
			mE	mS			
R34	S&P AQMS "Out station"	On-site	306 589	6 263 715	✓		
R35	S&P AQMS "In station"	On-site	306 434	6 263 491	✓		

Note: The requirements of this AQIA may vary from the specific requirements of other studies, and as such the selection and naming of receptor locations, may vary between technical reports. This does not affect or reduce the validity of those assumptions.

The results of the modelling assessment used to assess the potential impact of operational phase emissions are assessed sequentially in this AQIA. The impact assessment is principally driven by the requirement to manage potential exposure at locations representative of community exposure locations commensurate with the averaging period(s) for the respective pollutants.

Receptors R10-R19 are representative of surrounding industrial land uses and are not representative of locations where longer-term exposure might be reasonably expected. It is not reasonably expected for an individual to be at those locations for a 24-hour period to represent exposure at those locations, and as such, R10-R19 are omitted from the assessment of 24-hour averaged pollutant concentrations (such as PM_{10} and $PM_{2.5}$) and annual average pollutant concentrations (such as TSP, PM_{10} and $PM_{2.5}$). However, they have been included in the assessment of shorter-term averaging periods, such a 1-hour NO_2 concentrations which may be reasonably anticipated at those locations.

Similarly, odour is principally assessed at R1-R9 and R20-R33 as these represent locations where a reasonable level of amenity is to be anticipated. It is not proposed that those locations may be subjected to any level of odour, just that the sensitivity of the industrial locations is lower than may be reasonably expected at residential locations, and correspondingly the application of the 2 OU criterion at the industrial locations is not appropriate. However, in order to assess the potential for odour control, the results at all receptor locations has been provided.

It is noted that comments (responses) were received in response to the EIS for the proposed expansion of the Autorecyclers Pty Ltd operations from a number of local industrial operators, including:

- Hardware & General Supplies Limited Blacktown - 24/32 Forge St, Blacktown NSW 2148;
- B&E Foods - 25 Bessemer St, Blacktown NSW 2148; and
- Wesfresh Chicken Outlet - 25 Bessemer St, Blacktown NSW 2148.

It is noted that industrial receptors R16, R17 and R18 are adopted in this assessment, and may be considered to be representative of likely exposure predictions at Forge Street. There is no specific receptor located on 25 Bessemer Street, although it is noted that R18 lies between the Proposal site and that address, and R18 may be used as a conservative assessment location for 25 Bessemer Street.

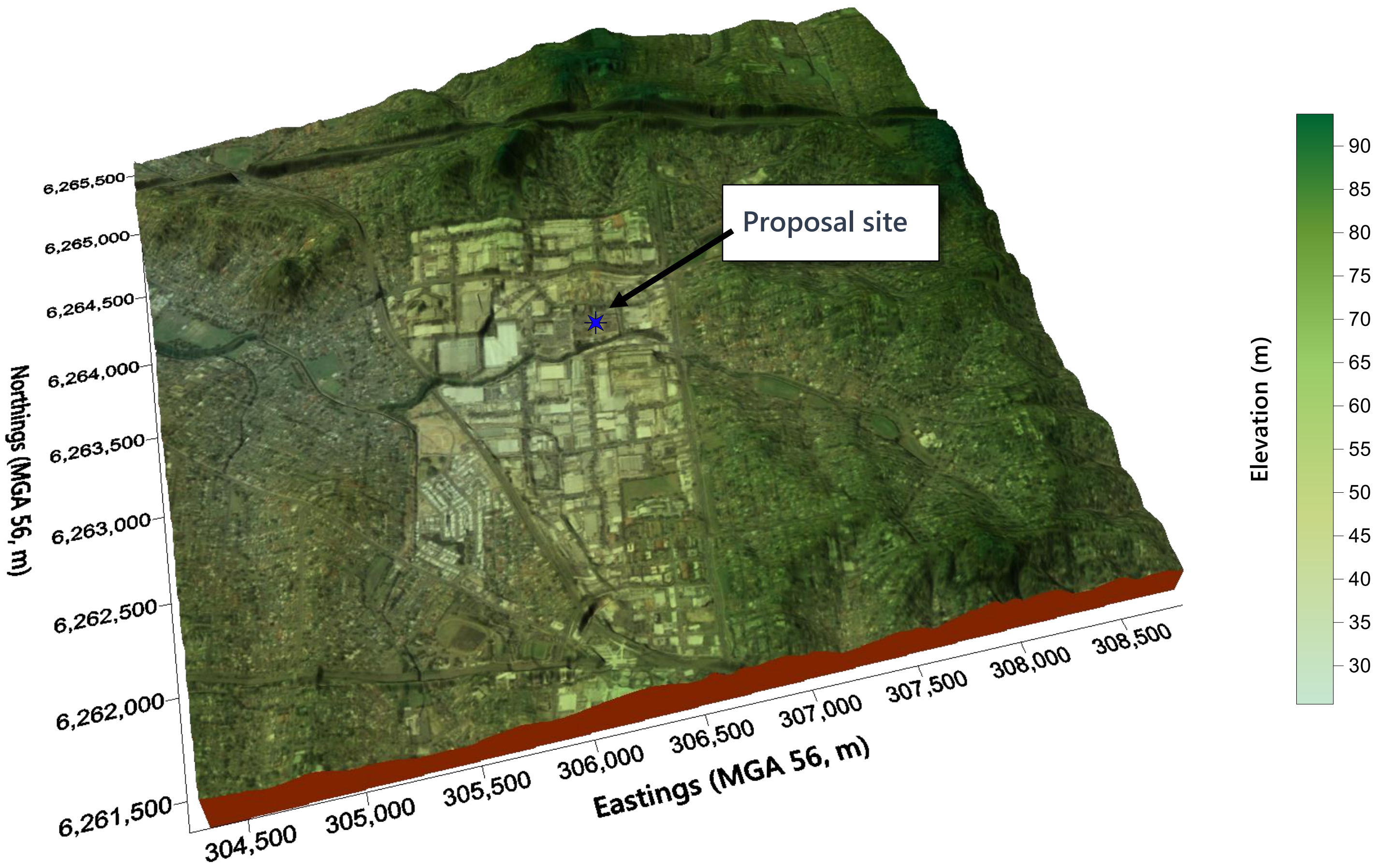
4.1.2. Uniform Receptor Locations

Additional to the sensitive receptors identified in **Section 4.1.1**, a grid of uniform receptor locations, has been used in the AQIA to allow presentation of contour plots of predicted impacts.

4.2. Topography

The elevation of the Proposal site is approximately 44 m Australian Height Datum (AHD). The topography between the Proposal site and nearest sensitive receptor locations is uncomplicated. A 3-dimensional representation of the topography surrounding the Proposal site is presented in **Figure 5** overleaf.

Figure 5 Three-dimensional representation of topography surrounding the Proposal site



Source: Northstar Air Quality

Note: MGA – Map Grid of Australia

4.3. 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 a number of surrounding Automatic Weather Stations (AWS). Meteorology is also measured by DPIE at a number of Air Quality Monitoring Station (AQMS) surrounding the Proposal site (refer **Section 4.4**).

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 A**.

A summary of the relevant AWS operated by BoM and the DPIE is provided in **Table 8** below (listed by proximity) and also displayed in **Figure 6** overleaf.

Table 8 Details of meteorological monitoring surrounding the Proposal site

Site Name	Source	Approximate Location (UTM)		Approximate Distance
		mE	mS	km
Prospect AQMS	DPIE	306 744	6 258 645	4.9
Rouse Hill AQMS	DPIE	305 670	6 271 042	7.4
Horsley Park Equestrian Centre AWS – Station # 67119	BoM	301 710	6 252 290	12.2
Sydney Olympic Park AWS – Station # 66212	BoM	321 583	6 245 405	17.4

Figure 6 Meteorological monitoring stations surrounding the Proposal site

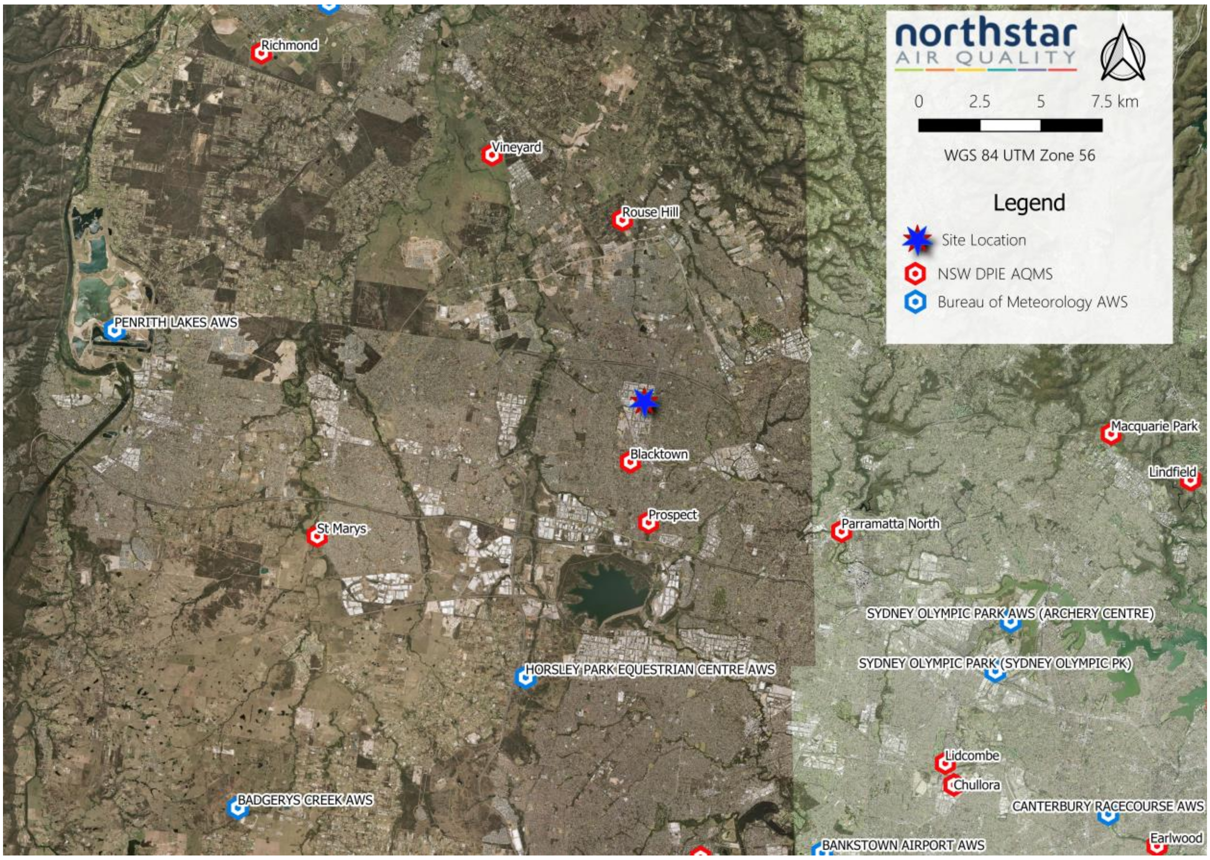


Image courtesy of Google Earth

Note: Blacktown AQMS decommissioned in 2004

The meteorological conditions measured at the identified meteorological stations, are presented in **Appendix A**.

It is considered that Prospect AQMS is most likely to represent the conditions at the Proposal site, based upon its proximity and lack of significant topographical features between the two locations. The wind roses presented in **Appendix A** indicate that from 2015 to 2019, winds at Prospect AQMS show similar wind distribution patterns across the years assessed, with a predominant south-westerly wind direction.

The majority of wind speeds experienced at Prospect AQMS over the 5-year period 2015 to 2019 are generally in the range <0.5 metres 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 an easterly direction. Winds of this speed are not frequent, occurring <0.1 % of the observed hours over the 5-year period.

Given the wind distributions across the years examined, data for the year 2018 has been selected as being appropriate for further assessment, as it best represents the general trend across the 5-year period studied. Reference should be made to **Appendix A** for further details.

4.4. Air Quality

4.4.1. DPIE Air Quality Monitoring Stations

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. This '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.

The Proposal site is located proximate to a number of AQMS operated by NSW DPIE (**Figure 6** and **Figure 7**).

Figure 7 Air Quality Monitoring Stations surrounding the Proposal site

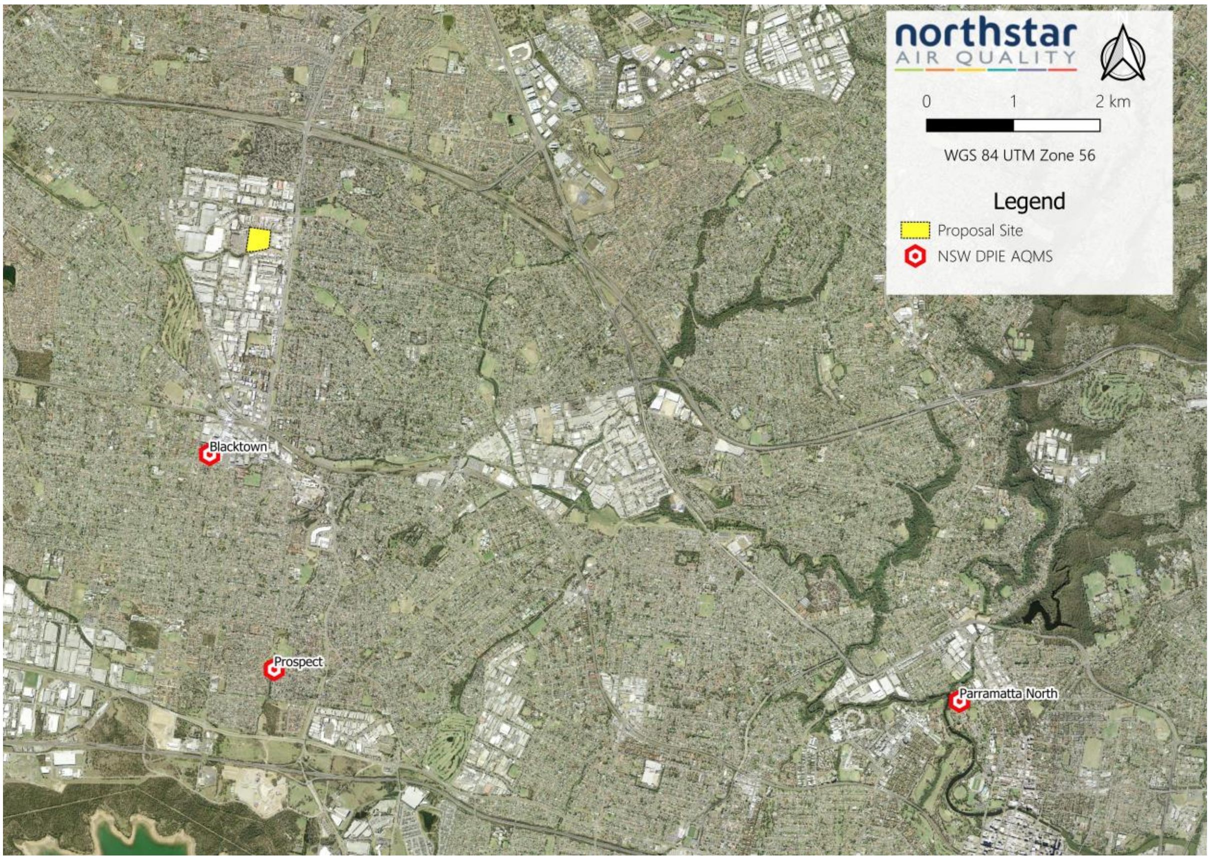


Image courtesy of Google Earth

Note: Blacktown AQMS decommissioned in 2004

It is noted that Blacktown AQMS has been decommissioned, and the closest active AQMS is noted to be located at Prospect and is generally considered to be the monitoring location most reflective of the conditions at the Proposal site.

Appendix B provides a detailed assessment of the background air quality monitoring data collected at the Prospect AQMS.

It is noted that none of the AQMS in proximity to the Proposal site measure Total Suspended Particulate (TSP) which is of relevance to the expected emissions from the Proposal. Based upon long-term historic monitoring data, a numerical relationship between TSP and PM_{10} has been established for the Sydney Metropolitan region. Based upon these data, a relationship between ambient concentrations of TSP : PM_{10} of 2.0551 : 1 is used to approximate background annual average TSP concentrations. This relationship is established and is used frequently to approximate background annual average TSP concentrations in similar locations (see **Appendix B**).

The impact assessment criteria used for deposited dust (see **Table 5**) are presented as (i) a cumulative deposition rate of 4 $g{\cdot}m^{-2}{\cdot}month^{-1}$ and (ii) a discrete deposition rate of 2 $g{\cdot}m^{-2}{\cdot}month^{-1}$. In lieu of a background deposition rate to derive a cumulative rate, the incremental impact assessment criterion (2 $g{\cdot}m^{-2}{\cdot}month^{-1}$) will be used. This is a commonly adopted approach when background deposition rates are not available, and is consistent with (ERM, 2015).

Table 9 presents a summary of the annual average per year (2014-2018) as measured at Prospect AQMS.

Table 9 Air Quality Background Concentrations

Pollutant	Annual average concentration ($\mu g{\cdot}m^{-3}$)				
	2014	2015	2016	2017	2018
PM_{10}	17.6	17.6	18.9	18.9	21.9
$PM_{2.5}$	7.5	8.2	8.7	7.7	8.5
NO_2	21.1	22.5	20.9	20.1	18.7
O_3	38.5	34.2	36.3	36.3	40.6

Source: NSW DPIE[4]

A detailed summary of the background air quality is presented in **Appendix B**, and a summary of the air quality monitoring data and assumptions used in this assessment are presented in **Table 10**, noting data over the calendar year 2018 has been used to be consistent with the meteorological data used in the assessment (see **Section 4.3**).

4 https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility

Table 10 Summary of background air quality used in the AQIA

Pollutant	Ave Period	Measured Value	Notes
Particles (as TSP) (derived from PM_{10})	Annual $\mu g \cdot m^{-3}$	45.01	Estimated on a TSP:PM_{10} ratio of 2.0551 : 1
Particles (as PM_{10}) (Prospect)	24-hour $\mu g \cdot m^{-3}$	Daily Varying	The 24-hour maximum for PM_{10} in 2018 was 113.3 $\mu g \cdot m^{-3}$ (exceeding the criterion)
	Annual $\mu g \cdot m^{-3}$	21.9	
Particles (as $PM_{2.5}$) (Prospect)	24-hour $\mu g \cdot m^{-3}$	Daily Varying	The 24-hour maximum for $PM_{2.5}$ in 2015 was 47.5 $\mu g \cdot m^{-3}$ (exceeding the criterion)
	Annual $\mu g \cdot m^{-3}$	8.5	
Dust deposition	Annual $g \cdot m^{-2} \cdot month^{-1}$	2.0	Difference in NSW DPIE maximum allowable and incremental impact criterion
Nitrogen dioxide (NO_2) (Prospect)	1-hour $\mu g \cdot m^{-3}$	104.6	Hourly max 1-hr average in 2018
	Annual $\mu g \cdot m^{-3}$	18.7	Annual average in 2018
Ozone (O_3) (Prospect)	1-hour $\mu g \cdot m^{-3}$	224.7	Hourly max 1-hr average in 2018
	Annual $\mu g \cdot m^{-3}$	39.8	Annual average in 2018

Note: Reference should be made to **Appendix B**

For context, in 2018 NSW experienced record temperatures and persistent dry conditions, with the entire State drought-declared in August 2018. The most extensive dust storm event occurred from 21 to 23 November 2018, when particle levels at many of the sites in the NSW air quality monitoring network exceeded the PM_{10} national standard. Ozone levels peaked in the warmer months from October to March (NSW Annual Air Quality Statement 2018).

On 28 December 2018, ozone levels above the national standards were recorded at Prospect.

In the instance of elevated background air quality conditions, the Approved Methods (NSW EPA, 2017) requires an AQIA to demonstrate that no additional exceedance of the air quality criteria are predicted as a consequence of the operation of the Proposal.

Background air quality monitoring of other pollutants assessed in this AQIA, including metals, are not routinely performed in NSW, or Australia. Although specific pollutant monitoring campaigns may be performed to identify and quantify risks surrounding specific emission sources. As such data is not available for the study area, background concentrations of other pollutants, including metals is assumed to be negligible. This is a commonly adopted assumption, and consistent with (ERM, 2015). Ozone (O_3) data is used to convert emissions of NO_X to NO_2 (see **Section 5.3**)

4.4.2. Exceptional Events

During 2018, local sources of air pollution, including hazard reduction burning, mining and industrial activity, and domestic wood heaters, affected air quality in some locations. Particle pollution (PM_{10} and $PM_{2.5}$), increased due to more frequent 'exceptional' events, such as dust storms, bushfires and hazard reduction burning.

In 2018, there were 51 days where exceptional events led to poor air quality, of which 25 days were affected by dust storms and 26 days were affected by bushfires or hazard reduction burning, and across NSW, most regions experienced some days of poor air quality due to dust storms. Increased hazard reduction burning, to manage bushfire risk, resulted in poor air quality in the Sydney region on some days during autumn and winter.

Annual $PM_{2.5}$ levels above the national standard were recorded at about half of the NSW air quality monitoring stations. This increase was mainly due to smoke from hazard reduction burning and from increased dust due to the drought (NSW OEH, 2018).

In 2018, air quality6 index (AQI) levels reached the 'hazardous' category (with an AQI greater than 200) on a total of 36 days. In Sydney, the majority of hazardous particle days (92 %) were due to smoke from large hazard reduction burns from April to August (NSW RFS, 2019), and a number of uncontrolled forest fires. Six of the hazardous days were due to dust storms, and these occurred in March, August and November (NSW Govt, 2018a), (NSW Govt, 2018b) The most extensive dust storm event occurred from 21 to 23 November 2018, when particle levels at many of the sites in the NSW air quality monitoring network exceeded the PM_{10} national standard. Sydney had 25 hazardous days in total as follow:

- 21 days in April (seven), May (seven), July (one), August (six) due to hazard reduction burns,
- one day each in April and July due to forest fires,
- one day in June due to a localised unidentified source and
- one day in November due to an extensive dust storm.

4.4.3. On-Site Monitoring

An ambient air quality monitoring program has historically been performed on site. The on-site monitoring includes measurement of PM_{10} using beta attenuation monitors (BAM) at two locations, named as "In Station" (currently located to the south-west of the Proposal site) and "Out Station" (currently located to the north of the Proposal site) , and meteorological monitoring at one location. For the purposes of this AQIA, data monitoring summary reports have been provided by S&P for the period Jan-Dec 2017, Jan-Dec 2018 and Feb 2020.

The locations of the monitoring locations are illustrated in **Figure 8**.

Figure 8 Sell and Parker Blacktown monitoring station locations

Source: Northstar Air Quality

The purpose of having the two monitoring locations is that during specific wind directions, the difference between the two measurements may be generally attributed to an on-site particulate contribution. When the wind is from the north north-east or south south-east directions, the influence of external contributions of particulate is likely to be less significant and the resultant change in measured concentration may be reasonably interpreted as an on-site contribution disregarding background. This metric is used by S&P to quantify on-site particulate emissions, and the 4-hour average PM_{10} concentration is used as an indicator to review the current particulate controls being deployed on site (see **Section 7.3** also).

However, when wind directions are from the east or west quadrants, the difference between the two measurements is less clearly identified and may be more attributed to off-site near-field sources of emissions. This may be more noticeable when the wind is from the western quadrant, and particulate emissions from the neighbouring Autorecyclers Pty Ltd may be a significant contributor under certain conditions. A paired-data correlation between the In-station and Out-station measurements is +0.638 and +0.630 for 2017 and 2018 respectively. The calculated coefficient indicates a reasonable correlation, but as it is not filtered by wind direction, it is influenced by cross-wind flows that do not reflect Proposal site activities.

The monitoring data has been collated from the monthly reports (as 24-hour PM_{10} measurements) and is summarised in **Table 11**. For each 24-hour average PM_{10} concentration, the difference between in In Station and Out Station concentration value has been calculated, irrespective of which station reported the higher value.

Table 11 S&P monitoring data summary (2017-2018)

Year	2017 (24-hr PM_{10} µg·m^{-3})			2018 (24-hr PM_{10} µg·m^{-3})		
Location	In Station	Out Station	Difference	In Station	Out Station	Difference
Mean	29.5	31.2	13.3	32.5	31.1	11.9
Standard deviation	24.7	28.6	18.0	27.3	22.7	17.5
Skew	*2.1*	*3.0*	*2.8*	*2.7*	*1.8*	*4.6*
Kurtosis	*5.8*	*11.4*	*11.9*	*11.9*	*4.2*	*35.8*
Minimum	2.4	2.4	0.0	3.2	3.3	0.0
Percentile 25	13.2	15.2	1.5	13.7	15.7	1.8
Percentile 50	21.9	22.4	5.7	24.9	25.0	5.5
Percentile 75	39.1	36.7	20.2	41.0	39.3	17.2
Percentile 90	62.0	56.9	34.0	65.3	58.1	32.2
Percentile 95	75.3	89.8	45.1	78.2	80.6	40.4
Percentile 99	131.3	140.8	89.6	135.9	103.3	64.4
Maximum	155.8	213.2	135.6	218.4	154.0	177.4

Deriving data useful for the AQIA is problematic due to the highly variable contributions of:

- background contributions to the measured concentration values, although these should generally contribute a similar concentration at each monitoring location (baring analyser response and the influence of micro-scale wind flows around each monitoring site);
- the variability of short-term (i.e. minutes) on-site dust-generating events to potentially affect longer-term (24-hour) concentration measurements;
- the influence emissions from the Autorcyclers Pty Ltd, and other proximate sources to the measured concentrations.

The maximum measured 24-hour PM_{10} differential over the period 2017 – 2018 is measured on 3rd August 2018 as 177 µg·m^{-3}. An excerpt from the raw 1-hour PM_{10} data report over 3rd August 2018 is reproduced below.

Table 12 S&P monitoring data excerpt (3 Aug 2018)

Date/Time	PM_{10} In station (µg·m^{-3})	PM_{10} Out station (µg·m^{-3})	WS (m·s^{-1})	WD (°)	Sigma (°)	AT 2m (°C)	AT 10m (°C)	SR (W·m^{-2})	Rain (mm)
3/08/2018 14:00	280	85	2.5	335	33	22.4	22.2	506	0.0
3/08/2018 15:00	107	33	1.7	349	40	23.1	22.9	392	0.0

Date/Time	PM_{10} In station ($\mu g \cdot m^{-3}$)	PM_{10} Out station ($\mu g \cdot m^{-3}$)	WS ($m \cdot s^{-1}$)	WD (°)	Sigma (°)	AT 2m (°C)	AT 10m (°C)	SR ($W \cdot m^{-2}$)	Rain (mm)
3/08/2018 16:00	-	21	1.7	5	50	23.3	23.2	243	0.0
3/08/2018 17:00	855	67	1.7	356	51	22.2	22.2	84	0.0
3/08/2018 18:00	269	34	0.9	7	51	20.5	20.6	6	0.0
3/08/2018 19:00	71	15	0.9	5	52	19.8	19.9	5	0.0
3/08/2018 20:00	-	29	0.8	4	41	19.6	19.6	6	0.0
3/08/2018 21:00	1244	15	0.9	15	36	18.6	18.7	6	0.0
3/08/2018 22:00	359	10	1.8	332	27	18.9	18.9	6	0.0
3/08/2018 23:00	26	62	3.6	299	29	18.3	18.3	3	0.0
4/08/2018 00:00	465	92	2.7	308	25	15.8	15.9	4	0.0

The selected data above shows high measured 1-hour PM_{10} differentials at the "In station" which is located to the south of the Proposal site, with a peak of >1 $mg \cdot m^{-3}$ at 21:00. The wind speeds are generally typical of a light breeze blowing from the northern quadrant (315° to 45°) which would represent conditions likely to transport on-site emissions to the In station monitoring station.

It is noted that the 1-hour PM_{10} measurements are not a compliance metric, but it does show that under certain conditions it is a useful tool for identifying potential off-site impacts and providing a trigger for appropriate management response.

In light of the above limitations, the most useful metric for the AQIA is the average differential 24-hour PM_{10} concentration of 13.3 $\mu g \cdot m^{-3}$ and 11.2 $\mu g \cdot m^{-3}$ for 2017 and 2018 respectively which represents the average 24-hour on-site increment, albeit acknowledged to be an over-estimation based upon the above factors.

The time series plots of the measured 24-hour PM_{10} concentrations are presented below in **Figure 9** for 2017 (left) and 2018 (right). The corresponding calculated difference is illustrated in **Figure 10**.

Figure 9 S&P 24-hr PM_{10} monitoring data summary (2017 left) (2018 right)

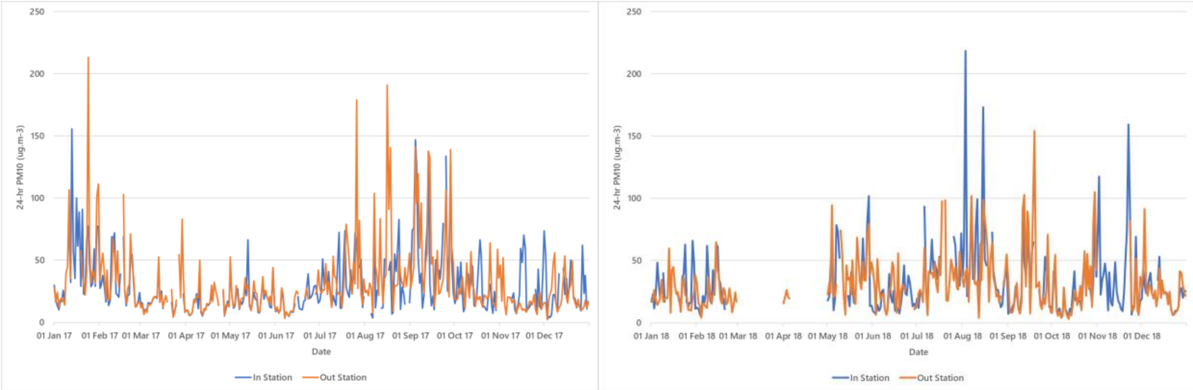
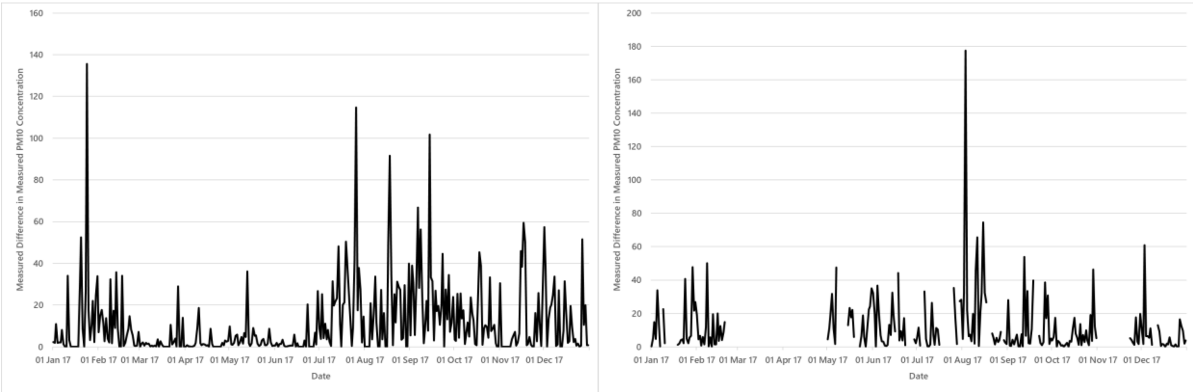


Figure 10 Difference in 24-hr PM_{10} monitoring data (2017 left) (2018 right)



This information is provided for context and descriptive purposes and is not used as part of this AQIA.

5. METHODOLOGY

5.1. Dispersion Modelling

A dispersion modelling assessment has been performed using the NSW EPA approved CALPUFF Atmospheric Dispersion Model. The modelling has been performed using TAPM and processing with CALTAPM, CALMET and CALPUFF, in accordance with the general requirements of the Approved Methods (NSW EPA, 2017). This approach is consistent with that adopted in ERM (2015) which supported the Original Approval.

Table 13 TAPM and CALMET Configuration

Model	Parameter	Value
TAPM (4.0.5)	Grid points	35 × 35 × 25
	Grid resolution (km)	30, 10, 3, 1
	Centre point (UTM)	306 258, 6 263 597
	Period	1 January to 31 December 2018
CALMET (6.5.0)	Observation mode	No obs
	Grids	120 × 120
	Vertical levels	12
	Land use	European Space Agency GlobCover Portal
	Elevation	90 m SRTM

An assessment of the impacts of the operation of activities at the Proposal site has been performed, which characterises the likely day-to-day (and hour-to-hour) operation, approximating average operational characteristics which are appropriate to assess against longer term (annual average) and shorter term (24-hr and 1-hr) criteria for emissions to air.

The modelling scenario provides an indication of the air quality impacts of the operation of activities at the Proposal site. The predictions are termed 'incremental impacts'. Added to the incremental impacts are background air quality concentrations (where available and discussed in **Section 4.4** and **Appendix B**), which represent the air quality which may be expected within the area surrounding the Proposal site, without the impacts of the Proposal itself. The addition of background assumptions to the incremental impacts derived the predicted 'cumulative impacts'.

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

5.2. Emissions Estimation

5.2.1. Air Pollutants

The estimation of emissions from a process is typically performed using direct measurement or through the application of factors, which appropriately represent the processes under assessment. This assessment has adopted emission factors from the US EPA AP42 emission factor compendium (US EPA, various) specifically Chapter 13 (Miscellaneous Sources) (USEPA, 2011) for the assessment of particulate matter emissions resulting from batch drop processes which represent material transfer points, and Chapter 11 (Mineral Products Industry) which were used to assess the emissions from wind erosion.

Data has been provided by the Applicant to approximate the activities being performed at the Proposal site on a day-to-day basis. These data have been split into disaggregated material flows through the process (e.g. ferrous and non-ferrous materials) and estimated for (a) 350 000 tpa material processing and (b) 600 000 tpa. The emissions inventory is presented in **Appendix C**. **Table 14** presents a summary of the emission sources modelled in the AQIA. The naming convention has been retained from (ERM, 2015) to provide consistency and assist review.

Table 14 Modelled emission source locations and descriptions

Ref	UTM mE	UTM mS	Description
Point Sources			
C1	306470	6263575	Oxy-acetylene cutting
WSS01	306567	6263616	Hammermill wet scrubber stack (EPL Point 3)
Material Handling			
MH01	306607	6263635	Non-ferrous metal transferred to the non-ferrous processing building
MH02	306519	6263572	Transfer of raw material directly to the inspected stockpile of scrap metal (bypass pre-shredder)
MH03	306503	6263664	Transfer of raw material directly to the inspected stockpile of scrap metal (bypass pre-shredder)
MH04	306509	6263576	Transfer of raw material from stockpile to pre-shredder
MH05	306522	6263569	Transfer of raw material from stockpile to pre-shredder
MH06	306523	6263581	Transfer of pre-shredder output to a truck to inspected stockpile of scrap metal close to the conveyor into the hammer mill
MH07	306503	6263664	Transfer of pre-shredder output to a truck to inspected stockpile of ap metal close to the conveyor into the hammer mill
MH08	306503	6263664	Transfer of the inspected stockpile of scrap metal close to the conveyor onto the hammer mill conveyor
MH09	306483	6263652	Transfer of the inspected stockpile of scrap metal close to the conveyor onto the hammer mill conveyor
MH10	306503	6263664	Ferrous metals are collected from the stockpile by FEL and loaded into trucks
MH11	306533	6263680	Ferrous metals are collected from the stockpile by FEL and loaded into trucks
Material Transfer Points			

Ref	UTM mE	UTM mS	Description
TP01	306525	6263577	Pre-shredder drop point
TP02	306517	6263691	The cleaned fragmented material (on a conveyor C1) passes under a drum magnet, where ferrous metals are dropped onto the picking conveyor (C2)
TP03	306529	6263701	Ferrous metals transferred from C2, where operators remove remaining non-ferrous materials to C3
TP04	306541	6263711	Ferrous metals are conveyed to the product stockpile
TP05	306512	6263687	Non-ferrous materials drop beneath the drum magnet to a conveyor (C4) that runs perpendicular to the ferrous product
TP06	306494	6263732	Transfer point at conveyor bend 1
TP07	306563	6263721	Transfer point at conveyor bend 2
TP08	306551	6263643	Transfer point at conveyor bend 3
Conveyors			
CV01 - 33	various	various	Material transfer by fully enclosed conveyor. Fully controlled.
Truck Dumping Materials			
TRKD01	306502	6263580	Truck dumping at raw material delivery
TRKD02	306503	6263664	Truck carries pre-shredder output to the inspected stockpile of scrap metal close to the conveyor into the hammer mill.
Wind Erosion from Stockpiles			
WE01	306492	6263587	Scrap stockpile
WE02	306505	6263575	Scrap stockpile
WE03	306524	6263583	Post pre-shredder stockpile 1- at pre-shredder
WE04	306503	6263664	Post pre-shredder stockpile 2- at hammer mill
WE05	306542	6263709	Ferrous product stockpile.
WE06	306544	6263695	Ferrous product stockpile.

The location of the sources listed in is illustrated in **Figure 11**. Note that wind erosion sources have been assessed as an area source, the points identified in **Table 14** and **Figure 11** are provided to allow location of those sources only.

Figure 11 Modelled emission source locations

Assumptions regarding various air quality controls have been derived from (ERM, 2015) as this is the latest AQIA study for the Proposal site and the assumptions underpin the Original Approval and also controls imposed through the EPL. The following is noted:

- The surface of the site is entirely paved and swept regularly to manage deposited silting to acceptable levels. Consequently, emissions from vehicle and plant movements on-site are considered negligible (NPI, 2012);
- All conveyor points (CV1-CV33) are fully sealed to isolate the material from the ambient environment. Emissions from all conveyors are assumed to be negligible;
- All material handling processes (MH1-MH11) have actively operating water misting systems, and a control factor of 70 % has been applied;
- Truck dumping will only be operated with dust suppression through water sprays, and a control factor of 70 % has been adopted;
- Emissions of PM_{10} from the Hammermill has been assumed to represent 47 % of the TSP estimate, in accordance with (SKM, 2005), and similarly emissions of $PM_{2.5}$ are assumed to represent 32 %(w/w) of PM_{10}.

- Metals from the Hammermill are assumed to be speciated by mass fraction of $PM_{2.5}$ consistently with that assessed by the USEPA[5] as Cr (as Cr_{VI}) 0.04 %(w/w), Cu 0.1 %(w/w); Fe 5.76 %(w/w); Pb 0.49 %(w/w); Mn 0.088 %(w/w); Ni 0.031 %(w/w); Ti 0.025 %(w/w); V 0.001 %(w/w); and Zn 2.1 %(w/w).

Reference should be made to **Appendix C** for the details of the emission estimation.

All material handling, transfer points, conveyors and truck dumping emissions are derived from the AP-42 batch drop estimation. Truck dumping emissions are assumed to be hourly varying with wind speed. Wind erosion sources (material stockpiles) are assumed to be hourly varying.

Dispersion modelling has been performed for the Proposal only. Emissions estimations for both the current (350 000 tpa) and proposed (600 000 tpa) operations can be seen in **Appendix C**.

The emissions from the Hammermill Wet Scrubber Stack (source WSS01) are regulated under EPL 11555. The emission concentration limit values applicable to this source are presented in **Table 4** (see **Section 3.1**). To facilitate a conservative assessment, emissions from WSS01 are assumed to be at the emission limit values prescribed under EPL 11555 for the current and proposed scenario.

5.2.2. Odour

In this AQIA it is assumed that the sources generating odour emissions are the dour emission sources are limited to the oxy-acetylene cutter (source C1) and the Hammermill Wet Scrubber Stack (source WSS01), which is consistent with (ERM, 2015). Reference should be made to **Appendix C** for details.

A peak to mean ratio of 2.3 has been applied to the predicted 1-hour odour impacts.

5.3. NO_X to NO_2 Conversion

The emission rates of oxides of nitrogen (NO_X) have been modelled as nitrogen dioxide (NO_2). Approximately 90% - 95% of NO_X from a combustion process will be emitted as NO, with the remaining 5% - 10% emitted directly as NO_2. Over time and after the point of discharge, NO in ambient air will be transformed by secondary atmospheric reactions to form NO_2, and this reaction often occurs at a considerable distance downwind from the point of emission, and by which time the plume will have dispersed and diluted significantly from the concentration at point of discharge.

Air quality impact assessments need to account for the conversion of NO to NO_2 to enable a comparison against the air quality criterion for NO_2. To perform this, various techniques are common, which are briefly outlined below:

5 https://www.epa.gov/air-emissions-modeling/speciate

- **100% conversion**: the most conservative assumption is to assume that 100% of the total NO_X emitted is discharged as NO_2, and that further reactions do not occur.
- **Jansen method**: where the location is represented by good monitoring data for NO and NO_X, the empirical relationship between NO and NO_2 may be used to derive 'steady state' relationships.
- **Ozone limiting method**: this method uses contemporaneous ozone data to estimate that rate at which NO is oxidised to NO_2 hour-on-hour using an established relationship.

This AQIA has used an assumption of 100 % conversion of NO_X to NO_2, in accordance with the methodology described in (NSW EPA, 2017).

6. RESULTS

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

- Incremental impact – relates to the concentrations predicted as a result of the construction and operation of the Proposal in isolation.
- Cumulative impact – relates to the incremental concentrations predicted as a result of the construction and operation of the Proposal PLUS the background air quality concentrations discussed in **Section 4.4**.

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**

Reference should be made to **Appendix D** which tabulates the results of the modelling at all receptor locations, irrespective of whether they represent community locations, industry receptors or on-site receptors.

The isopleth plots of predicted (i) annual average incremental TSP concentrations, (ii) incremental 24-hour PM_{10} concentrations (iii) incremental 24-hour $PM_{2.5}$ concentrations and (iv) incremental 1-hour NO_2 concentrations are presented in **Appendix E**.

Where incremental impacts are predicts as less than (<) the relevant reporting range, the cumulative impact has been calculated at 100 % of the reporting threshold.

6.1. Annual Average TSP, PM_{10} and $PM_{2.5}$

Incremental and cumulative annual average TSP, PM_{10} and $PM_{2.5}$ impacts are presented in **Table 15** for R1-R9 and R20-R33. R10-R19 are industrial receptors and are therefore not relevant to assess annual average impacts. Similarly, R34 and R35 are on-site monitoring locations and are therefore not relevant to assess annual average impacts.

Table 15 Predicted incremental annual average TSP, PM_{10} and $PM_{2.5}$ concentrations

Receptor	Annual Average Concentration (µg·m^{-3})								
	TSP			PM_{10}			$PM_{2.5}$		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
R1	0.5	45.0	45.5	0.3	21.9	22.2	<0.1	8.5	8.6
R2	0.5	45.0	45.5	0.3	21.9	22.2	<0.1	8.5	8.6
R3	0.4	45.0	45.4	0.3	21.9	22.2	<0.1	8.5	8.6
R4	0.3	45.0	45.3	0.2	21.9	22.1	<0.1	8.5	8.6
R5	0.3	45.0	45.3	0.2	21.9	22.1	<0.1	8.5	8.6
R6	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R7	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R8	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R9	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R20	0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6
R21	<0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6
R22	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R23	<0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6
R24	0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6
R25	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R26	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R27	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R28	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R29	0.4	45.0	45.4	0.3	21.9	22.2	<0.1	8.5	8.6
R30	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R31	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R32	0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6
R33	1.6	45.0	46.6	<0.1	21.9	22.0	<0.1	8.5	8.6
Criterion	-		90	-		25			8

The results do not predict an exceedance of the annual average TSP or PM_{10} criteria. The annual average $PM_{2.5}$ criterion is predicted to be exceeded, but these impacts are associated with a background contribution already exceeding the criterion (see also **Section 4.4** and **Table 10**).

The assessment does not predict the operation of the Proposal would lead to any additional exceedances of the relevant criteria.

6.2. 24-hour Average PM_{10} and $PM_{2.5}$

6.2.1. Incremental Impacts

Maximum incremental 24-hour PM_{10} and $PM_{2.5}$ impacts are presented in **Table 16** for R1-R9 and R20-R33. R10-R19 are industrial receptors and are therefore not relevant to assess 24-hour average impacts. Similarly, R34 and R35 are on-site monitoring locations and are therefore not relevant 24-hour average impacts as they do not evaluate potential exposure locations.

Table 16 Predicted incremental 24-hour average PM_{10} and $PM_{2.5}$ concentrations

Receptor	Maximum Incremental 24-hour Average Concentration ($\mu g \cdot m^{-3}$)	
	PM_{10}	$PM_{2.5}$
R1	5.3	0.9
R2	6.4	1.1
R3	4.5	0.8
R4	2.5	0.4
R5	1.8	0.3
R6	2.0	0.3
R7	2.2	0.4
R8	1.8	0.3
R9	1.8	0.3
R20	1.2	0.2
R21	1.0	0.2
R22	2.8	0.5
R23	1.6	0.3
R24	1.6	0.3
R25	2.1	0.4
R26	1.7	0.3
R27	2.5	0.4
R28	1.8	0.3
R29	4.0	0.7
R30	2.9	0.5
R31	2.0	0.3
R32	1.5	0.3
R33	1.0	0.2
Max	**6.4 (R2)**	**1.1 (R2)**

6.2.2. Cumulative Impacts

Cumulative impacts are assessed as incremental impact aggregated with the background concentration assumptions discussed in **Section 4.4** and **Appendix B**, and are presented in **Table 17** and **Table 18**.

Results are presented for the receptor at which the highest incremental PM_{10} and $PM_{2.5}$ impacts have been predicted, and also for the receptors at which the highest cumulative impacts (increment plus background) have been predicted. These may often 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 background, and the right side shows the total predicted concentration on days with the highest predicted incremental concentrations. Correspondingly, **Table 17** presents impacts at R2 (for PM_{10}) and R2 and R28 (for $PM_{2.5}$).

The left side of the tables show the predicted concentration on days with the highest cumulative impacts (typically driven by high background concentrations), and the right side shows the total predicted concentration on days with the highest predicted incremental concentrations.

Table 17 Predicted cumulative 24-hour average PM_{10} concentrations

Date	24-hour average PM_{10} concentration R2 (µg m^{-3})			Date	24-hour average PM_{10} concentration R2 (µg m^{-3})		
	Incremental Impact	Background	Cumulative Impact		Incremental Impact	Background	Cumulative Impact
22/11/2018	0.5	113.3	113.8	12/07/2018	6.4	20.0	26.4
19/03/2018	<0.1	70.2	70.3	13/06/2018	4.3	14.1	18.4
28/05/2018	<0.1	65.8	65.9	27/07/2018	3.6	31.2	34.8
18/07/2018	2.8	61.9	64.7	22/06/2018	2.8	22.7	25.5
15/02/2018	<0.1	61.6	61.7	23/05/2018	2.8	29.3	32.1
29/05/2018	<0.1	58.7	58.8	18/07/2018	2.8	61.9	64.7
21/11/2018	0.2	55.7	55.9	17/08/2018	2.6	20.0	22.6
19/07/2018	<0.1	54.4	54.5	23/06/2018	2.6	18.9	21.5
18/03/2018	1.5	47.9	49.4	26/08/2018	2.5	19.2	21.7
14/04/2018	<0.1	47.8	47.9	21/05/2018	2.4	17.5	19.9
Criterion		50		Criterion		50	
These data represent the highest Cumulative Impact 24-hour PM_{10} predictions outlined in red as a result of the operation of the project.				These data represent the highest Incremental Impact 24-hour PM_{10} predictions outlined in blue as a result of the operation of the project.			

The results predict exceedances of the 24-hour PM_{10} criterion, although these are shown to be driven by elevated background concentrations already exceeding the criterion (see also **Section 4.4** and **Table 10**).

Critically, the assessment does not predict the operation of the Proposal would lead to any additional exceedances of the relevant 24-hour PM_{10} criterion.

Table 18 Predicted cumulative 24-hour average $PM_{2.5}$ concentrations

Date	24-hour average $PM_{2.5}$ concentration R28 ($\mu g \cdot m^{-3}$)			Date	24-hour average $PM_{2.5}$ concentration R2 ($\mu g \cdot m^{-3}$)		
	Incremental Impact	Background	Cumulative Impact		Incremental Impact	Background	Cumulative Impact
29/05/2018	0.3	47.5	47.8	12/07/2018	1.1	13.8	14.9
28/05/2018	<0.1	42.5	42.6	13/06/2018	0.7	6.9	7.6
6/05/2018	<0.1	27.1	27.2	27/07/2018	0.6	19.5	20.1
27/05/2018	<0.1	27.0	27.1	22/06/2018	0.5	17.0	17.5
15/07/2018	0.3	23.1	23.4	23/05/2018	0.5	11.3	11.8
9/05/2018	0.1	21.7	21.8	26/08/2018	0.5	18.4	18.9
25/04/2018	<0.1	20.6	20.7	18/07/2018	0.5	8.9	9.4
8/05/2018	<0.1	19.9	20.0	23/06/2018	0.4	16.1	16.5
27/07/2018	0.1	19.5	19.6	17/08/2018	0.4	9.4	9.8
26/08/2018	0.2	18.4	18.6	2/08/2018	0.4	12.9	13.3
Criterion		25		Criterion		25	
These data represent the highest Cumulative Impact 24-hour PM_{10} predictions outlined in red as a result of the operation of the project.				These data represent the highest Incremental Impact 24-hour PM_{10} predictions outlined in blue as a result of the operation of the project.			

The results predict exceedances of the 24-hour $PM_{2.5}$ criterion, although these are shown to be driven by elevated background concentrations already exceeding the criterion (see also **Section 4.4** and **Table 10**).

Critically, the assessment does not predict the operation of the Proposal would lead to any additional exceedances of the relevant 24-hour $PM_{2.5}$ criterion.

6.3. Nitrogen Dioxide

Incremental and cumulative 1-hour and annual average NO_2 impacts are presented in **Table 19**. The results schedules report concentrations at R1-R33, as those receptor locations are relevant to a 1-hour averaging period. The industrial receptor locations are shown in slightly different shading to assist with interpretation. The results at R34 and R35 are not shown as they are on-site monitoring locations and are not representative of potential off-site exposure locations.

It is noted that the assessment assumes a 100 % conversion of NO_X to NO_2 (see **Section 5.3**).

Table 19 Predicted incremental 1-hour and annual average NO_2 concentrations

Rec.	Nitrogen dioxide (NO_2) concentration ($\mu g \cdot m^{-3}$)					
	1 hour			Annual Average		
	Increment	Background	Cumulative	Increment	Background	Cumulative
R1	0.8	104.6	105.4	<0.1	18.7	18.8
R2	0.8	104.6	105.4	<0.1	18.7	18.8
R3	0.7	104.6	105.3	<0.1	18.7	18.8
R4	0.2	104.6	104.8	<0.1	18.7	18.8
R5	0.2	104.6	104.8	<0.1	18.7	18.8
R6	0.2	104.6	104.8	<0.1	18.7	18.8
R7	0.1	104.6	104.7	<0.1	18.7	18.8
R8	0.2	104.6	104.8	<0.1	18.7	18.8
R9	0.3	104.6	104.9	<0.1	18.7	18.8
R10	2.4	104.6	107.0	<0.1	18.7	18.8
R11	4.2	104.6	108.8	0.1	18.7	18.8
R12	5.7	104.6	110.3	0.2	18.7	18.9
R13	5.8	104.6	110.4	0.1	18.7	18.8
R14	6.6	104.6	111.2	0.1	18.7	18.8
R15	6.7	104.6	111.3	<0.1	18.7	18.8
R16	3.9	104.6	108.5	<0.1	18.7	18.8
R17	1.7	104.6	106.3	<0.1	18.7	18.8
R18	1.0	104.6	105.6	<0.1	18.7	18.8
R19	3.6	104.6	108.2	<0.1	18.7	18.8
R20	0.1	104.6	104.7	<0.1	18.7	18.8
R21	<0.1	104.6	104.7	<0.1	18.7	18.8
R22	0.3	104.6	104.9	<0.1	18.7	18.8
R23	<0.1	104.6	104.7	<0.1	18.7	18.8
R24	<0.1	104.6	104.7	<0.1	18.7	18.8
R25	0.1	104.6	104.7	<0.1	18.7	18.8
R26	0.2	104.6	104.8	<0.1	18.7	18.8
R27	0.1	104.6	104.7	<0.1	18.7	18.8
R28	0.2	104.6	104.8	<0.1	18.7	18.8
R29	0.6	104.6	105.2	<0.1	18.7	18.8
R30	0.2	104.6	104.8	<0.1	18.7	18.8
R31	0.3	104.6	104.9	<0.1	18.7	18.8
R32	0.1	104.6	104.7	<0.1	18.7	18.8
R33	0.1	104.6	104.7	<0.1	18.7	18.8
Criterion		246			62	

The results do not predict any exceedances of the 1-hour or annual average NO_2 criteria.

6.4. Metals

Metals are assessed as the respective fraction of $PM_{2.5}$, as indicated in **Section 5.2** as Cr (as Cr_{VI}) 0.04 %(w/w), Cu 0.1 %(w/w); Fe 5.76 %(w/w); Pb 0.49 %(w/w); Mn 0.088 %(w/w); Ni 0.031 %(w/w); Ti 0.025 %(w/w); V 0.001 %(w/w); and Zn 2.1 %(w/w).

The maximum incremental 1-hour $PM_{2.5}$ prediction is 25.4 $\mu g \cdot m^{-3}$ at R11 (an industrial receptor). Accounting for the contribution of site-wide emissions rather than just the Hammermill in isolation and the above mass fractions derives maximum 1-hour concentrations of the following:

- Cr (assessed as Cr_{VI}) 0.01 $\mu g \cdot m^{-3}$ (11.3 % of the criterion)
- Cu 0.03 $\mu g \cdot m^{-3}$ (0.1 % of the criterion)
- Fe 1.46 $\mu g \cdot m^{-3}$ (1.6 % of the criterion)
- Mn 0.02 $\mu g \cdot m^{-3}$ (0.1 % of the criterion)

Lead (Pb) has an annual average criterion. The maximum (non-industrial) concentration has been used for the assessment. The maximum annual average $PM_{2.5}$ prediction of <0.1 $\mu g \cdot m^{-3}$ and a Pb fraction of 0.49 % derives an annual average lead concentration of 0.0005 $\mu g \cdot m^{-3}$ (0.1 % of the criterion).

Background concentrations of metals are assumed to be negligible (see **Section 4.4.1**), and therefore the assessment considers incremental impacts only, or alternatively, the incremental impact is equal to the cumulative impact.

The results do not predict any exceedances of the respective 1-hour metals criteria nor the annual average Pb criterion.

6.5. Annual Average Dust Deposition

Incremental and cumulative impacts are presented in **Table 20**.

Table 20 Predicted incremental & cumulative dust deposition rates

Receptor	Annual Average Dust Deposition ($g \cdot m^{-2} \cdot month^{-1}$)		
	Incremental Impact	Background	Cumulative Impact
R1	<0.1	2.0	2.1
R2	<0.1	2.0	2.1
R3	<0.1	2.0	2.1
R4	<0.1	2.0	2.1
R5	<0.1	2.0	2.1
R6	<0.1	2.0	2.1
R7	<0.1	2.0	2.1
R8	<0.1	2.0	2.1
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	<0.1	2.0	2.1
R16	<0.1	2.0	2.1
R17	<0.1	2.0	2.1
R18	<0.1	2.0	2.1
R19	<0.1	2.0	2.1
R20	<0.1	2.0	2.1
R21	<0.1	2.0	2.1
R22	<0.1	2.0	2.1
R23	<0.1	2.0	2.1
R24	<0.1	2.0	2.1
R25	<0.1	2.0	2.1
R26	<0.1	2.0	2.1
R27	<0.1	2.0	2.1
R28	<0.1	2.0	2.1
R29	<0.1	2.0	2.1
R30	<0.1	2.0	2.1
R31	<0.1	2.0	2.1
R32	<0.1	2.0	2.1
R33	<0.1	2.0	2.1
Criterion	2	-	4

The results do not predict any exceedances of the annual average dust deposition rate.

6.6. Odour

Incremental 99th percentile odour impacts are presented in **Table 21** at receptors R1-R9 and R20-R33 representing locations where amenity impacts are to be managed. Results for R10-R19 (industrial locations) are presented, although these should not be compared to the odour impact criterion of 2 OU with cuation as they are not representative of typical sensitive exposure locations, although it is noted that the predictions are all lower than the odour criterion in any case.

Table 21 Predicted incremental 99th percentile odour impacts

Receptor	99th percentile nose response time odour concentration (OU)
R1	0.2
R2	0.2
R3	0.2
R4	0.1
R5	0.1
R6	0.1
R7	0.1
R8	0.1
R9	0.1
R10	*0.9*
R11	*1.1*
R12	*1.1*
R13	*1.0*
R14	*0.8*
R15	*0.8*
R16	*0.9*
R17	*0.5*
R18	*0.4*
R19	*1.0*
R20	0.1
R21	0.0
R22	0.1
R23	0.0
R24	0.1
R25	0.1
R26	0.1
R27	0.1
R28	0.1
R29	0.2
R30	0.1

Receptor	99th percentile nose response time odour concentration (OU)
R31	0.1
R32	0.1
R33	0.1
Criterion	2.0

The assessment does not predict any exceedance of the 2 OU odour impact criterion at any receptors, nor at any industrial assessment locations.

In accordance with the requirements of the POEO (see **Section 3.3**) odour is to be assessed and controlled from each premises to not give rise to offensive odour.

Correspondingly, odour is assessed as discrete emissions only although the potential cumulative impacts are discussed considering the AQIA supporting the neighbouring operations of Autorecyclers Pty Ltd (see **Section 2.3**) in **Section 7.2**.

7. DISCUSSION AND CONCLUSION

7.1. Compliance with Air Quality Criteria

The prediction of potential impacts associated with operational activities has been performed in general accordance with the requirements of the NSW Approved Methods (NSW EPA, 2017), using an approved and appropriate dispersion modelling technique. The estimation of emissions has been performed using referenced emission factors, and this is documented in **Section 5.2**.

The predicted incremental and cumulative impacts from the operation of the Proposal are presented in **Section 6**, which may be compared to the relevant air quality criteria outlined in **Section 3**. Based upon the assumptions presented in this report, the AQIA does not predict there to be any exceedances of the air quality criteria with the exception of:

- Annual average $PM_{2.5}$, which is associated with a background $PM_{2.5}$ concentration of 8.5 $\mu g{\cdot}m^{-3}$ (already exceeding the criterion of 8.0 $\mu g{\cdot}m^{-3}$) (see **Section 6.1**);
- 24-hour PM_{10} at R1 which is caused by a background 24-hour PM_{10} concentration of 68.7 $\mu g{\cdot}m^{-3}$ (already exceeding the criterion) (see **Section 0**);
- 24-hour $PM_{2.5}$ at R2 on eight 24-hour periods, caused by daily-varying background 24-hour $PM_{2.5}$ concentrations already exceeding the 50 $\mu g{\cdot}m^{-3}$ criterion) (see **Section 0**);
- 24-hour $PM_{2.5}$ at R2 on four 24-hour occasions which is associated with a background 24-hour $PM_{2.5}$ concentration already exceeding the 25 $\mu g{\cdot}m^{-3}$ (see **Section 0**).

On all occasions of predicted exceedances of the 24-hour PM_{10} and $PM_{2.5}$ criteria, the assessment is driven by elevated background conditions, that would give rise to exceedances irrespective of any contribution of the proposal site:

7.2. Aggregated Impacts with Autorecyclers Pty ltd

Reference has been made to the AQIA (TAS, 2019) submitted as part of the EIS for the extension of throughput to 130 000 tpa at the neighbouring site (see **Section 2.3**).

To facilitate the assessment of aggregated potential impacts, the discrete impact assessment results have been extracted from that AQIA and are summarised in the section below. Reference is made to **Section 2.3** and **Section 4.1.1** for the discussion of how the discrete receptor locations were selected for this purpose, and the co-incidence of receptors in the studies is tabulated below. It is noted that the co-ordinates of the receptor locations in (TAS, 2019) are not presented in that report, and have been approximated from a desktop mapping exercise.

The results of the following receptors have been used for this exercise:

Table 22 Aggregated impact receptors

Northstar Receptor	TAS Receptor	mE	mS	Northstar Receptor	TAS Receptor	mE	mS
R1	R3	306 993	6 263 656	R22	R2	306 919	6 263 049
R2	R4	306 975	6 263 528	R28	R1	306 709	6 262 724
R3	R5	306 963	6 263 414	R29	R6	307 037	6 263 846
R4	R13	305 627	6 263 452	R30	R8	306 386	6 264 424
R6	R12	305 475	6 263 762	R31	R7	306 723	6 264 372
R7	R11	305 584	6 264 114	R32	R10	305 695	6 264 456
R8	R9	306 081	6 264 458	R33	R15	305 974	6 262 378

The calculated aggregated annual average TSP, PM_{10} and $PM_{2.5}$ concentrations are presented in **Table 23** overleaf, and the corresponding 24-hour average PM_{10} and $PM_{2.5}$ concentrations are presented in **Table 24**.

The aggregated assessment has used the maximum incremental impact predicted in this study with the respective contemporaneous 24-hour background and aggregated this with the maximum 24-hour increment predicted from emissions associated with the proposed Autorecyclers Pty Ltd throughput expansion to 130 000 tpa. It is noted that this is a highly conservative assumption, as the incremental impacts are not necessarily contemporaneous.

Table 23 Predicted aggregated annual average TSP, PM_{10} and $PM_{2.5}$ concentrations

Rec	TAS Rec	Northstar (2020)						TAS (2019)			Estimated Aggregate		
		TSP		PM_{10}		$PM_{2.5}$		TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
		Incr	BG	Inc	BG	Inc	BG	Inc	Inc	Inc	Aggr	Aggr	Aggr
R1	R3	0.5	45.0	0.3	21.9	<0.1	8.5	0.3	0.2	0.1	45.9	22.4	8.7
R2	R4	0.5	45.0	0.3	21.9	<0.1	8.5	0.4	0.2	0.1	45.9	22.4	8.7
R3	R5	0.4	45.0	0.3	21.9	<0.1	8.5	0.5	0.2	0.1	45.9	22.4	8.6
R4	R13	0.3	45.0	0.2	21.9	<0.1	8.5	0.4	0.2	0.1	45.7	22.3	8.6
R6	R12	0.2	45.0	0.1	21.9	<0.1	8.5	0.3	0.1	<0.1	45.5	22.1	8.6
R7	R11	0.2	45.0	0.1	21.9	<0.1	8.5	0.2	0.1	<0.1	45.4	22.1	8.6
R8	R9	0.2	45.0	0.1	21.9	<0.1	8.5	0.3	0.1	<0.1	45.5	22.1	8.6
R22	R2	0.2	45.0	0.1	21.9	<0.1	8.5	0.2	0.1	<0.1	45.4	22.1	8.6
R28	R1	0.2	45.0	0.1	21.9	<0.1	8.5	0.2	0.1	<0.1	45.4	22.1	8.6
R29	R6	0.4	45.0	0.3	21.9	<0.1	8.5	0.6	0.3	0.1	46.0	22.5	8.6
R30	R8	0.2	45.0	0.1	21.9	<0.1	8.5	0.3	0.1	<0.1	45.5	22.1	8.6
R31	R7	0.2	45.0	0.1	21.9	<0.1	8.5	0.3	0.2	0.1	45.5	22.2	8.6
R32	R10	0.1	45.0	0.1	21.9	<0.1	8.5	0.2	0.1	<0.1	45.4	22.1	8.6
R33	R15	0.1	45.0	0.1	21.9	<0.1	8.5	0.3	0.1	<0.1	45.4	22.1	8.6

Note Incr = incremental impact ($\mu g{\cdot}m^{-3}$), BG = background ($\mu g{\cdot}m^{-3}$), aggr = aggregate ($\mu g{\cdot}m^{-3}$) (comprised of Northstar increment + background + TAS increment

Table 24 Predicted aggregated 24-hour PM_{10} and $PM_{2.5}$ concentrations

Rec	TAS Rec	Northstar (2020)				TAS (2019)		Estimated Aggregate	
		PM_{10}		$PM_{2.5}$		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
		Inc	BG	Inc	BG	Inc	Inc	Aggr	Aggr
R1	R3	5.3	20.0	0.9	13.8	3.0	1.0	28.3	15.7
R2	R4	6.4	20.0	1.1	13.8	3.4	1.2	29.8	16.1
R3	R5	4.5	20.0	0.8	13.8	3.0	1.1	27.5	15.7
R4	R13	2.5	22.9	0.4	10.7	2.3	0.8	27.7	11.9
R6	R12	2.0	18.4	0.3	13.0	2.4	0.9	22.8	14.2
R7	R11	2.2	22.1	0.4	13.3	2.1	0.8	26.4	14.5
R8	R9	1.8	13.9	0.3	6.6	1.9	0.7	17.6	7.6
R22	R2	2.8	8.9	0.5	6.8	1.5	0.5	13.2	7.8
R28	R1	1.8	24.1	0.3	23.1	1.8	0.5	27.7	23.9
R29	R6	4.0	18.9	0.7	16.1	2.9	0.9	25.8	17.7
R30	R8	2.9	11.3	0.5	7.7	2.1	0.8	16.3	9.0
R31	R7	2.0	20.0	0.3	6.9	2.4	0.8	24.4	8.0
R32	R10	1.5	22.1	0.3	13.3	1.4	0.6	25.0	14.2
R33	R15	1.0	58.7	0.2	11.0	1.7	0.6	61.4	11.8

Note Incr = incremental impact (μg·m^{-3}), BG = background (μg·m^{-3}), aggr = aggregate (μg·m^{-3}) (comprised of Northstar increment + background + TAS increment

Table 23 indicates that the annual average $PM_{2.5}$ concentrations are predicted to exceed to relevant air quality criteria at R33. However, as highlighted in **Section 4.4**, the background is (in itself) exceeding the air quality criterion. The incremental annual average $PM_{2.5}$ predictions from both sites are predicted to be 0.1 $\mu g \cdot m^{-3}$ or less at all receptors.

The assessment predicts a 24-hour exceedance at R33, however this is noted to be driven by an already exceeding background PM_{10} value, and the assessment does not predict any additional exceedances of the relevant criterion.

With regard to odour, the following aggregated impact is estimated as shown in **Table 25**.

Table 25 Predicted aggregated 3-second odour concentrations

REC	TAS Rec	Northstar (2020)	TAS (2019)	Estimated Aggregate
		OU (3-sec OU)		
R1	R3	0.9	0.2	1.1
R2	R4	0.8	0.2	1.0
R3	R5	0.7	0.2	0.9
R4	R13	0.4	0.3	0.7
R6	R12	0.3	0.2	0.5
R7	R11	0.3	0.2	0.5
R8	R9	0.5	0.2	0.7
R22	R2	0.5	0.1	0.6
R28	R1	0.4	0.1	0.5
R29	R6	0.7	0.3	1.0
R30	R8	0.6	0.2	0.8
R31	R7	0.6	0.2	0.8
R32	R10	0.4	0.2	0.6
R33	R15	0.3	0.1	0.4

Based upon the above, it is considered that the aggregated impact of the Proposal with the proposed expansion of Autorecyclers Pty Ltd should not cause any exceedance of the relevant odour criterion.

The aggregated assessment presented above does not predict any additional exceedances of any criteria.

7.3. Air Quality Management

7.3.1. Proposed Air Quality Management Measures

The AQIA is underpinned by an emissions estimation that is described in **Section 5.2** and **Appendix C** which accounts for various "control factors" on various sources, as derived from published sources. The control factors applied are commensurate with operational controls described by S&P. The specific controls and therefore management measures to be routinely applied include the following:

- Regularly sweeping of the Proposal site surface and access routes to adequately control the build-up of silt on road surfaces to prevent vehicle and plant resuspension of deposited material. This should include, as a minimum, daily road sweeping / washing and further controls applied when circumstances warrant additional control.
- Maintenance of fully sealed conveyors and conveyor transfer points to eliminate emissions from those sources. This will include the full and complete mechanical sealing of those activities to isolate those emissions from the atmosphere.
- The operation of effective dust suppression through water spray / misting systems on all material handling emissions.
- Truck dumping is similarly only to be performed with the application of effective dust suppression through water sprays / misting systems.
- The Hammermill emissions are managed by air extraction through air pollution control (APC) devices including a cyclone and wet scrubber. Both the cyclone and wet scrubber should be regularly maintained and operated in accordance with the manufacturer's specification, and the hammermill should only be operated when both APC devices are operating effectively.

The SEARs provides a requirement to assess the feasibility of "***semi-encapsulation of oxy-cutting activities to manage particulate emissions***". The emissions inventory presented in **Appendix C** demonstrates that the point sources emissions are dominated by the wet scrubber stack (WSS01), and emissions from the oxy-cutting process are low. In addition to particulates, the predicted impacts of odour and NO_X from the oxy-cutting process (and the site as a whole) are shown to be significantly lower than the relevant criteria. Based upon the information presented within this AQIA, it is not clear whether the requirement to semi-encapsulate the emissions from the oxy-cutter would result in any significant reduction to the site emission budgets.

It is further advised by S&P that semi-encapsulation would impeded the operation of mobile plant transferring material to and from the oxy-cutting area, creating logistical and safety constraints for those operations., and it is not considered to represent a practical nor warranted solution at the current location.

7.3.2. Committed Air Quality Management Measures

It is noted that (ERM, 2015) presents a comprehensive list of best practice measures to be implemented by reference to the relevant EU Integrated Pollution Prevent & Control (IPPC) Bureau reference documents., including waste treatment which includes: "***common waste treatments such as the temporary storage of waste, blending and mixing, repackaging, waste reception, sampling, checking and analysis, waste transfer and handling installations, and waste transfer stations***"[6]. The site-specific mitigation measures to be implemented to achieve best available techniques includes measures for:

- Managing, receiving and recording incoming raw material streams, and identification of unacceptable materials, including spot checks;
- Procedural visual material checks at the point of raw material reception, raw material handling at the cutter, subsequent transfer, control cabin;
- Non-acceptance of cars with LPG cylinders;
- Draining of petrol and oil from scrap cars and storage in above-ground storage tanks for removal off-site;
- Waste and product storage to control emissions to atmosphere;
- Full and complete enclosure of all conveyors and conveyor transfer points;
- Operation of an "Emission Collection System" is regulated through EPL 11555 to manage and control emissions from the Hammermill;
- Operation of all oxy-cutting processes under wet conditions to manage the emissions of NO_X and metal fumes;
- Operation of water sprays / mists on all material handling activities, and the collection of subsequent run-off within an on-site dam;
- Regular sweeping of on-site surfaces to minimise wheel-generated emissions from plant and vehicles;
- Management of dust emissions through the Environmental Management Plan (EMP).

[6] https://eippcb.jrc.ec.europa.eu/reference/waste-treatment-0

7.3.3. Implementation through the EMP

This AQIA does not seek to replace the S&P EMP as the published / approved EMP includes various commitments implemented to comply with the conditions associated with The Original Approval. However, to comply with the requirement of the SEARs (see **Section 1.4**) this AQIA proposes additions in accordance with the assumptions and commitments underpinning this assessment (as outlined above).

The EMP should be updated by S&P and provided to DPIE for comment and implemented at the earliest opportunity.

7.3.4. Air Quality Monitoring

The EMP includes a commitment for the monitoring of PM_{10} concentrations at two AQMS, the 'In-station' and the 'Out-station'. Reference should be made to **Section 4.4.3** of this report that provides a summary of the locations of the AQMS and the measured concentration values.

The limitations of the measured data and its applicability to this AQIA are discussed in **Section 4.4.3**. It is proposed that the air quality monitoring program is continued to achieve the following objectives:

- provide quantification of impacts using methods referenced in (NSW DEC, 2007),
- provide S&P relevant metrics (i.e. rolling 4-hour PM_{10} concentration value) to implement reactive air quality management responses;
- provide the relevant regulatory authorities with a means to audit and verify operational air quality control.

However, as noted in **Section 4.4.3**, the analysis and use of the data collected by the AQMS is not straight forward, and requires an element of judgement of source contribution to interpret the data, particularly with regard to the disaggregation of the measured concentrations to background sources, neighbouring contributions and on-site contributions.

It is recommended that the current AQMS configuration, metrics and trigger points are reviewed to increase the value of the AQMS system.

7.4. Summary

S&P is seeking approval to increase the throughput limit of the RRF from 350 000 to 600 000 tonnes per annum (tpa). Approval for the Proposal is sought as State Significant Development (SSD) under Part 4, Division 4.7 of the *Environmental Planning and Assessment 1979* (EP&A Act).

The existing infrastructure at the Proposal site has the capacity to accommodate an increased throughput without altering the approved operational hours or requiring any construction works on the Proposal site.

The AQIA has been performed in accordance with the relevant guidance, and is cognisance of the SEARs (see **Section 1.4**).

Using a range of site-specific data regarding the type and nature of activities to be performed on site, emissions to air have been estimated in accordance with the relevant guidance, and the dispersion of emissions has been modelled using approved atmospheric dispersion modelling techniques. The corresponding impacts have been predicted at a number of receptor locations representing community exposure and at industrial locations, as discrete impacts and as cumulative impacts which account for general prevailing air quality conditions considered to be representative of the site.

The impact prediction does not predict any exceedances of the relevant air quality and odour assessment criteria, as published in NSW Environment Protection Authority guidance "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*".

The air quality impact assessment also considers the potential impacts of the operation of the neighbouring Autorecyclers Pty Ltd operations at a proposed increased throughput of 130 000 tonnes per year. The report assesses the potential aggregated impacts with those emissions, and the assessment does not predict any exceedance of the relevant air quality and odour assessment criteria, as published in NSW Environment Protection Authority guidance "*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*".

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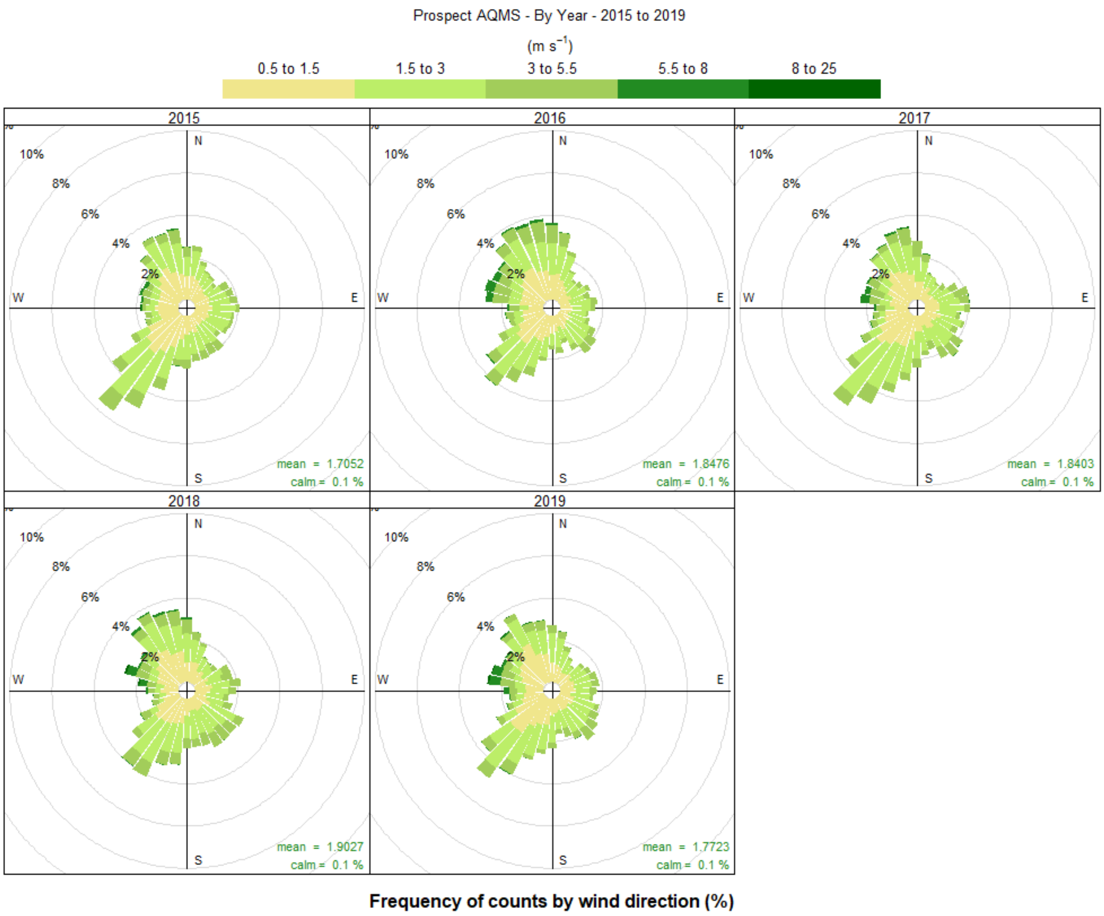
Appendix A

Meteorology

As discussed in **Section 4.3** 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 taken at a number of surrounding automatic weather stations (AWS) operated by the Bureau of Meteorology (BoM). Meteorology is also measured by the NSW Department of Planning, Industry and Environment (DPIE) at a number of Air Quality Monitoring Station (AQMS) surrounding the Proposal site (refer **Section 4.4**).

Meteorological conditions at Prospect AQMS was chosen for further investigation due to its location relative to the Proposal site. This site has been examined to determine a 'typical' or representative dataset for use in dispersion modelling. Annual wind roses for the most recent 5 years of data (2015 to 2019) are presented in **Figure A2.**

Figure A2 Annual wind roses 2015 to 2019, Prospect AQMS



The wind roses indicate that from 2015 to 2019, winds at Prospect AQMS show similar patterns across the years, with a predominant south-easterly wind direction.

The majority of wind speeds experienced at Prospect AQMS over the 5-year period, 2015 to 2019 are generally in the range <0.5 metres 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 a north westerly direction. Winds of this speed are not frequent, occurring <0.1% of the observed hours over the 5-year period, at Prospect. Calm winds (<0.5 $m{\cdot}s^{-1}$) occur during 0.1 % of hours on average across the 5-year period.

Given the wind distributions across the years examined, data for the year 2015 has been selected as being appropriate for further assessment, as it best represents the general trend across the 5-year period studied.

Presented in **Figure A3** are the annual wind rose for the 2015 to 2019 period.

Figure A3 Annual wind roses 2015 to 2019 – Prospect AQMS

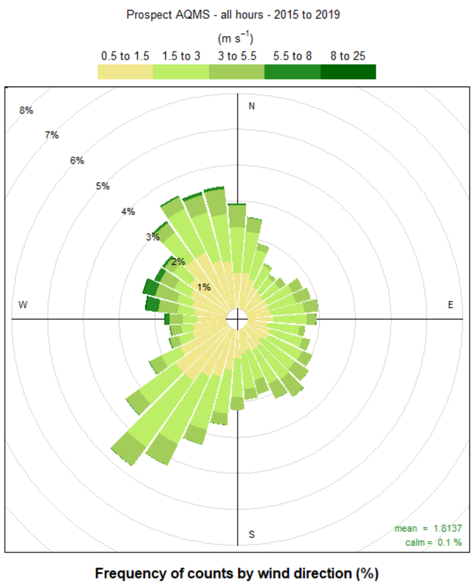
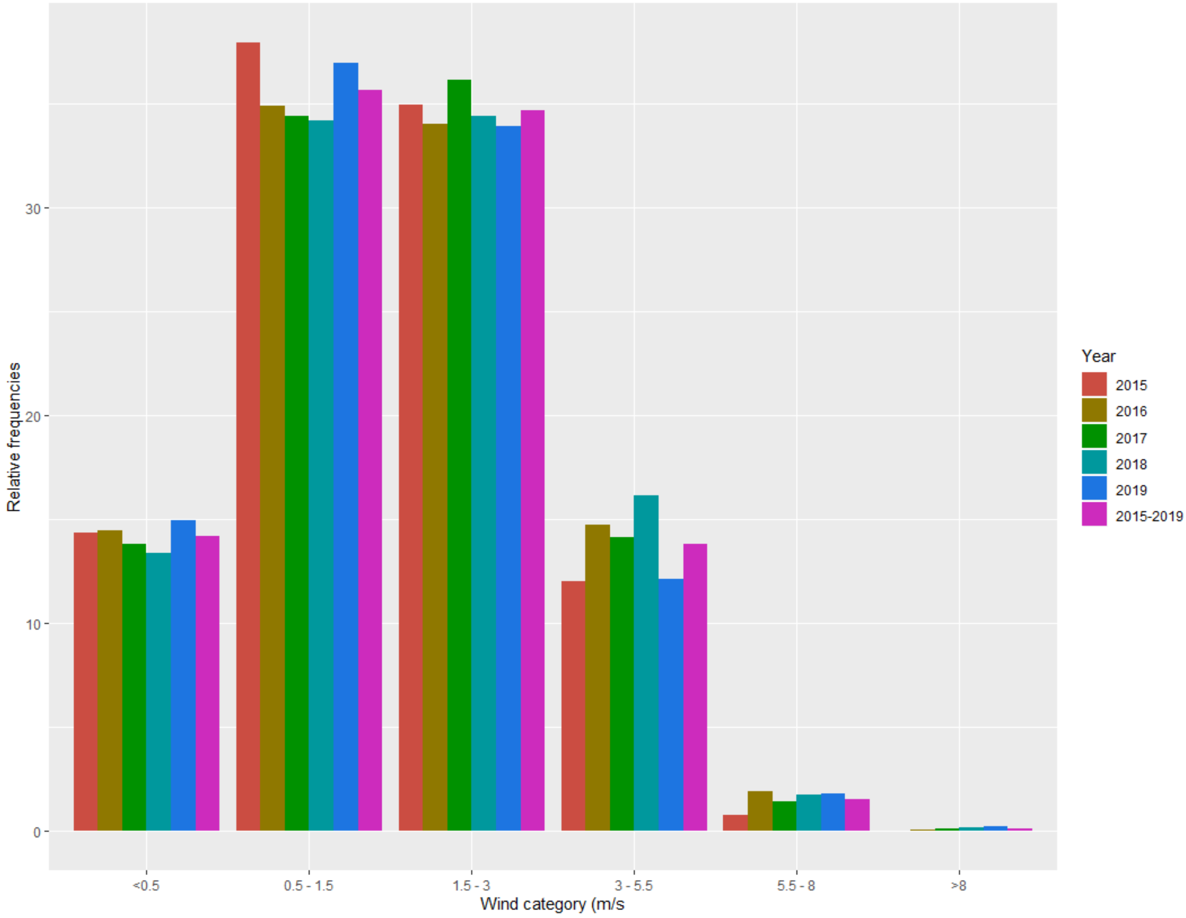


Figure A4 Annual wind speed distribution – Prospect AQMS



Meteorological Processing

The BoM and DPIE 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 TAPM meteorological model in a format suitable for using in the CALPUFF dispersion model (refer **Section 5.1)**.

Meteorological modelling using The Air Pollution Model (TAPM, v 4.0.5) 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, rain water 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.

CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field and thus the final wind field reflects the influences of local topography and current land uses.

The parameters used in TAPM and CALMET modelling are presented in **Table A1**.

Table A1 Meteorological parameters used for this study

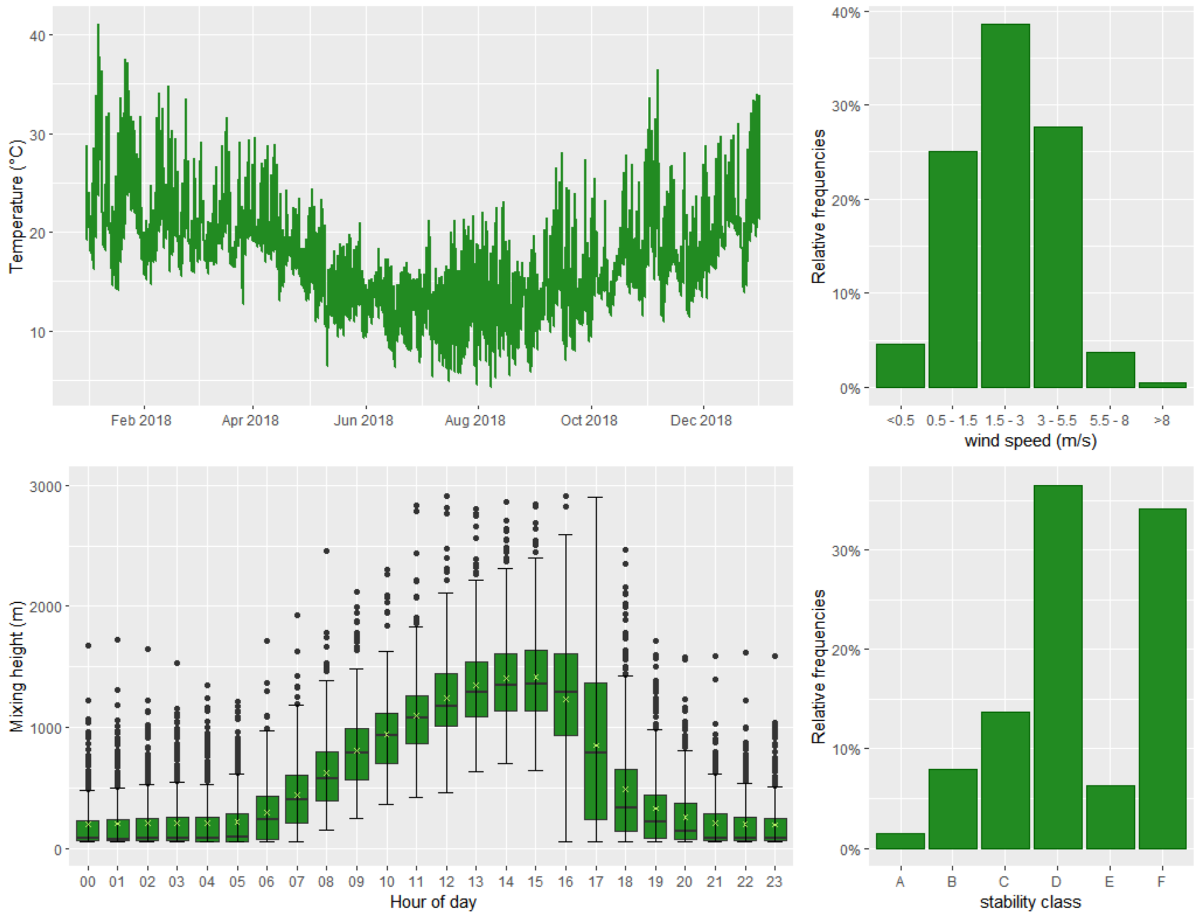
TAPM v 4.0.5	
Modelling period	1 January 2019 to 31 December 2019
Centre of analysis	306 258 mE, 6 263 597 mS (UTM Coordinates)
Number of grid points	35 × 35 × 25
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Terrain	AUSLIG 9 second DEM
Data assimilation	None
CALMET	
Modelling period	1 January 2019 to 31 December 2018
South-West corner of analysis	294,580 mE, 6,251,617 mS (UTM Coordinates)
Meteorological grid domain (resolution)	0.2 km x 120 x 120
Vertical resolution (cell heights)	10 (0 m, 20 m, 40 m, 80 m, 12 0m, 180 m, 300 m, 600 m, 1000 m, 1200 m, 1800 m, 2200 m, 3000 m)
Data assimilation	No-obs approach using TAPM – 3D.DAT file

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 recirulation 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 CALMET at the Proposal site during 2019 period are illustrated in **Figure A5**. Also presented are predicted temperature, stability class and wind speed frequency.

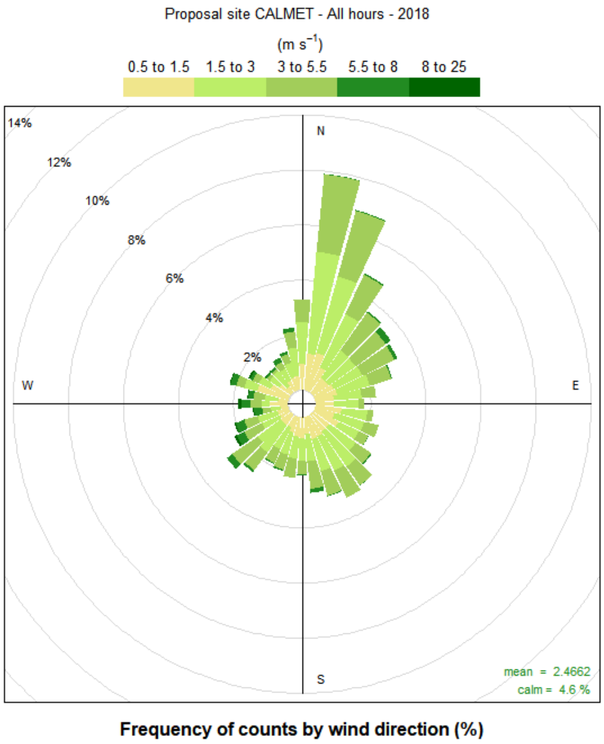
As expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground based temperature inversions and growth of the convective mixing layer.

Figure A5 Predicted meteorological parameters – Proposal site 2018



The modelled wind speed and direction at the Proposal site during 2019 are presented in **Figure A1**.

Figure A1 Predicted wind speed and direction – Proposal site 2018



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Appendix B

Background Air Quality Data

Continuous air quality monitoring data measured at a representative location has been adopted for the purposes of this assessment. 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, Industry and Environment (DPIE) at four air quality monitoring station (AQMS) within a 17 km radius of the Proposal site. Details of the monitoring performed at these AQMS is presented in **Table B1** and **Figure 6**.

Table B1 Details of closest AQMS surrounding the site

AQMS Location	Data Availability	Distance to Site (km)	Screening Parameters					
			2018 Data	Measurements				
				PM_{10}	$PM_{2.5}$	TSP	NO_2	O_3
Prospect	2007 - 2019	4.9	✓	✓	✓	×	✓	✓
Rouse Hill	Since May 2019	7.3	✓	✓	✓	×	✓	✓
Parramatta North	2017- 2019	9.5	✓	✓	✓	×	✓	✓
St Marys	2002-2019	14.5	✓	✓	✓	×	✓	✓

Based on the sources of AQMS data available and their proximity to the Proposal site, Prospect was selected as the candidate source of AQMS data for use in this assessment.

Summary statistics are for PM_{10} and $PM_{2.5}$ data are presented in **Table B2**.

Table B2 PM_{10} and $PM_{2.5}$ statistics 2018

AQMS	Prospect	
Year	2015	
Pollutant	PM_{10}	$PM_{2.5}$
Averaging Period	24-hour	24-hour
Data Points (number)	363	352
Mean (µg·m^{-3})	21.9	8.5
Standard Deviation (µg·m^{-3})	10.9	4.9
Skew[1]	2.7	3.0
Kurtosis[2]	15.6	17.7
Minimum (µg·m^{-3})	5.4	1.1
Percentiles (µg·m^{-3})		
1	7.1	2.0
5	9.9	3.2
10	11.2	4.1
25	14.8	5.3
50	20.2	7.4
75	25.8	10.4
90	33.3	13.8
95	37.4	16.1
97	42.9	17.8
98	52.8	19.9
99	61.7	25.0
Maximum	113.3	47.5
Data Capture (%)	99.5	96.4

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.

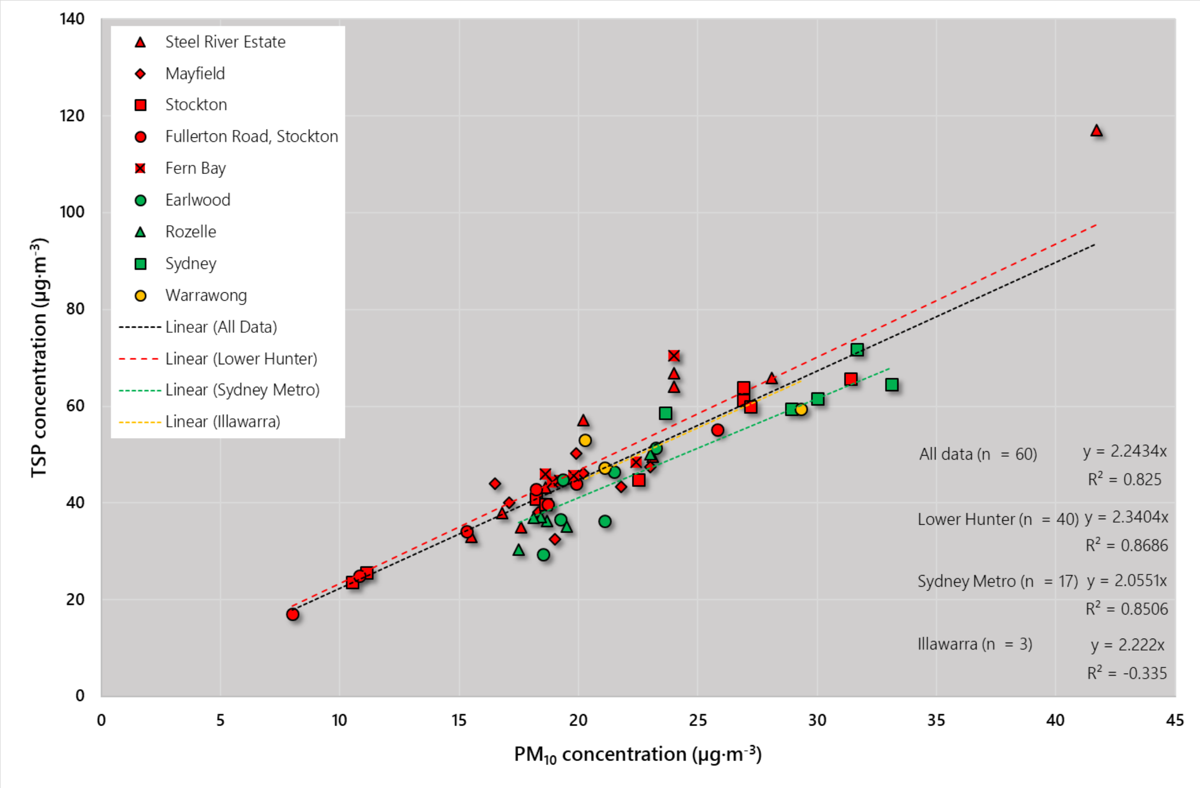
2: Kurtosis represents an expression of the value of measured values in relation to a normal distribution. Positive skew represents a more peaked distribution, and negative skew represents a distribution more flattened than a normal distribution. Kurtosis is dimensionless.

Concentrations of TSP are not measured by the NSW DPIE at any AQMS surrounding the Proposal site. An analysis of co-located measurements of TSP and PM_{10} in the Lower Hunter (1999 to 2011), Illawarra (2002 to 2004), and Sydney Metropolitan (1999 to 2004) regions is presented in **Figure B1**.

The analysis concludes that, on the basis of the measurements collected across NSW between 1999 to 2011, the derivation of a broad TSP:PM_{10} ratio of 2.0551 : 1 (i.e. PM_{10} represents ~48 % of TSP) is appropriate to be applied to measurements in the Sydney Metro.

In the absence of any more specific information, this ratio has been adopted within this AQIA. These estimates have not been adjusted for background exceedances.

Figure B1 Co-located TSP and PM_{10} Measurements, Lower Hunter, Sydney Metro and Illawarra



Similarly, no dust deposition data is available for the area surrounding the Proposal site. The incremental impact criterion of 2 $g \cdot m^{-2} \cdot month^{-1}$ as outlined within the Approved Methods has been adopted which effectively provides a background deposition level of 2 $g \cdot m^{-2} \cdot month^{-1}$ (the total allowable deposition being 4 $g \cdot m^{-2} \cdot month^{-1}$).

A summary of background air quality data for the site for the year 2018 is presented in **Table B3**.

Graphs presenting the daily varying PM_{10} and $PM_{2.5}$ data recorded at Prospect in 2018 are presented in **Figure B2** and **Figure B3**, respectively.

Table B3 Summary of Background Air Quality Data (Prospect 2018)

Pollutant	TSP (µg·m^{-3})	PM_{10} (µg·m^{-3})	$PM_{2.5}$ (µg·m^{-3})	NO_2 (µg·m^{-3})	O_3 (µg·m^{-3})
Averaging Period	Annual	24-Hour	24-Hour	1-Hour	1-Hour
Data Points (number)	363	363	352	7583.0	7529.0
Mean	45.01	21.9	8.5	18.7	39.8
Standard Deviation	-	10.9	4.9	17.0	28.8
Skew[1]	-	2.7	3.0	1.2	1.0
Kurtosis[2]	-	15.6	17.7	1.0	1.9
Minimum	45.01	5.4	1.1	-4.1	-2.1
Percentiles (µg·m^{-3})					
1	-	7.1	2.0	0.0	0.0
5	-	9.9	3.2	0.0	2.1
10	-	11.2	4.1	2.1	4.3
25	-	14.8	5.3	6.2	17.1
50	-	20.2	7.4	12.3	38.5
75	-	25.8	10.4	28.7	55.6
90	-	33.3	13.8	43.1	72.8
95	-	37.4	16.1	53.3	89.9
97	-	42.9	17.8	59.5	102.7
98	-	52.8	19.9	64.5	112.6
99	-	61.7	25.0	69.7	130.1
Maximum	45.01	113.3	47.5	104.6	224.7
Data Capture (%)	99.5	99.5	96.4	86.6	85.9

Figure B2 PM_{10} Measurements, Prospect 2018

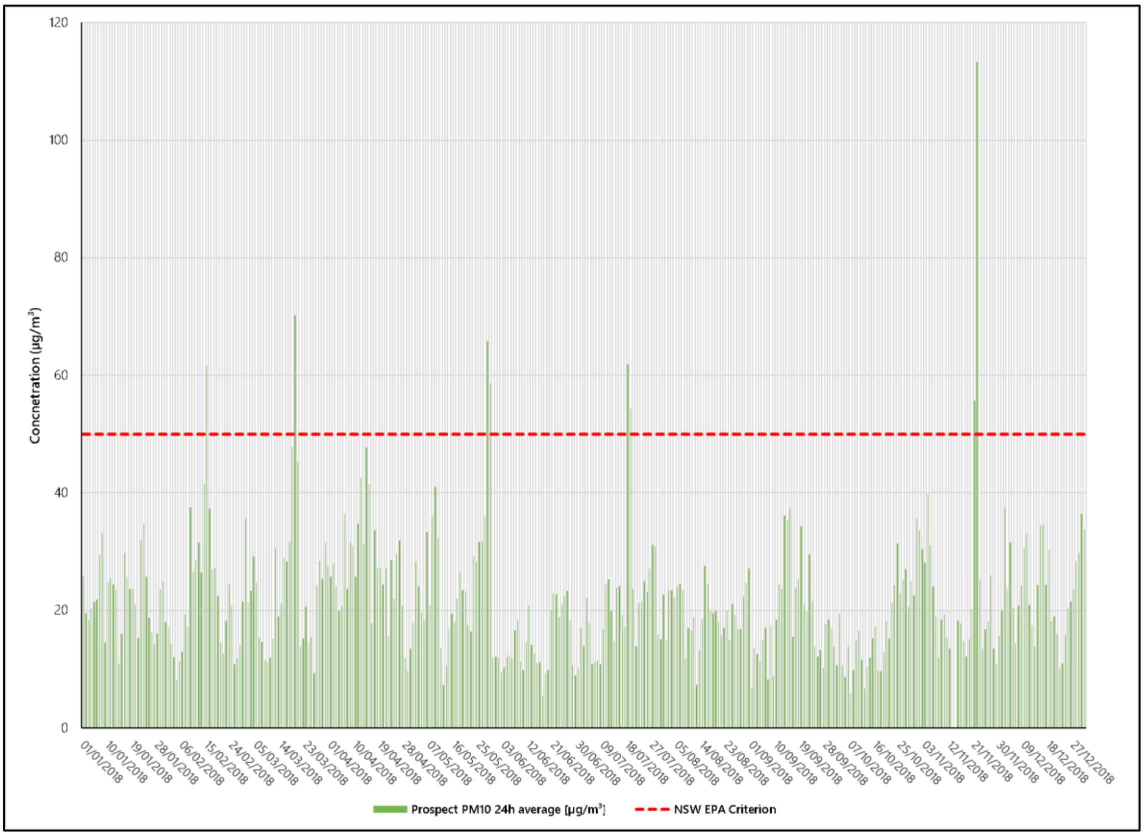
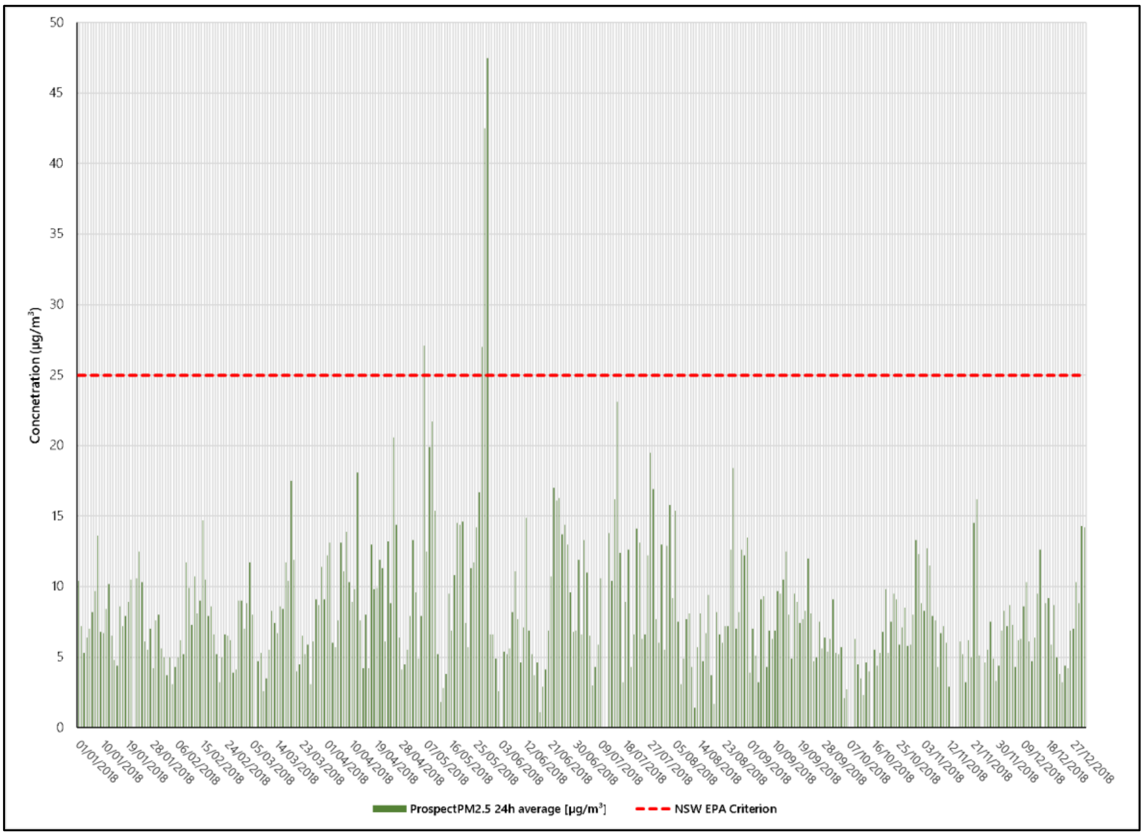


Figure B3 $PM_{2.5}$ Measurements, Prospect 2018



Appendix C

Emission Estimates

Point Source Emissions (C1 and WSS01)

Source	Units	C1	WSS01
Description		Metal cutting	Wet scrubber stack
Co-ordinates	mE	306 613	306 567
	mS	6 263 608	6 263 613
Discharge height	m AGL	1	15.5
Hour (start)	hrs	9:00	6:00
Hour (stop)	hrs	15:00	21:00
Duration	hrs	6	15
Diameter	m ID	0.05	0.595
Cross sectional area	m^2	0.002	0.278
Emission temperature	degC	700	40
Flow	$Nm^3{\cdot}hr^{-1}$	-	21 805
Flow	$Am^3{\cdot}hr^{-1}$	-	25 000
Flow	$Nm^3{\cdot}s^{-1}$	-	6.06
Velocity	$m{\cdot}s^{-1}$	0.01	25.0
Conc (TSP)	$mg{\cdot}Nm^{-3}$	-	20
Conc (PM_{10})	$mg{\cdot}Nm^{-3}$	-	9.4
Conc ($PM_{2.5}$)	$mg{\cdot}Nm^{-3}$	-	3.0
Conc (odour)	OU	940	1600
Mass Fraction (Cr)	%(w/w) $PM_{2.5}$	-	0.04
MF (Cu)	%(w/w) $PM_{2.5}$	-	0.1
MF (Fe)	%(w/w) $PM_{2.5}$	-	5.76
MF (Pb)	%(w/w) $PM_{2.5}$	-	0.49
MF (Mn)	%(w/w) $PM_{2.5}$	-	0.088
MF (Ni)	%(w/w) $PM_{2.5}$	-	0.031
MF (Ti)	%(w/w) $PM_{2.5}$	-	0.025
MF (V)	%(w/w) $PM_{2.5}$	-	0.001
MF (Zn)	%(w/w) $PM_{2.5}$	-	2.1
ER (TSP)	$g{\cdot}s^{-1}$	-	1.2114E-01
ER (PM_{10})	$g{\cdot}s^{-1}$	-	5.6936E-02
ER ($PM_{2.5}$)	$g{\cdot}s^{-1}$	-	1.8219E-02
ER (odour)	$OU{\cdot}m^3{\cdot}s^{-1}$	1.8457E-02	1.1111E+04
ER (NO_X)	$g{\cdot}s^{-1}$	4.3000E-02	

Constant Rate Emission Sources

Source	Co-ordinates		Emission	Source group	Activity Rate				Emission Factor				Control
	mE	mS	type		Existing	Proposed	Units	Hours	TSP	PM_{10}	$PM_{2.5}$	Units	(%)
MH01	306607	6263635	volume	Materials handling	50	86	t·day^{-1}	15	0.0019	0.0009	0.0001		70
MH02	306519	6263572	volume	Materials handling	750	1286	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH03	306503	6263664	volume	Materials handling	750	1286	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH04	306509	6263576	volume	Materials handling	300	514	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH05	306522	6263569	volume	Materials handling	300	514	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH06	306523	6263581	volume	Materials handling	300	514	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH07	306503	6263664	volume	Materials handling	300	514	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH08	306503	6263664	volume	Materials handling	1050	1800	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH09	306483	6263652	volume	Materials handling	1050	1800	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH10	306503	6263664	volume	Materials handling	790	1354	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
MH11	306533	6263680	volume	Materials handling	790	1354	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	70
TP01	306525	6263577	volume	Transfer point	300	514	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	0
TP02	306517	6263691	volume	Transfer point	790	1354	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	0
TP03	306529	6263701	volume	Transfer point	790	1354	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	0
TP04	306541	6263711	volume	Transfer point	790	1354	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	0
TP05	306512	6263687	volume	Transfer point	40	69	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	0
TP06	306494	6263732	volume	Transfer point	240	411	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	0
TP07	306563	6263721	volume	Transfer point	240	411	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	0
TP08	306551	6263643	volume	Transfer point	240	411	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	0
CV01	306484	6263660	volume	Conveyor	1050	1800	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	100
CV02	306486	6263672	volume	Conveyor	1050	1800	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	100
CV03	306489	6263687	volume	Conveyor	1050	1800	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	100
CV04	306489	6263694	volume	Conveyor	1050	1800	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	100
CV05	306513	6263691	volume	Conveyor	790	1354	t·day^{-1}	15	0.0019	0.0009	0.0001	kg·t^{-1}	100

Source	Co-ordinates		Emission type	Source group	Activity Rate				Emission Factor				Control (%)
	mE	mS			Existing	Proposed	Units	Hours	TSP	PM_{10}	$PM_{2.5}$	Units	
CV06	306520	6263693	volume	Conveyor	790	1354	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV07	306527	6263699	volume	Conveyor	790	1354	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV08	306534	6263704	volume	Conveyor	790	1354	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV09	306538	6263708	volume	Conveyor	790	1354	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV10	306514	6263695	volume	Conveyor	40	69	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV11	306515	6263702	volume	Conveyor	40	69	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV12	306516	6263711	volume	Conveyor	40	69	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV13	306491	6263710	volume	Conveyor	220	377	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV14	306492	6263718	volume	Conveyor	220	377	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV15	306493	6263727	volume	Conveyor	220	377	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV16	306503	6263732	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV17	306512	6263731	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV18	306522	6263729	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV19	306533	6263727	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV20	306542	6263726	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV21	306551	6263725	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV22	306558	6263724	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV23	306558	6263713	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV24	306556	6263703	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV25	306555	6263693	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV26	306553	6263683	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV27	306552	6263674	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV28	306551	6263663	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV29	306550	6263653	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV30	306551	6263643	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100
CV31	306557	6263635	volume	Conveyor	240	411	$t{\cdot}day^{-1}$	15	0.0019	0.0009	0.0001	$kg{\cdot}t^{-1}$	100

Source	Co-ordinates		Emission type	Source group	Activity Rate				Emission Factor				Control
	mE	mS			Existing	Proposed	Units	Hours	TSP	PM_{10}	$PM_{2.5}$	Units	(%)
CV32	306562	6263625	volume	Conveyor	240	411	$t \cdot day^{-1}$	15	0.0019	0.0009	0.0001	$kg \cdot t^{-1}$	100
CV33	306567	6263617	volume	Conveyor	240	411	$t \cdot day^{-1}$	15	0.0019	0.0009	0.0001	$kg \cdot t^{-1}$	100

Constant Rate Emission Sources (Emission Estimates)

Source	Emission rate ($g \cdot s^{-1}$) Proposed Activity Rates - Uncontrolled			Emission rate ($g \cdot s^{-1}$) Proposed Activity Rates - Controlled		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
MH01	3.059E-03	1.447E-03	2.191E-04	9.177E-04	4.340E-04	6.572E-05
MH02	4.588E-02	2.170E-02	3.286E-03	1.376E-02	6.510E-03	9.859E-04
MH03	4.588E-02	2.170E-02	3.286E-03	1.376E-02	6.510E-03	9.859E-04
MH04	1.835E-02	8.680E-03	1.314E-03	5.506E-03	2.604E-03	3.943E-04
MH05	1.835E-02	8.680E-03	1.314E-03	5.506E-03	2.604E-03	3.943E-04
MH06	1.835E-02	8.680E-03	1.314E-03	5.506E-03	2.604E-03	3.943E-04
MH07	1.835E-02	8.680E-03	1.314E-03	5.506E-03	2.604E-03	3.943E-04
MH08	6.424E-02	3.038E-02	4.601E-03	1.927E-02	9.115E-03	1.380E-03
MH09	6.424E-02	3.038E-02	4.601E-03	1.927E-02	9.115E-03	1.380E-03
MH10	4.833E-02	2.286E-02	3.461E-03	1.450E-02	6.858E-03	1.038E-03
MH11	4.833E-02	2.286E-02	3.461E-03	1.450E-02	6.858E-03	1.038E-03
TP01	1.835E-02	8.680E-03	1.314E-03	1.835E-02	8.680E-03	1.314E-03
TP02	4.833E-02	2.286E-02	3.461E-03	4.833E-02	2.286E-02	3.461E-03
TP03	4.833E-02	2.286E-02	3.461E-03	4.833E-02	2.286E-02	3.461E-03
TP04	4.833E-02	2.286E-02	3.461E-03	4.833E-02	2.286E-02	3.461E-03
TP05	2.447E-03	1.157E-03	1.753E-04	2.447E-03	1.157E-03	1.753E-04
TP06	1.468E-02	6.944E-03	1.052E-03	1.468E-02	6.944E-03	1.052E-03
TP07	1.468E-02	6.944E-03	1.052E-03	1.468E-02	6.944E-03	1.052E-03
TP08	1.468E-02	6.944E-03	1.052E-03	1.468E-02	6.944E-03	1.052E-03

Source	Emission rate (g·s^{-1}) Proposed Activity Rates - Uncontrolled			Emission rate (g·s^{-1}) Proposed Activity Rates - Controlled		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
CV01	6.424E-02	3.038E-02	4.601E-03	0.000E+00	0.000E+00	0.000E+00
CV02	6.424E-02	3.038E-02	4.601E-03	0.000E+00	0.000E+00	0.000E+00
CV03	6.424E-02	3.038E-02	4.601E-03	0.000E+00	0.000E+00	0.000E+00
CV04	6.424E-02	3.038E-02	4.601E-03	0.000E+00	0.000E+00	0.000E+00
CV05	4.833E-02	2.286E-02	3.461E-03	0.000E+00	0.000E+00	0.000E+00
CV06	4.833E-02	2.286E-02	3.461E-03	0.000E+00	0.000E+00	0.000E+00
CV07	4.833E-02	2.286E-02	3.461E-03	0.000E+00	0.000E+00	0.000E+00
CV08	4.833E-02	2.286E-02	3.461E-03	0.000E+00	0.000E+00	0.000E+00
CV09	4.833E-02	2.286E-02	3.461E-03	0.000E+00	0.000E+00	0.000E+00
CV10	2.447E-03	1.157E-03	1.753E-04	0.000E+00	0.000E+00	0.000E+00
CV11	2.447E-03	1.157E-03	1.753E-04	0.000E+00	0.000E+00	0.000E+00
CV12	2.447E-03	1.157E-03	1.753E-04	0.000E+00	0.000E+00	0.000E+00
CV13	1.346E-02	6.366E-03	9.639E-04	0.000E+00	0.000E+00	0.000E+00
CV14	1.346E-02	6.366E-03	9.639E-04	0.000E+00	0.000E+00	0.000E+00
CV15	1.346E-02	6.366E-03	9.639E-04	0.000E+00	0.000E+00	0.000E+00
CV16	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV17	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV18	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV19	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV20	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV21	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV22	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV23	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV24	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV25	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV26	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00

Source	Emission rate (g·s^{-1}) Proposed Activity Rates - Uncontrolled			Emission rate (g·s^{-1}) Proposed Activity Rates - Controlled		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
CV27	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV28	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV29	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV30	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV31	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV32	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00
CV33	1.468E-02	6.944E-03	1.052E-03	0.000E+00	0.000E+00	0.000E+00

Hourly Varying Emission Sources

Source	Co-ordinates		Emission	Source group	Activity Rate				Emission Factor				Control
	mE	mE	type		Existing	Proposed	Units	Hours	TSP	PM_{10}	$PM_{2.5}$	Units	(%)
TRKD01	306502	6263580	volume	Truck dumping	1500	2571	t·day^{-1}	15	0.0005	0.0003	0.0000	kg·t^{-1}	70
TRKD02	306503	6263664	volume	Truck dumping	300	514	t·day^{-1}	15	0.0005	0.0003	0.0000	kg·t^{-1}	70
WE01	306494	6263578	volume	Wind erosion	653	653	m^2	24	850	425	63.75	kg·ha^{-1}·yr^{-1}	0
WE02	306507	6263543	volume	Wind erosion	428	428	m^2	24	850	425	63.75	kg·ha^{-1}·yr^{-1}	0
WE03	306631	6263571	volume	Wind erosion	2100	2100	m^2	24	850	425	63.75	kg·ha^{-1}·yr^{-1}	0
WE04	306503	6263664	volume	Wind erosion	2562	2562	m^2	24	850	425	63.75	kg·ha^{-1}·yr^{-1}	0
WE05	306542	6263709	volume	Wind erosion	303	303	m^2	24	850	425	63.75	kg·ha^{-1}·yr^{-1}	0
WE06	306544	6263695	volume	Wind erosion	303	303	m^2	24	850	425	63.75	kg·ha^{-1}·yr^{-1}	0

Hourly Varying Emission Sources (Emission Estimates)

Source	Emission rate ($g \cdot s^{-1}$) Proposed Activity Rates - Uncontrolled			Emission rate ($g \cdot s^{-1}$) Proposed Activity Rates - Controlled		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
TRKD01	2.544E-02	1.203E-02	1.822E-03	7.633E-03	3.610E-03	5.467E-04
TRKD02	5.089E-03	2.407E-03	3.644E-04	1.527E-03	7.220E-04	1.093E-04
WE01	1.760E-03	8.800E-04	1.320E-04	1.760E-03	8.800E-04	1.320E-04
WE02	1.154E-03	5.768E-04	8.652E-05	1.154E-03	5.768E-04	8.652E-05
WE03	5.660E-03	2.830E-03	4.245E-04	5.660E-03	2.830E-03	4.245E-04
WE04	6.905E-03	3.453E-03	5.179E-04	6.905E-03	3.453E-03	5.179E-04
WE05	8.167E-04	4.083E-04	6.125E-05	8.167E-04	4.083E-04	6.125E-05
WE06	8.167E-04	4.083E-04	6.125E-05	8.167E-04	4.083E-04	6.125E-05

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Appendix D

Schedule of Results

Predicted Annual Average TSP, PM_{10} and $PM_{2.5}$ Concentrations and Annual Average Dust Deposition Rate – Proposed Scenario

Receptor	Annual Average Concentration ($\mu g \cdot m^{-3}$)									Annual Average Rate ($(g \cdot m^{-2} \cdot month^{-1})$)		
	TSP			PM_{10}			$PM_{2.5}$			Annual Average Dust Deposition		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
R1	0.5	45.0	45.5	0.3	21.9	22.2	<0.1	8.5	8.6	<0.1	2.0	2.1
R2	0.5	45.0	45.5	0.3	21.9	22.2	<0.1	8.5	8.6	<0.1	2.0	2.1
R3	0.4	45.0	45.4	0.3	21.9	22.2	<0.1	8.5	8.6	<0.1	2.0	2.1
R4	0.3	45.0	45.3	0.2	21.9	22.1	<0.1	8.5	8.6	<0.1	2.0	2.1
R5	0.3	45.0	45.3	0.2	21.9	22.1	<0.1	8.5	8.6	<0.1	2.0	2.1
R6	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R7	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R8	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R9	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R10	7.4	45.0	52.4	3.8	21.9	25.7	0.6	8.5	9.1	<0.1	2.0	2.1
R11	16.0	45.0	61.0	7.9	21.9	29.8	1.3	8.5	9.8	<0.1	2.0	2.1
R12	7.4	45.0	52.4	3.7	21.9	25.6	0.6	8.5	9.1	<0.1	2.0	2.1
R13	3.8	45.0	48.8	2.0	21.9	23.9	0.3	8.5	8.8	<0.1	2.0	2.1
R14	2.2	45.0	47.2	1.2	21.9	23.1	0.2	8.5	8.7	<0.1	2.0	2.1
R15	2.0	45.0	47.0	1.1	21.9	23.0	0.2	8.5	8.7	<0.1	2.0	2.1
R16	3.2	45.0	48.2	1.7	21.9	23.6	0.3	8.5	8.8	<0.1	2.0	2.1
R17	1.6	45.0	46.6	0.9	21.9	22.8	0.2	8.5	8.7	<0.1	2.0	2.1
R18	1.2	45.0	46.2	0.7	21.9	22.6	0.1	8.5	8.6	<0.1	2.0	2.1
R19	9.6	45.0	54.6	4.8	21.9	26.7	0.8	8.5	9.3	<0.1	2.0	2.1

Receptor	Annual Average Concentration (µg·m⁻³)									Annual Average Rate ((g·m⁻²·month⁻¹)		
	TSP			PM_{10}			$PM_{2.5}$			Annual Average Dust Deposition		
	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact	Incremental Impact	Background	Cumulative Impact
R20	0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R21	<0.1	45.0	<45.1	<0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R22	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R23	<0.1	45.0	<45.1	<0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R24	0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R25	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R26	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R27	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R28	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R29	0.4	45.0	45.4	0.3	21.9	22.2	<0.1	8.5	8.6	<0.1	2.0	2.1
R30	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R31	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R32	0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
R33	1.6	45.0	46.6	<0.1	21.9	22.0	<0.1	8.5	8.6	<0.1	2.0	2.1
Criterion	-	90		-	25			8		2	-	

Predicted Maximum 24-hour PM_{10} and $PM_{2.5}$ Concentrations – Proposed Scenario

Receptor	Maximum 24-hour average concentration (µg·m^{-3})	
	PM_{10}	$PM_{2.5}$
R1	5.3	0.9
R2	6.4	1.1
R3	4.5	0.8
R4	2.5	0.4
R5	1.8	0.3
R6	2.0	0.3
R7	2.2	0.4
R8	1.8	0.3
R9	1.8	0.3
R10	42.9	6.8
R11	60.3	9.4
R12	40.8	6.3
R13	24.2	3.8
R14	15.8	2.5
R15	17.7	2.9
R16	18.0	2.9
R17	8.6	1.5
R18	8.6	1.4
R19	36.1	5.6
R20	1.2	0.2
R21	1.0	0.2
R22	2.8	0.5
R23	1.6	0.3
R24	1.6	0.3

Receptor	Maximum 24-hour average concentration (µg·m^{-3})	
	PM_{10}	$PM_{2.5}$
R25	2.1	0.4
R26	1.7	0.3
R27	2.5	0.4
R28	1.8	0.3
R29	4.0	0.7
R30	2.9	0.5
R31	2.0	0.3
R32	1.5	0.3
R33	1.0	0.2

Predicted Maximum 1-Hour and Annual Average NO_2 Concentrations

Rec.	Nitrogen dioxide (NO_2) concentration ($\mu g \cdot m^{-3}$)					
	1 hour			Annual Average		
	Increment	Background	Cumulative	Increment	Background	Cumulative
R1	6.7	104.6	111.3	<0.1	18.7	18.8
R2	6.5	104.6	111.1	<0.1	18.7	18.8
R3	5.5	104.6	110.1	<0.1	18.7	18.8
R4	1.8	104.6	106.4	<0.1	18.7	18.8
R5	1.5	104.6	106.1	<0.1	18.7	18.8
R6	1.4	104.6	106.0	<0.1	18.7	18.8
R7	1.0	104.6	105.6	<0.1	18.7	18.8
R8	1.3	104.6	105.9	<0.1	18.7	18.8
R9	2.4	104.6	107.0	<0.1	18.7	18.8
R10	20.5	104.6	125.1	0.5	18.7	19.2
R11	35.4	104.6	140.0	1.0	18.7	19.7
R12	47.4	104.6	152.0	1.3	18.7	20.0
R13	48.8	104.6	153.4	0.9	18.7	19.6
R14	55.1	104.6	159.7	0.8	18.7	19.5
R15	56.1	104.6	160.7	0.8	18.7	19.5
R16	32.8	104.6	137.4	0.7	18.7	19.4
R17	14.3	104.6	118.9	0.3	18.7	19.0
R18	8.3	104.6	112.9	0.2	18.7	18.9
R19	30.1	104.6	134.7	0.5	18.7	19.2
R20	0.9	104.6	105.5	<0.1	18.7	18.8
R21	0.6	104.6	105.2	<0.1	18.7	18.8
R22	2.3	104.6	106.9	<0.1	18.7	18.8
R23	0.8	104.6	105.4	<0.1	18.7	18.8

R24	0.6	104.6	105.2	<0.1	18.7	18.8
R25	1.2	104.6	105.8	<0.1	18.7	18.8
R26	1.3	104.6	105.9	<0.1	18.7	18.8
R27	1.0	104.6	105.6	<0.1	18.7	18.8
R28	1.3	104.6	105.9	<0.1	18.7	18.8
R29	4.8	104.6	109.4	<0.1	18.7	18.8
R30	1.7	104.6	106.3	<0.1	18.7	18.8
R31	2.2	104.6	106.8	<0.1	18.7	18.8
R32	0.9	104.6	105.5	<0.1	18.7	18.8
R33	1.0	104.6	105.6	<0.1	18.7	18.8

Predicted 99th Percentile Odour Concentrations

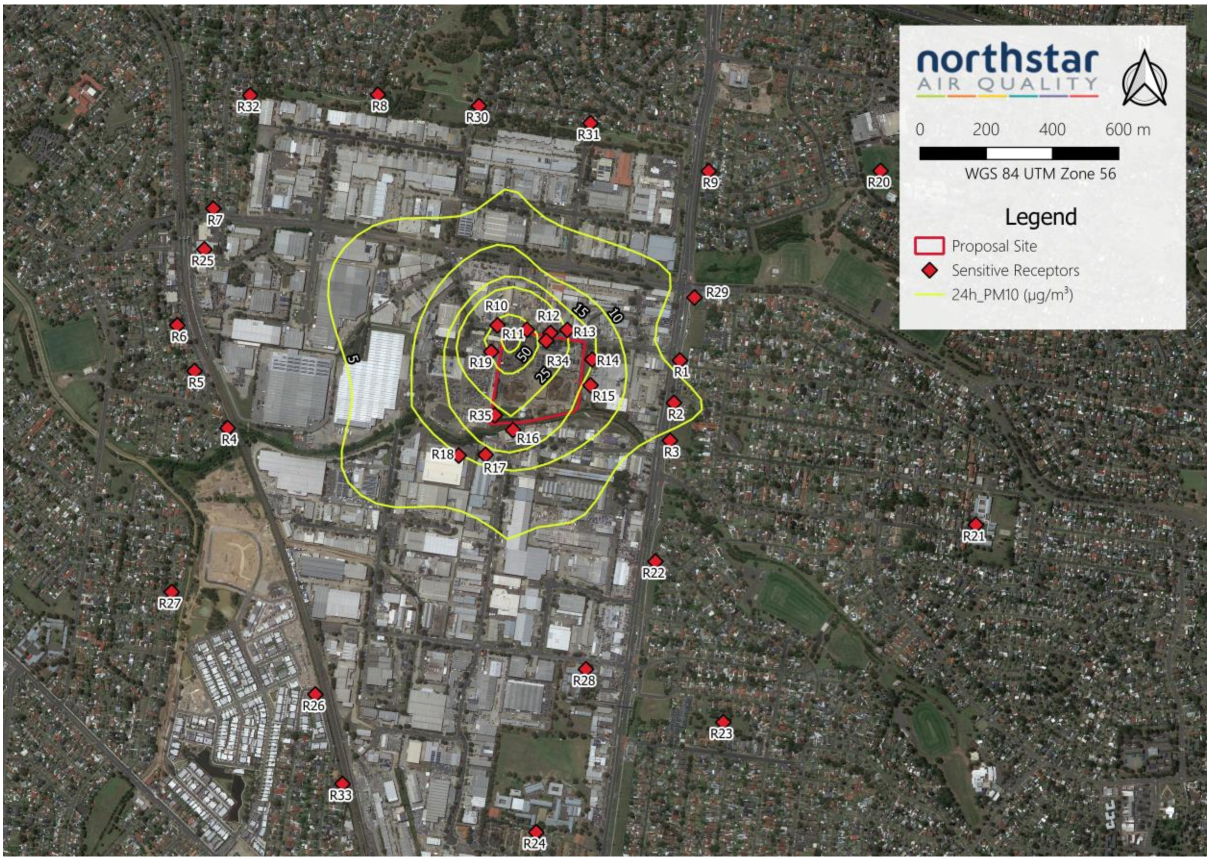
Receptor	99th percentile 1-h average odour concentration (OU)
R1	0.2
R2	0.2
R3	0.2
R4	0.1
R5	0.1
R6	0.1
R7	0.1
R8	0.1
R9	0.1
R10	0.9
R11	1.1
R12	1.1
R13	1.0
R14	0.8

Receptor	99th percentile 1-h average odour concentration (OU)
R15	0.8
R16	0.9
R17	0.5
R18	0.4
R19	1.0
R20	0.1
R21	0.0
R22	0.1
R23	0.0
R24	0.1
R25	0.1
R26	0.1
R27	0.1
R28	0.1
R29	0.2
R30	0.1
R31	0.1
R32	0.1
R33	0.1

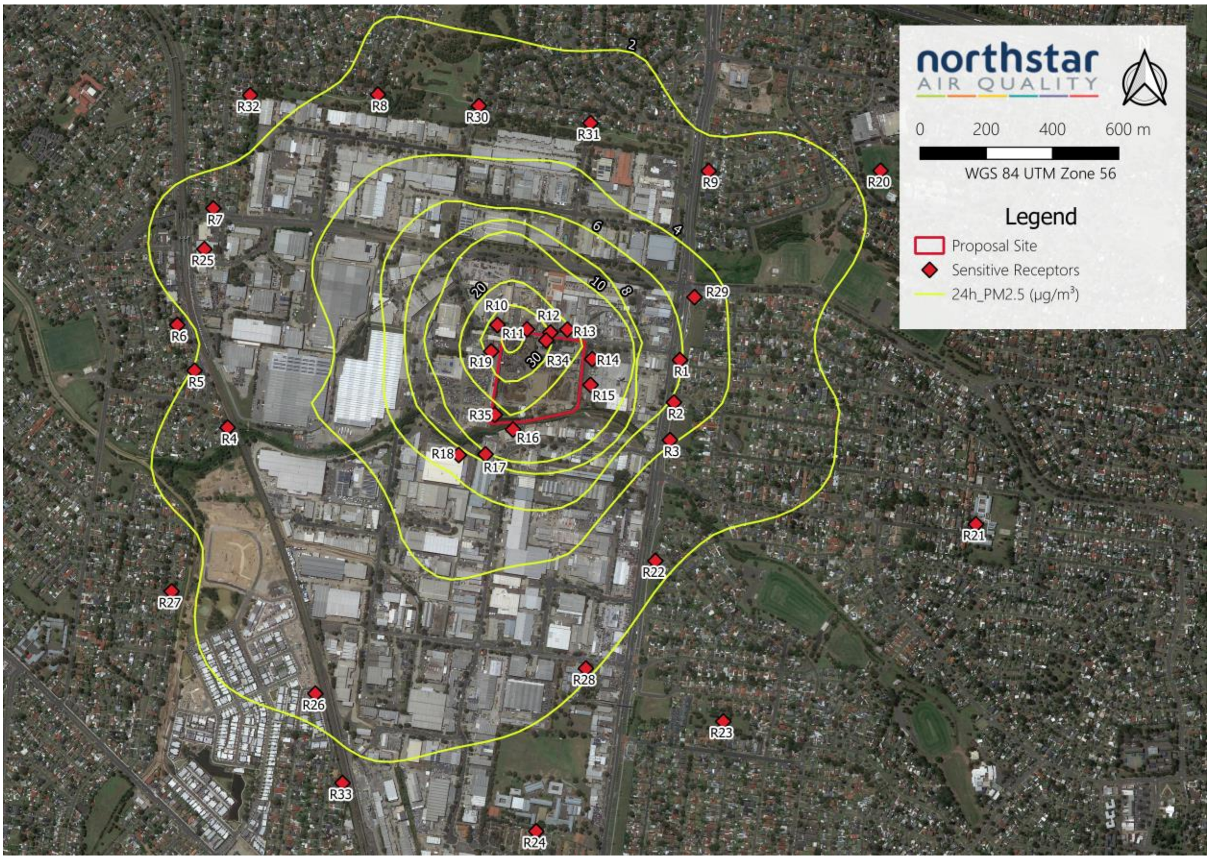
Appendix E

Isopleth Plots

Incremental 24-hour PM_{10} predictions



Incremental 24-hour $PM_{2.5}$ predictions



Incremental annual average TSP predictions

Incremental 1-hour NO_2 predictions