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Polytrade Material Recycling Facility, Smithfield

Air Quality Impact Assessment

Addressee(s):	Polytrade Pty Ltd
Report Reference:	21.1140.FR1V5
Date:	12 August 2022
Status:	Revised Final

Quality Control

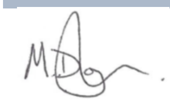
Study	Status	Prepared	Checked	Authorised
INTRODUCTION	Revised Final	Northstar	ML, GCG	MD
THE PROPOSAL	Revised Final	Northstar	ML, GCG	MD
LEGISLATION, REGULATION AND GUIDANCE	Revised Final	Northstar	ML, GCG	MD
EXISTING CONDITIONS	Revised Final	Northstar	ML, GCG	MD
METHODOLOGY	Revised Final	Northstar	ML, GCG	MD
AIR QUALITY IMPACT ASSESSMENT	Revised Final	Northstar	ML, GCG	MD
MITIGATION AND MONITORING	Revised Final	Northstar	ML, GCG	MD
CONCLUSION	Revised Final	Northstar	ML, GCG	MD

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
21	1140	Revised Final	R1	V5
Based upon the above, the specific reference for this version of the report is:				**21.1140.FR1V5**

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.



Martin Doyle **12 August 2022**

Non-Technical Summary

Northstar Air Quality was engaged by Polytrade Pty Ltd to perform an air quality impact assessment for the proposed operation of a materials recycling facility, to be located at 132-144 Warren Road, Smithfield, NSW.

A dispersion modelling assessment conducted in accordance with the relevant NSW Environment Protection Authority guidance has been performed to determine the likely air quality impacts upon surrounding receptor locations. Activity rates associated with average operational conditions have been used to determine the potential impact and compared against annual average criteria. To determine the potential maximum 24-hour impact of the Proposal, the materials haulage, handling and processing rates have been assumed to be 1.4 times that of the daily average rates, which is considered to represent a conservative assumption.

It is noted that in the absence of waste industry-specific emission factors, those associated with extractive industries have been adopted. These factors provide an emission rate far greater than would be anticipated in reality as the adopted emission factors are normally used to determine emissions of particulate from the unloading of overburden (soil) or rock, for example. Clearly, the particulate emission associated with a load of mixed recyclables is likely to be orders of magnitude lower than a load of overburden or rock. The results of the assessment should therefore take into consideration that conservatism and should be viewed as confirmation that the activities can be performed without resulting in additional exceedances of the air quality criteria. The results should not be viewed as a representation of the actual particulate impacts anticipated at any location.

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

It is respectfully considered that the Proposal should not be rejected on the grounds of air quality.

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1. INTRODUCTION

Polytrade Pty Ltd (Polytrade) has engaged Northstar Air Quality Pty Ltd (Northstar) to perform an air quality impact assessment (AQIA) for the proposed operation of a materials recycling facility (the Proposal) located at 132-144 Warren Road, Smithfield, NSW – Lot 2 of Deposited Plan (DP) 1230452 (the Proposal site).

This AQIA supports the State Significant Development (SSD) for the Proposal, provides an assessment of predicted off-site air quality impacts, and presents a range of mitigation measures to minimise air quality impacts, where required and relevant.

The *Environmental Planning and Assessment Act* 1979 (EP&A Act) forms the statutory framework for planning approval and environmental assessment in NSW. The Development qualifies as State Significant Development (SSD) under *State Environmental Planning Policy (State and Regional Development) 2011*, in accordance with Section 4.36 of the EP&A Act.

1.1 Purpose of the Report

The purpose of this report is to examine and identify whether the impacts of the operation of the Proposal may adversely affect local air quality and provide recommendations to manage risks to acceptable levels.

This AQIA has been performed in accordance with, and with due reference to:

- *Environmental Planning and Assessment Act* 1979;
- *Protection of the Environment Operations Act* 1997;
- Protection of the Environment Operations (Clean Air) Regulation 2021; and
- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW EPA, 2016).

1.2 Scope of Assessment

The AQIA has been performed to assess the potential effects of the operation of the Proposal upon air quality (including odour).

The report presents data that summarise and characterise the existing environmental conditions, identifies the potential emissions to air associated with the operation of the Proposal, examines the potential for off-site impacts and identifies appropriate mitigation measures that would be required to reduce those potential impacts.

1.3 Secretary's Environmental Assessment Requirements

Planning Secretary's Environmental Assessment Requirements (SEARS) have been provided for the Proposal by the NSW Department of Planning, Industry & Environment (DPIE) on 10 June 2021 and included input from NSW Environment Protection Authority (EPA). Table 1 provides a summary of the SEARs relevant to this AQIA.

Table 1 Coverage of SEARs and other Government Agency requirements relevant to air quality

Authority	Requirement	Relevant section
DPIE (10 June 2021)	The EIS must include an assessment of the potential impacts of the proposal (including cumulative impacts) and develop appropriate measures to avoid, mitigate, manage and/or offset these impacts. The EIS must address the following specific matters: **Air quality and odour** – including: - Including a quantitative assessment of the potential air quality, dust and odour impacts of the development in accordance with relevant Environment Protection Authority guidelines.	Section 6
	- The details of buildings and air handling systems and strong justification for any material handling, processing or stockpiling external to buildings.	Section 5.3
	- Details of proposed mitigation, management and monitoring measures.	Section 7
NSW EPA (4 June 2021)	**Air quality** - The EIS must: a. assess the potential impacts on local and regional air quality. Assessment of risk relates to environmental harm, risk to human health and amenity.	Section 6
	b. include an air quality assessment that identifies all potential air emissions from the Premises, including but not limited to coarse particulates, PM_{10}, $PM_{2.5}$, and odour. The proponent must assess the impact of these discharges and demonstrate effective control of all identified air emissions from the Premises.	Section 6
	c. propose mitigation measures to minimise the generation and emission of dust during the construction phase.	Section 7
	d. proposed mitigation measures to prevent the generation and emission of dust during the operational phase.	Section 7

1.4 Additional Information Request

On 10 May 2022, DPIE (now Department of Planning & Environment) provided a number of comments relating to this AQIA.

- *Daily traffic numbers are unclear. Tables 1 and 37 of the EIS indicate 95 trucks per day whereas the air quality report is based on 137 trucks per day (115 incoming waste / 22 dispatch). Also, the traffic report does not quantify the proposed number of trucks per 24-hour period. Please ensure consistent traffic numbers are provided in all documents and assessment of traffic impacts is undertaken on this basis.*

  The AQIA has been updated to consider daily traffic movements of 95 trucks per day (73 incoming / 22 dispatch).

- *Section 5.3 of the air quality impact assessment assumes all materials loading activities will occur in an enclosed building and that doors are likely to be closed. However, from the acoustic report it is understood that all roller doors may sometimes be open with the exception of roller doors F & I which are recommended closed. Truck dwell times requiring roller doors to be open during use should be quantified to ascertain worst case air pollution emissions.*

- *The air quality assessment should also include potential impacts from the proposed loading of trucks outside of the building.*

  The AQIA has been updated to assess the potential air quality impacts of materials being unloaded and handled by front end loader outside of the building.

  Emissions of particulate and odour have been assumed to be emitted from all nine doors (i.e. doors are assumed to be open).

  Given that materials are baled prior to removal from the site, the loading of trucks with that baled material is anticipated to result in negligible emissions and has not been subject to assessment.

- *Section 6.3 of the air quality impact assessment concludes the performance of the proposal does not result in any exceedances of the maximum 24-hour average PM2.5 impact assessment criteria. However, Table 14 appears to indicate the proposal results in an additional exceedance of PM2.5 at receiver R6 from 27.0 to 27.8 µg/m3. Please clarify.*

  The AQIA has been updated to cover the comments provided and results have subsequently changed accordingly. However, in relation to the specific comment above, an additional exceedance of the criterion was <u>not</u> predicted, as 27.0 $\mu g{\cdot}m^{-3}$ is already in exceedance of the 24-hour $PM_{2.5}$ criterion of 25.0 $\mu g{\cdot}m^{-3}$.

- *Provide details of the 'ceiling ventilation' and 'existing roof vents' referred to in Sections 9.8.2 and Table 44 of the EIS and confirm that these have been considered in the air quality impact assessment and advise if any filtration system is recommended.*

  These have not been included in the modelling assessment. The emissions from the proposal site have been modelled as being emitted from nine open doors, which represents a worst-case assessment.

- *Clarify the differences in percentage components of materials handled in the facility between Table 19 in the EIS and Table 2 in the air quality impact assessment. Please also confirm the differences do not have any material bearing on the air quality impact assessment.*

  The percentage of each material has been updated in the assessment and modelled accordingly. Section 2.6 provides the updated materials quantities subject to assessment. No material changes to the results are evident.

2. THE PROPOSAL

The following provides a description of the context, location, and scale of the Proposal and identifies the potential for emissions to air associated with the operation of the Proposal.

2.1 Environmental Setting

The Proposal site is located at 132-144 Warren Road, Smithfield, NSW within the Local Government Area (LGA) of the City of Cumberland. A map showing the location of the Proposal site is presented in Figure 1.

The land use surrounding the Proposal site is zoned as IN1 (General Industrial). The closest identified residential residence is approximately 400 meters (m) to the northeast of the Proposal site, on Warren Road, Woodpark.

A full description of the sensitivity of the surrounding land, and the identification of discrete receptor locations used in the AQIA is provided in Section 4.1.

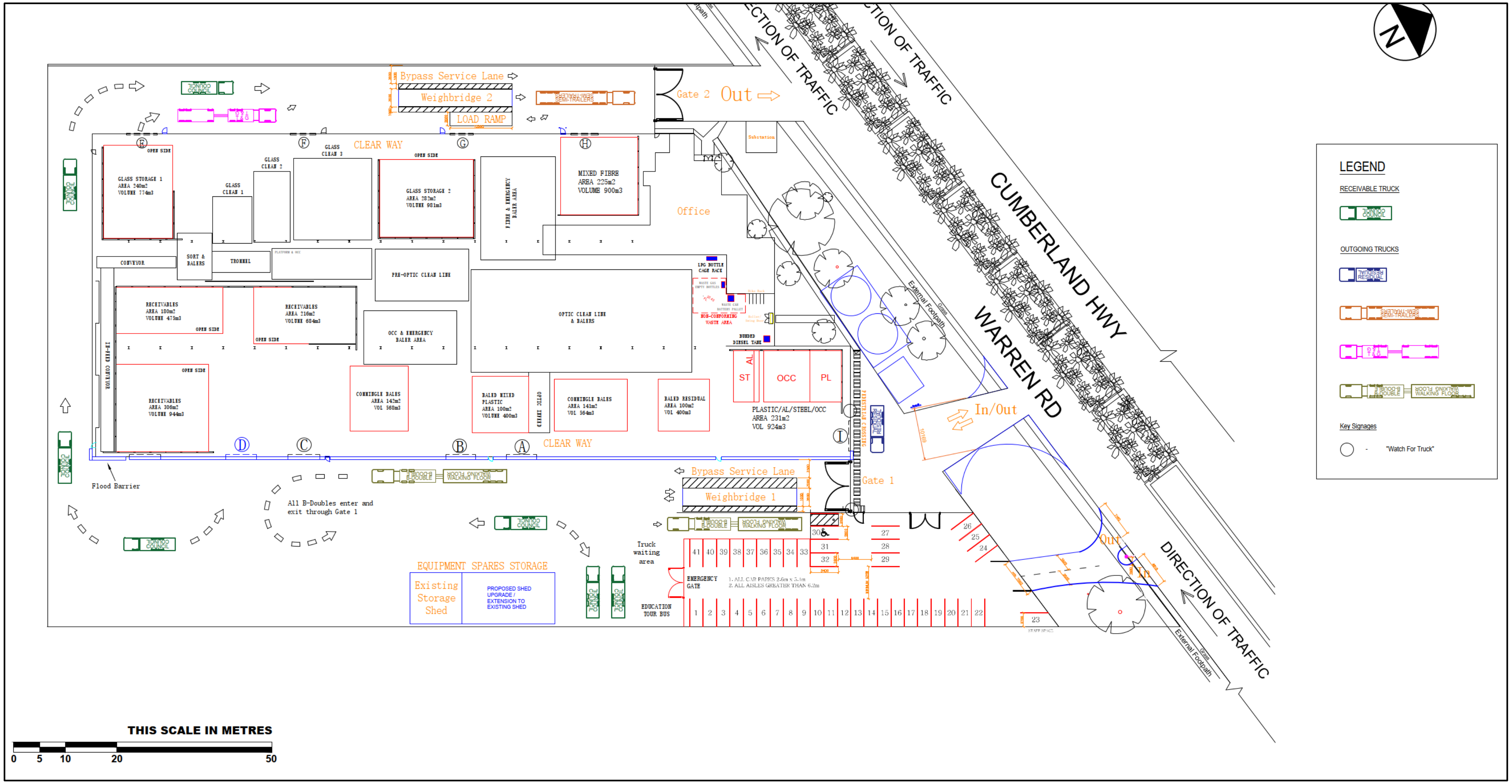
2.2 Overview and Purpose

The Proposal seeks to gain development approval for the operation of a materials recycling facility on approximately 1.9 hectares (ha) of land zoned as IN1 (General Industrial) under the Cumberland Local Environmental Plan (LEP) 2021. The Proposal site would receive and process up to 150 000 tonnes per year ($t \cdot yr^{-1}$) of domestic kerbside co-mingled recycling (yellow bin lid) and commercial recycling. Activities such as delivery, materials handling, sorting, storage, and despatch of material would be performed at the Proposal site. A layout of the Proposal site is provided in Figure 2.

Figure 1 Proposal site location

Note: Image courtesy of Google Maps.

Figure 2 Proposed site layout



Source: Polytrade July 2022 Rev 12

2.3 Process Description

2.3.1. Overview

The Proposal site would operate 24 hours per day, 7 days per week. Kerbside domestic co-mingled recycling would be received at the Proposal site between the hours of 0500 hrs (5:00 am) and 2300 hrs (11:00 pm) Monday to Friday. Commercial recycling is anticipated to be received between 0500 hrs (5:00 am) and 2300 hrs (11:00 pm) 7 days per week. Material processing will occur over a period of 24 hours, and despatch will occur over between 0500 hrs (5:00 am) and 2300 hrs (11:00 pm) 7 days per week.

Material will be delivered to the Proposal site from Warren Road via the weighbridge on the eastern side of the site and deposited outside the relevant receiving area. Vehicles will then exit via another weighbridge on the western side of the Proposal site as illustrated in Figure 2. The deposited materials will be visually inspected and pre-sorted within the receival area to remove larger items before processing through sorting equipment and plant.

Materials suitable for recycling are then transferred to an infeed hopper using a front-end loader (FEL) where sorting equipment will separate materials by size, weight and material type in accordance with the following categories:

- Glass;
- Mixed fibre (paper and cardboard);
- Old Corrugated Cardboard;
- Plastic;
- Aluminium;
- Steel; and,
- Residual material.

All storage of sorted materials is anticipated to occur within the building at the Proposal site prior to offtake in accordance with NSW Fire and Rescue guidance (Fire and Rescue, 2020). Paper / cardboard are expected to be stored on the western side of the building. Plastics and appropriately sized ferrous and non-ferrous metals are expected to be baled and stored in bunkers in the eastern end of the building (refer Figure 2). Glass will be stored in the western portion of the building in a concrete bunker.

Non-conforming waste is considered to be material that is not consistent with the input stream or is unable to be recovered. These materials are expected to be baled and stored in a concrete bunker in the eastern portion of the building prior to despatch to an appropriate facility for disposal.

Offtake of recyclable materials will be collected at the Proposal site from the locations illustrated in Figure 2. Baled paper / cardboard and plastics are expected to be loaded onto tautliner articulated vehicles on the western side of the building. Ferrous and non-ferrous metals will be loaded onto semitrailers in export containers at the eastern side of the building. The glass loading area is located on the western end of the building where material will be loaded onto truck and dogs using an FEL.

2.4 Identification of Potential Emissions to Atmosphere

Given the nature of the Proposal outlined briefly above, emissions to air would be likely to be generated as described below.

2.4.1. Construction Phase

Some minor construction works are proposed at the Proposal site prior to operation commencing. The proposed construction works comprise the following:

- Construction of internal roads;
- Installation of two weighbridges;
- Marking of parking and hardstand;
- Installation of stormwater infrastructure;
- Extension of existing shed; and
- Establishment of fencing and landscaping.

The proposed construction works to be performed at the Proposal site are relatively minor and are not anticipated to result in significant air quality impacts experienced at surrounding land uses. The Applicant has also proposed to manage particulate emissions deriving from construction activities through various mitigation measures including watering, covering soil and reducing truck speeds.

Given the minor extent of construction activity and the implementation of mitigation measures, impacts associated with fugitive particulate emissions from the Proposal site would be negligible. Emissions associated with the proposed construction works have not been further considered in this assessment.

2.4.2. Operational Phase

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

- Wheel-generated particulate emissions from the operation of the trucks and other site vehicles on paved road surfaces;
- Particulate emissions from the unloading and loading of materials from trucks;
- Particulate emissions from materials handling (sorting) and processing; and

- Odour from a minor quantity of contaminated materials.

The Proposal is expected to result in approximately 95 heavy vehicle movements per day, including unloading / loading recyclable materials to / from the Proposal site. Correspondingly, over a 12-hour operational day, the hourly average traffic is expected to be approximately 8 vehicles per hour, or 1 vehicle every 7.5 minutes, on average.

Estimating the contribution of the Proposal site to existing annual average daily traffic (AADT) flows on the local road network has been performed based on measured 2021 traffic flows on Fairfield Street, Fairfield (RMS traffic counter 66249) which is approximately 2.5 kilometres (km) away from the Proposal site. The calculated AADT flows on surrounding roads during operation, including the addition of the flows associated with the Proposal are anticipated to be approximately 19 273 vehicles.

To evaluate the significance of the estimated changes in operational traffic flows, reference has been made to the Environmental Protection UK (EPUK) document "*Development Control: Planning for Air Quality (2010 Update)*" (EPUK, 2010) which has been referenced in lieu of any identified NSW or Australian guidance. The guidance provides threshold criteria for evaluating the significance of changes in traffic, as a traffic flow change of more than 5 % to 10 % on roads with AADT of > 10 000 vehicles required to be assessed through quantitative methods (i.e. dispersion modelling).

The criteria outlined in EPUK (2010) provide a screening (i.e. qualitative) level of assessment which considers the potential for adverse air quality impacts based on traffic flows. As estimated in the scoping report, the anticipated changes in traffic account for approximately 0.5 % of existing traffic flow, and therefore do not exceed that threshold. Based on this screening approach it is not considered likely that the impacts associated with the Proposal would lead to significant changes in the existing traffic flow or adverse impacts during the operational phase. In accordance with the adopted guidance, the qualitative assessment screens that potential risk and a quantitative assessment is not considered to be warranted.

It is noted however that particulate potentially generated by wheel-generated dust has been included as part of this AQIA.

The incoming waste received at the Proposal site is not anticipated to be highly odorous and would not typically contain putrescible waste. However, it is reasonable to assume that a fraction of incoming waste may be odorous by nature of residual materials left on recyclable material, such as residues of food present in recyclable food containers. A conservative assessment has therefore been conducted that assesses potential odour impacts that could occur should 5 % of waste from the co-mingled recyclables stream be contaminated by putrescible residues.

Given the nature of the material to be accepted at the Proposal site, and the fact that the unloading, sorting and storage areas are all enclosed and on hardstand, leachate is not anticipated to be generated in any significant quantities, or which cannot be contained by the drainage system. Significant spillages of leachate presented in waste material would be cleaned immediately through the use of spill kits.

An odour complaints procedure would also be implemented as part of the Air Quality Management Plan (AQMP) and the complaint log would form part of the ongoing environmental management of the site.

In light of the above, a quantitative assessment of the potential odour impacts identified above has been performed.

2.5 Environmental Controls

A number of air quality management measures are to be employed as part of the operation of the Proposal to minimise the generation and off-site transport of particulate matter and odour. A discussion of these adopted measures is presented in Section 5.3.

2.6 Activity Rates

The AQIA requires a range of activity data that describes the activity rates performed on site, such as vehicle movements, processing rates etcetera.

As the AQIA is required to assess impacts over both shorter-term and longer-term periods, the activity data presented in Table 2 are assumed to be representative of the proposed activity over the relevant assessment periods.

Table 2 Adopted activity rates

Parameter	Units	Annual	Daily maximum
Operating hours	hours	8 760	24
Operating days	days	365	-
Waste receival – council and contractor	-	5 am to 11 pm, Monday to Friday	
Waste receival – commercial recycling vehicles	-	5 am to 11 pm, 7 days	
Material despatch	-	24 hours, 7 days	
Material delivery, handling and processing rates			
Residential and commercial recycling material (total) (100 %)	tonnes	150 000	577
Paper (31 %) and cardboard (8 %)	tonnes	58 500	225
Glass (31 %)	tonnes	46 800	180
Plastic (17.5 %)	tonnes	26 500	102
Steel (3 %) and aluminium (0.5 %)	tonnes	5 200	20
Residual (9 %)	tonnes	13 000	50
Haulage route			
Distance of loop from entry to exit	metres	400	
Average vehicle weight (weighted average)	tonnes	12.9	
Vehicle movements			
Heavy vehicle movements (material delivery) – 5 days per week	number	18 980	73

Parameter	Units	Annual	Daily maximum
Heavy vehicle movements (material despatch) – 7 days per week	number	8 030	22

Note: The distribution of waste materials has been provided by the applicant. These data are used in the emissions estimation outlined in **Section 5.2**.

It is noted that the maximum daily rate of material handling and processing has been assumed to be 1.4 times that of the average daily rate. This is likely to be a conservative assumption although has been adopted to ensure that the predicted short-term impacts are not underestimated. The likelihood of the maximum daily handling and processing rate being coincidental with the meteorological conditions which may give rise to the worst-case impacts is low but is required to be assessed in this manner.

A peak to average activity factor of ×1.4 provides an equivalent annual waste activity rate of 210 000 $t{\cdot}yr^{-1}$ of co-mingled recyclables would be received at the Proposal site each year (150 000 $t{\cdot}yr^{-1}$ × 1.4). That assumption equates to a peak daily activity rate of 577 tonnes per day ($t{\cdot}day^{-1}$) (as presented in Table 2).

For clarity, that assumption is not the proposed annual waste acceptance capacity, but the equivalence of applying the above peak to average activity factor to the annual throughput for the purposes of the AQIA only.

This assumption is consistent with recently performed AQIA for similar facilities in Sydney (e.g. Chullora MRF (Katestone, 2020) assumed a peak to average activity factor of ×1.3. The reality of waste collection contracts would mean that the potential for peak rates to exceed that assumption are low, and it is considered to represent a suitable worst-case assumption.

3. LEGISLATION, REGULATION AND GUIDANCE

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, 2016)) which has been consulted during the preparation of this assessment report.

3.1 Ambient Air Quality Standards

The Approved Methods lists the statutory methods that are to be used to model and assess emissions of criteria air pollutants from stationary sources in NSW. Section 7.1 of the Approved Methods clearly outlines the impact assessment criteria for the Proposal. The criteria listed in the Approved Methods are derived from a range of sources (including NHMRC, NEPC, DoE, WHO and ANZECC). Where relevant to this AQIA (coincident with the potential emissions identified in Section 2.4), the criteria have been adopted as set out in Section 7.1 of NSW EPA (2016) which are presented in Table 3.

Table 3 NSW EPA air quality standards and goals

Pollutant	Averaging period	Units[(E)]	Criterion	Notes
Particulates (as PM_{10})	24 hours	$\mu g{\cdot}m^{-3}$ [(A)]	50	Numerically equivalent to the AAQ NEPM[(B)] standards and goals.
	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	

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
(E) Gas volumes are expressed at 25°C (298 K) and at an absolute pressure of 1 atmosphere (101.325 kPa)

3.2 NSW Government Air Quality Planning

NSW EPA has formed a comprehensive strategy with the objective of driving improvements in air quality across the State. This comprises several drivers, including:

- Legislation: formed principally through the implementation of the *Protection of the Environment Operations Act* 1997 and the Protection of the Environment Operations (Clean Air) Regulations 2010. The overall objective of this legislative instruments is to achieve the requirements of the National Environment Protection (Ambient Air Quality) Measure;
- Clean Air for NSW: The 10-year plan for the improvement in air quality;
- Interagency Taskforce on Air Quality in NSW: a vehicle to co-ordinate cross-government incentives and action on air quality;

- Managing particles and improving air quality in NSW; and
- Diesel and marine emission management strategy.

In regard to the relevance of the NSW Government's drive to improve air quality across the State and this AQIA, it is imperative that it is demonstrated that the Proposal would lead to the development of the NSW economy (in terms of activity and employment) and not cause an unacceptable environmental detriment to achieve its objective.

3.3 Odour Assessment Criteria

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".

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 threshold and defines one odour unit (OU). An odour goal of less than 1 OU would theoretically result in no odour impact being experienced. In practice, the character of a particular 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 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, 2006a) recommends that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 OU. This is expressed as the 99th percentile value, as a nose response time average (approximately one second).

Odour assessment criteria need to take into account the range in sensitivities to odours within the community in order to provide additional protection for individuals with a heightened response to odours. This is addressed in the Technical Framework (DECC, 2006a) by setting a population dependant odour assessment criterion. 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 is shown in Table 4. 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 4 NSW EPA Technical Framework odour criteria

Population of Affected Community	Impact Assessment Criteria for Complex Mixture of Odours (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, DEC 2006

The NSW EPA generally determines that in the Sydney Metropolitan region, an odour performance goal of 2 OU should be applied. The 2 OU goal has therefore been adopted for the purposes of this assessment.

4. EXISTING CONDITIONS

4.1 Surrounding Land Sensitivity

4.1.1. Land Use Zoning

Land use zoning as a mechanism to provide planning and environmental control to achieve the objectives of the *Environmental Planning and Assessment Act* (1979).

The land use surrounding the Proposal site is zoned by Cumberland City Council in the Cumberland City Council Local Environmental Plan (2021) and is illustrated in Figure 3. The land surrounding the Proposal site is zoned as IN1 (General Industrial). The closest residential land uses are approximately 400 m to the northwest in Woodpark.

4.1.2. Discrete Receptor Locations

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

It is noted that one of the assessment criteria applied to particulates (see Section 3.1) is over a 24-hour averaging period, and as such the predicted impacts need to be interpreted at commercial and industrial receptor locations with care. It is considered to be atypical for a person to be at those locations for a complete 24-hour period and as such the exposure risks at those locations would be over-estimated by the modelling assessment.

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 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 4.1.3) that are used to plot out the predicted impacts, and as such the accidental non-inclusion of a location sensitive to changes in air quality does not render the AQIA invalid, or otherwise incapable of assessing those potential risks.

Figure 3 Land use zoning

Source: Image courtesy of NSW Department of Planning and Environment

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

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
- None 0

The Proposal site is located in an area of very low / low population density which would be expected given the industrial nature of the surrounding area. Medium population densities are observed to the south and north-west of the Proposal site.

The receptors adopted for use within this AQIA are presented in Table 5. This selection is derived from the information presented in Figure 3 and Figure 4.

Table 5 Discrete sensitive receptor locations used in the study

Rec.	Land Use	Distance to Proposal site (m)	Location (UTM)	
			mE	mS
R1	Industrial	12.7	310 477	6 252 973
R2	Industrial	175.7	310 315	6 252 996
R3	Industrial	55.2	310 590	6 253 115
R4	Residential	403.1	310 936	6 253 325
R5	Industrial	107.3	310 705	6 252 944
R6	Industrial	15.4	310 605	6 252 919
R7	Industrial	34.5	310 550	6 252 830
R8	Industrial	116.9	310 428	6 252 775

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.

Figure 4 Population density and sensitive receptors surrounding the Proposal site

Note: Image courtesy of Google Maps

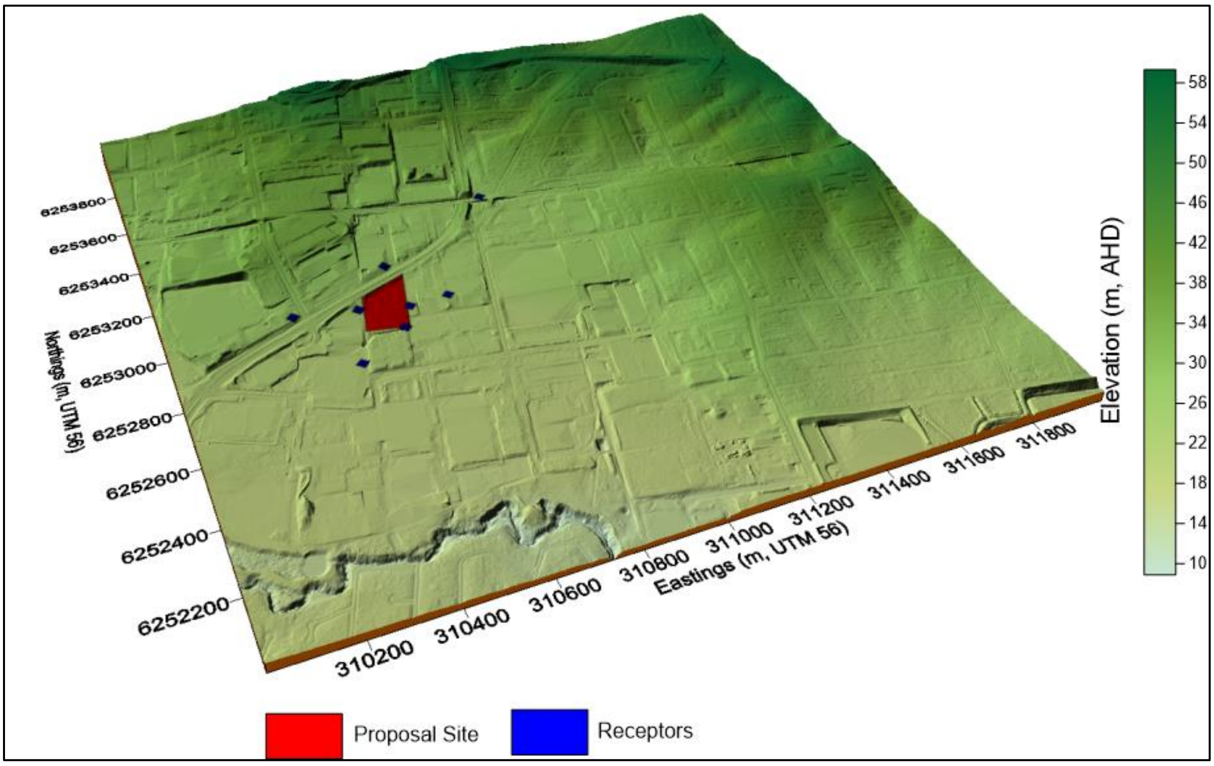
4.1.3. Uniform Receptor Locations

Additional to the sensitive receptors identified in Section 4.1.2, 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 25 m Australian Height Datum (AHD). The topography between the Proposal site and nearest sensitive receptor locations is uncomplicated.

Figure 5 Local topography surrounding the Proposal site



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).

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 is provided in Table 6 (listed by proximity).

Table 6 Details of meteorological monitoring surrounding the Proposal site

Site Name	Approximate Location (UTM)		Approximate Distance
	mE	mS	km
Horsley Park Equestrian Centre AWS -Station # 67117	301 708	6 252 298	8.8
Sydney Olympic Park AWS – Station # 66161	320 947	6 252 557	10.3
Sydney Olympic Park (Archery Centre) AWS – Station # 66137	321 575	6 254 599	11.1

It is considered that Horsley Park Equestrian Centre AWS 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 2016 to 2020, winds at Horsley Park Equestrian Centre AWS show similar wind distribution patterns across the years assessed, with a predominant south-westerly wind direction.

The majority of wind speeds experienced at Horsley Park Equestrian Centre AWS over the 5-year period 2016 to 2020 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 westerly and south-easterly direction. Winds of this speed are not frequent, occurring less than 1 % of the observed hours over the 5-year period. Calm winds prevail, occurring more than 17 % of observed hours.

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

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 will vary depending on the pollutants to be assessed and can often be characterised by using representative air quality monitoring data. For this study, the most recent five years of completed data (2016-2020) has been assessed to determine the background air quality environment surrounding the Proposal site.

The Proposal site is located proximate to a number of (three) AQMS operated by NSW DPIE. These locations (listed by proximity) are briefly summarised in Table 7.

Table 7 Closest DPIE AQMS to the Proposal site

AQMS Location	Data Availability	Distance to Site (km)	Measurements		
			PM_{10}	$PM_{2.5}$	TSP
Parramatta North	2017 - present	6.6	✓	✓[1]	×
Prospect	2007 - present	6.7	✓	✓	×
Chullora	2002 - present	9.9	✓	✓	×

The closest active AQMS is noted to be located at Parramatta North, however, this monitoring station does not have a completed dataset for the period 2016-2017, and therefore data from Prospect AQMS has been obtained for this assessment and is considered to be reflective of the conditions at the Proposal site, given its proximity and siting.

A full summary of air quality monitoring data measured at Prospect AQMS for the year 2018 (consistent with the selected meteorological period) is provided in Appendix B.

The background air quality data has been utilised in this AQIA to assess the contribution of the Proposal to the air quality of the surrounding area. A full discussion of how the Proposal impacts upon local air quality is presented in Section 6.

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 in CALPUFF 2-dimensional (2-D) mode.

The meteorological dataset has been developed using The Air Pollution Model (TAPM, v 4.0.4) (see Appendix A for further information).

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

The modelling scenario used in this AQIA provides an indication of the air quality impacts of the operation of activities at the Proposal site. Added to these impacts are background air quality concentrations (where available and discussed in Section 4.4) which represent the air quality which may be expected within the area surrounding the Proposal site, without the impacts of the Proposal itself.

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

5.2 Emissions Estimation

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 for materials handling processes, and movement of trucks on paved site roads, as contained within the US EPA AP-42 emission factor compendium (USEPA, 2006) to represent the emission of particulate matter resulting from the operations occurring at the Proposal site as described in Section 2.4.

Emissions resulting from the loading of materials have been estimated using the US EPA AP-42 emission factor for batch drop (Section 13.2.4.3, Aggregate Handling and Storage Piles (US EPA, 2006b)), with emissions resulting from the transfer of materials estimated using the AP-42 emission factor for conveyor transfer points (Section 11.19.2, Crushed Stone Processing and Pulverized Mineral Processing (US EPA, 2004)). It is stressed that these emission factors have been adopted in the absence of waste industry specific emission factors and will significantly over-estimate the emissions of particulate matter resulting from those processes. The results of this assessment should therefore be viewed as an assessment of compliance, rather than an assessment of the likely impact.

The batch drop emission factor can result from several distinct source activities because the adding or removal of material from a storage pile or receiving surface results in batch drop operations and in other cases continuous drop operations. Either type of drop events emission factor can be estimated through:

$$EF\ (kg \cdot tonne^{-1}) = k(0.0016)\frac{(\frac{U}{2.2})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:

$EF_{(kg \cdot tonne^{-1})}$ = emission factor

k = particle size multiplier, where TSP = 0.74; PM_{15} = 0.48; PM_{10} = 0.35; PM_5 = 0.20; $PM_{2.5}$ = 0.053

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

M = material moisture content (%)

The quality rating for this application is rated A.

The mean wind speed has been taken to be 2.1 $m \cdot s^{-1}$ (long-term average wind speed measured at Horsley Park AWS between 2016 and 2020, refer Appendix A) for those activities occurring outside of the building (i.e. unloading of materials, and pick up by front end loader). For all other activities occurring within the building, the wind speed has been taken to be 0.5 $m \cdot s^{-1}$, which is considered to be reasonable, given that those activities would be significantly shielded by the building structure, and located away from the doors.

Once again, it is noted that this emission factor is associated with extractive industrial operations. The relative 'dustiness' of materials being delivered to, and unloaded at, the MRF are anticipated to be significantly lower than those associated with extractive industries. The results of this AQIA associated with particulate matter should be viewed as highly conservative.

Emissions associated with the transfer of materials on conveyors and conveyor transfer points have been taken from

In relation to odour, emissions associated with the 5 %(w/w) of contaminated material assumed to be present at the Proposal site have been calculated based on emission factors associated with municipal solid waste, in the absence of more specific data. It has been assumed that 47.8 t of material would be received at the Proposal site each hour during a peak busy day (574 t over a 12 hour period), and of that, 5 %(w/w), or 2.4 t, may be contaminated. Applying an emission factor of 113.5 odour units per tonne of waste per second ($OU \cdot m^3 \cdot t^{-1} \cdot s^{-1}$) results in an emission rate of 271.4 $OU \cdot m^3 \cdot s^{-1}$. The emission factor has been sourced from monitoring data (TOU, 2018) and as applied in a recent co-mingled recycling SSD AQIA (Katestone, 2020).

The evaluation of odour impacts requires the estimation of short or peak concentrations on the time scale of less than one second. Dispersion model predictions are typically valid for averaging periods of one hour and longer. Dispersion models therefore need to be supplemented to accurately simulate atmospheric dispersion of odours and the instantaneous perception of odours by the human nose. The prediction of peak concentrations from estimates of ensemble means can be obtained from a ratio between extreme short-term concentration and longer-term averages. Properly defined peak-to-mean ratios depend upon the type of source, atmospheric stability and distance downwind. The NSW EPA recommended factor for estimating peak concentrations for volume source is 2.3, in all atmospheric conditions. This factor has been adopted within this assessment.

A full description of the emission sources included in the assessment for each scenario, and the emission factors and assumptions adopted are presented in Appendix C. The factors adopted are presented in Table 8.

Table 8 Adopted particulate matter emission factors

Emission source	Emission factor	Emission rate			Justification
		TSP	PM_{10}	$PM_{2.5}$	
Haulage (external roads)	Paved roads (13.2.1 – AP-42)	0.0827 $kg \cdot VKT^{-1}$	0.016 $kg \cdot VKT^{-1}$	0.0038 $kg \cdot VKT^{-1}$	Factor associated with paved roads (AP42) with a silt content of 2 $g \cdot m^{-2}$ adopted.
Unloading material outside of the building, FEL on that material	Batch drop (13.2.4.3 – AP-42)	0.0011 $kg \cdot t^{-1}$	0.0005 $kg \cdot t^{-1}$	0.00008 $kg \cdot t^{-1}$	AP-42 equation uses material and site-specific data and is used for the aggregate handling industry. Assumed material moisture content of 2 % for all materials and average wind speed of 2.1 $m \cdot s^{-1}$

Emission source	Emission factor	Emission rate			Justification
		TSP	PM_{10}	$PM_{2.5}$	
Batch drop operations within the building		0.00017 $kg \cdot t^{-1}$	0.00008 $kg \cdot t^{-1}$	0.00001 $kg \cdot t^{-1}$	Assumed material moisture content of 2 % for all materials and average wind speed of 0.5 $m \cdot s^{-1}$ (afforded by wind shielding of the building structure)
Conveyor transfer points	Conveyor transfer point (11.9.2.1 - AP-42)	0.0015 $kg \cdot t^{-1}$	0.00055 $kg \cdot t^{-1}$	0.00015 $kg \cdot t^{-1}$	The AP-42 factor adopted is a constant factor for conveyor transfer points in the aggregate handling industry.

Wind erosion has not been considered within the dispersion modelling assessment. Given the nature of the materials received and activities to be performed at the Proposal site, a significant quantity of particulate matter is not anticipated to be present on the hardstand surfaces of either the internal or external hardstand areas. Furthermore, available emission factors which account for wind erosion are generally associated with the mining industry, and are relevant to areas which experience a constant replenishment of fine particulate material (e.g. coal dust). Given that the factors already applied to the materials receival, handling and processing activities at the Proposal site are already conservative, the inclusion of unrealistic emissions of particulate matter from clean hardstand areas is not considered to appropriately reflect actual site operations. The non-inclusion of wind erosion sources is consistent with a recent SSD AQIA for a similar co-mingled recycling facility in Sydney (Katestone, 2020).

5.3 Emissions Controls

This section discusses the control measures to be adopted as part of the Proposal.

Materials receival activities, and the action of the front-end loader on that received and unloaded material has been assumed to occur outdoors of the respective loading doors alongside the building. For the purposes of dispersion modelling, emissions of particulate matter from these sources have been assumed to include no emission controls, to represent potential worst-case impacts on surrounding receptors.

All other materials handling, processing and loading activities will occur in a building. The use of a building will act to reduce wind shear and wind speeds within that building, resulting in significantly lower generation of particulate matter, and reduce the potential for that material to be transported offsite. The emission factors have been adjusted to take into account the reduction in wind speeds afforded by the building structure. This control has been implemented through the following adjustments:

- A reduction in emissions estimated through the use of the US EPA AP-42 section 13.2.4.3 equation (batch drop) of 85 %, commensurate with the reduction in wind speed from 2.1 $m \cdot s^{-1}$ to 0.5 $m \cdot s^{-1}$; and
- The application of a 70 % control factor for all other particulate emissions generated from activities performed within the building.

For the purposes of dispersion modelling however, emissions of particulate matter (and odour) have been assumed to be released from each of the nine openable doors at the Proposal site. This is not anticipated to occur in reality, as doors are likely to be closed, although the modelling has been performed in this manner to assess potential worst-case impacts on surrounding receptors.

External roadways at the Proposal site would all be constructed of hardstand/paved surface which would be regularly swept to ensure that silt loadings are minimised. In addition, vehicle speeds within the Proposal site will be limited to 15 $km \cdot hr^{-1}$, which would also ensure that any resuspension of deposited material is reduced. An emission control efficiency of 44 % has been applied to account for significantly reduced vehicle speeds.

Table 9 provides the emission control efficiencies associated with each adopted management measure. Emissions controls which would be implemented continuously have been included in the dispersion modelling assessment. Those which would be applied on an as-required basis have not been included as they cannot be defensibly included to impact (for example) the maximum 24-hour particulate concentrations.

The Proposal would employ best practice emission controls on all activities
Applied conservatism The emission controls outlined in Table 9 are those which will be employed at the Proposal site. Some applied emission controls measures do not have an associated emission control efficiency, although their adoption would result in emissions from the Proposal, and subsequent impacts, being lower than those calculated, modelled, and assessed. All of the control measures outlined in Table 9 will be adopted, and their implementation will result in reductions in emissions from the Proposal. The results outlined in Section 6 should therefore be viewed with that conservatism in mind. It is noted that the Proposal does not rely on any unquantifiable emissions reductions to confirm compliance with the environmental objectives outlined in Section 3, rather these controls provide confidence that the results presented in Section 6 would be easily achievable.

Table 9 Emission reduction methods and particulate control efficiencies

Emission control method	Adoption	Control efficiency (%)	Adopted in dispersion modelling	Reference / Notes
Road haulage				
Vehicle restrictions that limit the speed of vehicles on the road	☑	44	☑	44 % for speeds < 40 $km \cdot hr^{-1}$ - table 6-6 of (Countess Environmental , 2006)[A]
Materials handling				
Minimising the drop height from vehicles	☑	30	☒	Adopted as far as practicable. Reduction associated with a drop height reduction from 3 m to 1.5 m (Katestone Environmental Pty Ltd, 2011)
Covering loads with a tarpaulin	☑	-	-	Not quantified
Limit load sizes to ensure material is not above the level of truck sidewalls	☑	-	-	Not quantified
Performance of relevant activities within a building	☑	70	☑	Table 4 of (NPI, 2012) (Katestone Environmental Pty Ltd, 2011) Applied to relevant sources within the building only. Note that the emission factor for batch drop operations has been adjusted to account for the reduction in wind speed afforded by the building, which equates to an emission control factor of 85 %.
Minimising travel speeds and distances	☑	-	-	Not quantified
Materials processing				
Performance of relevant activities within a building	☑	70	☑	Table 4 of (NPI, 2012) (Katestone Environmental Pty Ltd, 2011) Applied to relevant sources within the building only. Note that the emission factor for batch drop operations has been adjusted to account for the reduction in wind speed

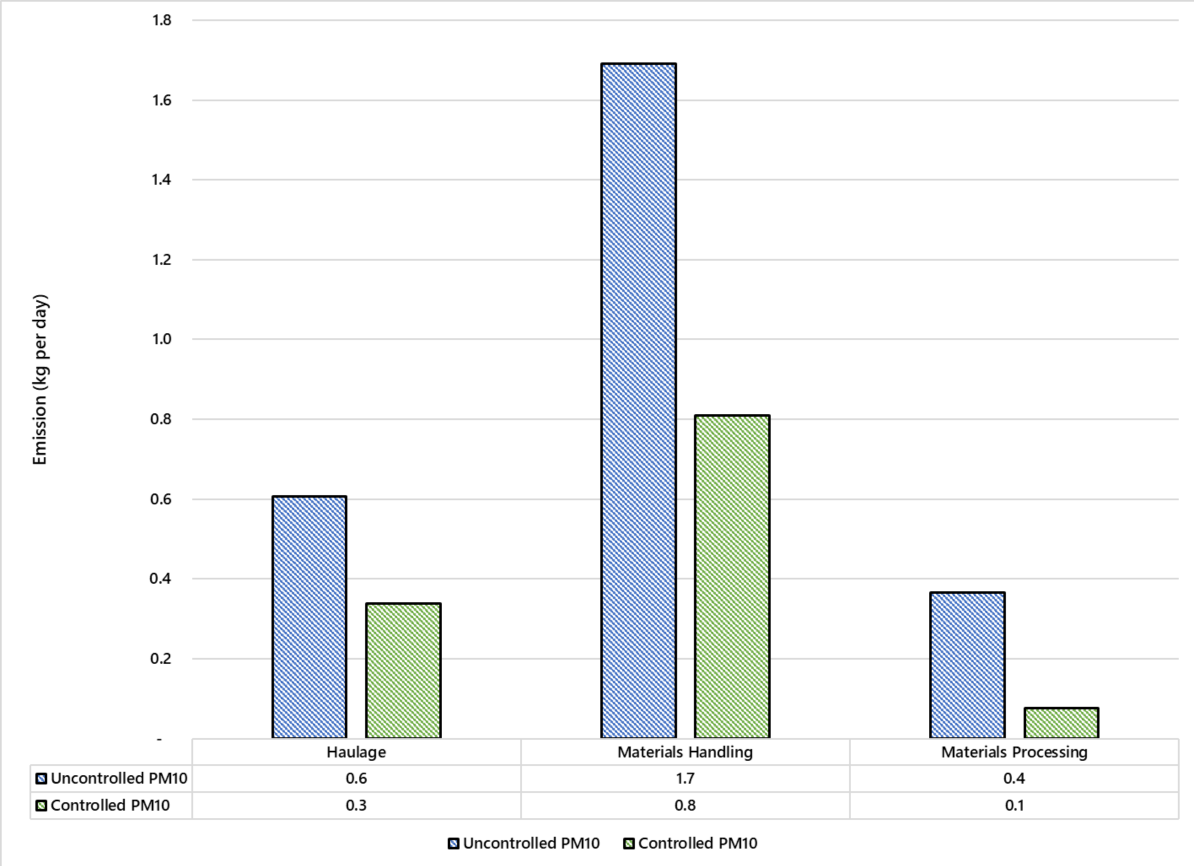
Emission control method	Adoption	Control efficiency (%)	Adopted in dispersion modelling	Reference / Notes
				afforded by the building, which equates to an emission control factor of 85 %.

Notes: (A): For unpaved roads but applied to paved roads

(B): Converted from quoted value of 0.48 gal·yd^{-2}

Based on the foregoing, the distribution of calculated annual average uncontrolled and controlled particulate emissions across broad emissions categories is presented in Figure 6 for PM_{10}.

Figure 6 Calculated uncontrolled & controlled peak daily PM_{10} emissions



6. AIR QUALITY IMPACT ASSESSMENT

The methodology used to assess operational phase impacts is discussed in Section 5. 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 operation of the Proposal in isolation.
- **Cumulative impact** – relates to the concentrations predicted as a result of the operation of the Proposal PLUS the background air quality concentrations discussed in Section 4.4.

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**

Results are presented in this section for the predictions of particulate matter (TSP, PM_{10}, $PM_{2.5}$ and dust deposition). The averaging periods associated with the criteria for these pollutants is 24-hour and annual averages, as specified in Table 3. The emissions adopted for these scenarios reflect the operational profile of the Proposal over those averaging periods (refer Section 5.2).

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

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

The results indicate that predicted incremental concentrations of TSP, PM_{10} and $PM_{2.5}$ at all receptor locations are low (< 5.1 % of the annual average TSP criterion, < 6.8 % of the annual average PM_{10} criterion and < 3.8 % of the $PM_{2.5}$ criterion).

The addition of existing background concentrations (refer Section 4.4), results in predicted concentrations of annual average TSP being < 55.1 % and annual average PM_{10} being ≤ 94.4 % of the relevant criteria at the nearest receptors.

The existing adopted annual average $PM_{2.5}$ background concentration is shown to be in exceedance of the relevant criterion (highlighted in Table 10), even without the operation of the Proposal added.

Examination of the predicted $PM_{2.5}$ impacts which would result from the operation of the Proposal indicates that these concentrations are predicted to be < 0.4 $\mu g{\cdot}m^{-3}$ at all surrounding receptors.

The inclusion of the best practice management dust control measures is shown to minimise offsite annual average $PM_{2.5}$ impacts to the maximum extent possible.

The performance of the Proposal does not in itself result in any additional exceedances of the annual average particulate matter impact assessment criteria.

Table 10 Predicted 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	Regional Background	Cumulative Impact	Incremental Impact	Regional Background	Cumulative Impact	Incremental Impact	Regional Background	Cumulative Impact
R1	4.2	45.0	49.2	1.6	21.9	23.5	0.3	8.5	8.8
R2	0.2	45.0	45.2	0.1	21.9	22.0	<0.1	8.5	8.6
R3	0.6	45.0	45.6	0.2	21.9	22.1	<0.1	8.5	8.6
R4	<0.1	45.0	45.1	<0.1	21.9	22.0	<0.1	8.5	8.6
R5	1.0	45.0	46.0	0.4	21.9	22.3	<0.1	8.5	8.6
R6	4.6	45.0	49.6	1.7	21.9	23.6	0.3	8.5	8.8
R7	2.2	45.0	47.2	0.8	21.9	22.7	0.2	8.5	8.7
R8	0.6	45.0	45.6	0.2	21.9	22.1	<0.1	8.5	8.6
Criterion	-	90		-	25		-	8	

No contour plots of annual average TSP, PM_{10} or $PM_{2.5}$ are presented, given the minor contribution from the Proposal at the nearest relevant sensitive receptors.

6.2 Annual Average Dust Deposition Rates

Table 11 presents the annual average dust deposition predicted as a result of the operations at the Proposal site. An assumed background dust deposition of 2 g·m^{-2}·month^{-1} is presented in Table 11, although comparison of the incremental concentration with the incremental criterion of 2 g·m^{-2}·month^{-1} is also valid (as discussed within Section 4.4). In either case, the resulting conclusions drawn are identical. Annual average dust deposition is predicted to meet the criteria at all receptors surrounding the Proposal site where the predicted impacts are < 20 % of the incremental criterion at receptor locations.

No contour plot of annual average dust deposition is presented, given the minor contribution from the Proposal at the nearest sensitive receptors.

The performance of the Proposal does not result in any exceedances of the annual average dust deposition impact assessment criteria.

Table 11 Predicted annual average dust deposition

Receptor	Annual Average Dust Deposition ($g \cdot m^{-2} \cdot month^{-1}$)		
	Incremental Impact	Regional Background	Cumulative Impact
R1	0.4	2.0	2.4
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	0.4	2.0	2.4
R7	0.2	2.0	2.2
R8	<0.1	2.0	2.1
Criterion	2	-	4

6.3 Maximum 24-hour PM_{10} and $PM_{2.5}$

Table 12 presents the maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations predicted to occur at the nearest receptors as a result of the Proposal operations. No background concentrations are included within this table. The maximum predicted incremental impacts are highlighted in bold text.

Table 12 Predicted maximum incremental 24-hour 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	7.7	1.4
R2	1.4	0.3
R3	1.8	0.4
R4	0.2	<0.1
R5	1.8	0.4
R6	**8.0**	**1.5**
R7	4.7	0.9
R8	2.1	0.4
Criterion	50	25

The predicted maximum incremental concentrations are demonstrated to represent up to 16% of the PM_{10} criterion, and up to 6.0 % of the $PM_{2.5}$ criterion at receptor R6.

The predicted cumulative maximum 24-hour average PM_{10} and $PM_{2.5}$ concentrations resulting from the operation of the Proposal, with background included are presented in Table 13 and Table 14 respectively.

Results are presented in Table 13 and Table 14 for the receptor at which the greatest impacts have been predicted (refer to Table 12) for PM_{10} and $PM_{2.5}$.

The left side of Table 13 and Table 14 show the predicted concentration on days with the highest predicted cumulative impacts (generally driven by days of increased background contributions), and the right side shows the total predicted concentration on days with the highest predicted incremental concentrations, respectively.

The analysis indicates that no additional exceedances of the 24-hour average impact assessment criterion for PM_{10} or $PM_{2.5}$ are likely to occur as a result of the operation of the Proposal. Examination of the results for all receptors indicates that no additional exceedances of the PM_{10} and $PM_{2.5}$ criterion are predicted at any receptor location.

Table 13 Summary of contemporaneous impact and background – PM_{10}

Date	24-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$) – Receptor 6			Date	24-hour average PM_{10} concentration ($\mu g \cdot m^{-3}$) – Receptor 6		
	Incr.	Background	Cumul.		Incr.	Background	Cumul.
22/11/2018	1.7	113.3	115.0	26/08/2018	8.0	19.2	27.2
19/03/2018	3.7	70.2	73.9	9/05/2018	7.6	41.0	48.6
28/05/2018	4.3	65.8	70.1	22/09/2018	5.8	29.5	35.3
18/07/2018	3.2	61.9	65.1	8/05/2018	5.6	36.1	41.7
15/02/2018	1.9	61.6	63.5	23/06/2018	5.3	18.9	24.2
29/05/2018	2.3	58.7	61.0	22/06/2018	4.9	22.7	27.6
21/11/2018	1.4	55.7	57.1	27/05/2018	4.7	36.0	40.7
19/07/2018	1.2	54.4	55.6	27/07/2018	4.6	31.2	35.8
14/04/2018	1.9	47.8	49.7	17/05/2018	4.6	22.0	26.6
18/03/2018	1.2	47.9	49.1	26/05/2018	4.6	31.8	36.4
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.			

Note: Incr = Increment, Cumul = Cumulative impact

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

Date	24-hour average $PM_{2.5}$ concentration (µg·m^{-3}) – Receptor 7			Date	24-hour average $PM_{2.5}$ concentration (µg·m^{-3}) – Receptor 6		
	Incr.	Regional Background	Cumul.		Incr.	Regional Background	Cumul.
29/05/2018	0.6	47.5	48.1	26/08/2018	1.5	18.4	19.9
28/05/2018	0.3	42.5	42.8	9/05/2018	1.4	21.7	23.1
6/05/2018	0.2	27.1	27.3	22/09/2018	1.1	12.0	13.1
27/05/2018	0.2	27.0	27.2	8/05/2018	1.1	19.9	21.0
15/07/2018	0.1	23.1	23.2	23/06/2018	1.0	16.1	17.1
9/05/2018	0.1	21.7	21.8	22/06/2018	0.9	17.0	17.9
25/04/2018	<0.1	20.6	20.7	27/07/2018	0.9	19.5	20.4
8/05/2018	0.4	19.9	20.3	27/05/2018	0.9	27.0	27.9
27/07/2018	<0.1	19.5	19.6	17/05/2018	0.9	10.8	11.7
12/04/2018	0.6	18.1	18.7	26/05/2018	0.9	16.7	17.6
These data represent the highest Cumulative Impact 24-hour $PM_{2.5}$ predictions (outlined in red) as a result of the operation of the project.				These data represent the highest Incremental Impact 24-hour $PM_{2.5}$ predictions (outlined in blue) as a result of the operation of the project.			

Note: Incr = Increment, , Cumul = Cumulative impact

The performance of the Proposal does not in itself result in any additional exceedances of the maximum 24-hour average PM_{10} and $PM_{2.5}$ impact assessment criteria.

The implementation of best practice emission controls at the Proposal site results in the minimisation of PM_{10} and $PM_{2.5}$ concentrations at surrounding receptors.

6.4 Odour

Presented in Table 15 are the 99th percentile 1-second average odour concentrations predicted at the surrounding receptor locations, as a result of the Proposal operation.

The results of Table 15 indicate that the operation of the Proposal would not likely result in any exceedance of the assessment criterion for odour at all receptor locations. Therefore, it would be anticipated that the odour environment currently experienced in the area would not significantly change as a result of the Proposal.

Table 15 Predicted 99th percentile odour concentrations

Receptor	99th percentile 1-second average odour (OU)
	Incremental Impact
R1	0.8
R2	0.1
R3	0.2
R4	<0.1

Receptor	99th percentile 1-second average odour (OU)
	Incremental Impact
R5	0.2
R6	0.6
R7	0.5
R8	0.2
Criterion	2.0

The performance of the Proposal does not result in any exceedances of the odour assessment criteria.

7. MITIGATION AND MONITORING

Based on the findings of the air quality impact assessment, it is considered that the current Proposal layout and operation will be sufficiently controlled to ensure that exceedances (or additional exceedances in the case of 24-hour PM_{10} and $PM_{2.5}$) would not be experienced as a result of the Proposal operation.

The Proposal has been designed to incorporate best practice particulate matter and odour control, which includes the performance of all activities within enclosed, hardstand sheds, as fully described in Section 5.3.

The mitigation measures proposed to be included as part of the Proposal operation and the control efficiencies afforded have been presented in Table 9.

7.1 Air Quality Management Plan

Further to the above mitigation, it is recommended that the proponent implements and maintains an Air Quality Management Plan (AQMP), including procedures for the recording, evaluation and actioning of complaints arising from the proposed activities.

8. CONCLUSION

Northstar Air Quality was engaged by Polytrade Pty Ltd to perform an AQIA for the proposed operation of a materials recycling facility, to be located at 132-144 Warren Road, Smithfield,, NSW.

A dispersion modelling assessment has been performed in accordance with the requirements of the NSW Approved Methods (NSW EPA, 2016) to determine the likely air quality impacts upon surrounding receptor locations. Activity rates associated with average operational conditions have been used to determine the potential impact and compared against annual average criteria. To determine the potential maximum 24-hour impact of the Proposal, the materials haulage, handling and processing rates have been assumed to be 1.4 times that of the average daily rate. This is considered to represent a conservative assumption and is consistent with previous study for similar processes (Katestone, 2020).

It is noted that in the absence of waste industry-specific emission factors, those associated with extractive industries have been adopted. These factors provide an emission rate far greater than would be anticipated in reality as the adopted emission factors are normally used to determine emissions of particulate from the unloading of overburden (soil) or rock, for example. Clearly, the particulate emission associated with a load of mixed recyclables is likely to be orders of magnitude lower than a load of overburden or rock. The results of the assessment should therefore take into consideration that conservatism and should be viewed as confirmation that the activities can be performed without resulting in additional exceedances of the air quality criteria. The results should not be viewed as a representation of the actual particulate impacts anticipated at any location.

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

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

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

It is respectfully considered that the Proposal should not be rejected on the grounds of air quality.

9. REFERENCES

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APPENDIX A

Meteorology

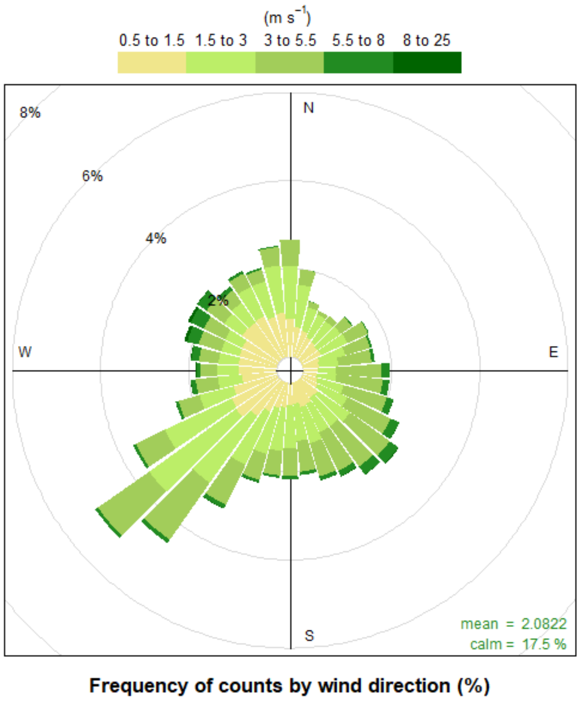
A summary of the relevant monitoring sites is provided in **Table A1**.

Table A1 Details of the meteorological monitoring surrounding the Proposal site

Site Name	Approximate Location (UTM)		Approximate Distance
	mE	mS	km
Horsley Park Equestrian Centre AWS -Station # 67117	301 708	6 252 298	8.8
Sydney Olympic Park AWS – Station # 66161	320 947	6 252 557	10.3
Sydney Olympic Park (Archery Centre) AWS – Station # 66137	321 575	6 254 599	11.1

Meteorological conditions at Horsley Park Equestrian Centre AWS have been examined to determine a 'typical' or representative dataset for use in dispersion modelling. Annual wind roses for the most recent years of data (2016 to 2020) are presented in Figure A1.

Figure A1 Annual wind roses 2016 to 2020, Horsley Park Equestrian Centre AWS



The wind roses indicate that from 2016 to 2020, winds at Horsley Park Equestrian Centre AWS show a predominant south-westerly wind direction.

The majority of wind speeds experienced at the Horsley Park Equestrian Centre AWS between 2016 and 2020 are generally in the range 1.5 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 rare and occur less than 1 % of the observed hours during the years. Calm winds (<0.5 $m \cdot s^{-1}$) occur for 17.5 % of hours across the years.

The distribution of winds in year 2018 was selected as the most representative year with a typical profile. Presented in Figure A2 are the annual wind rose for the 2016 to 2020 period and the year 2018, and in Figure A3 the annual wind speed distribution for Horsley Park Equestrian Centre AWS. These figures indicate that the distribution of wind speed and direction in 2018 is very similar to that experienced across the longer-term period.

It is concluded that conditions in 2018 may be considered to provide a suitably representative dataset for use in dispersion modelling.

Figure A2 Annual wind roses 2016 to 2020, and 2018 Horsley Park Equestrian Centre AWS

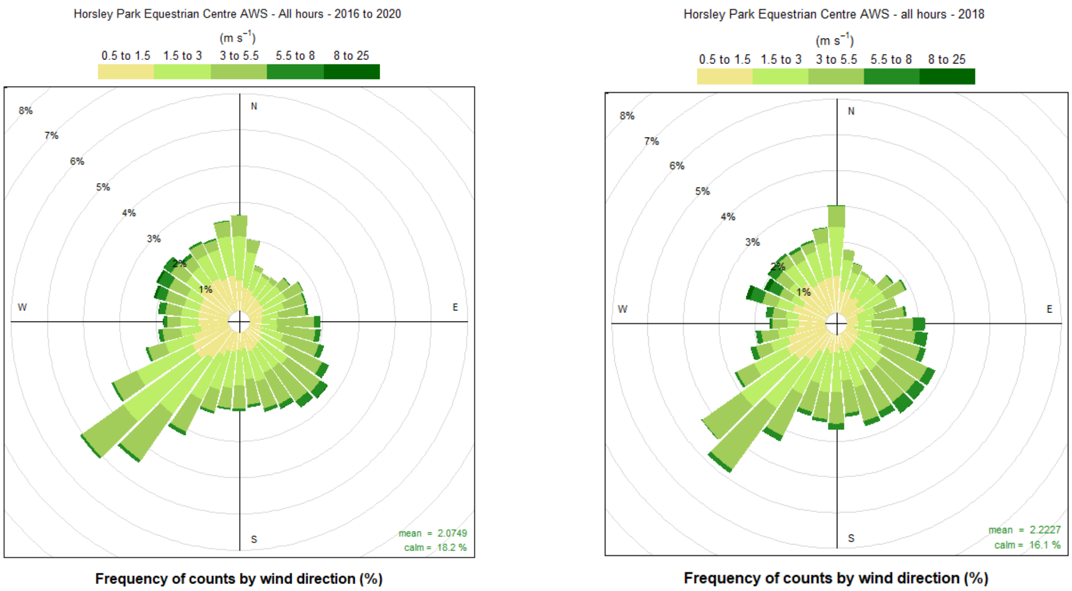
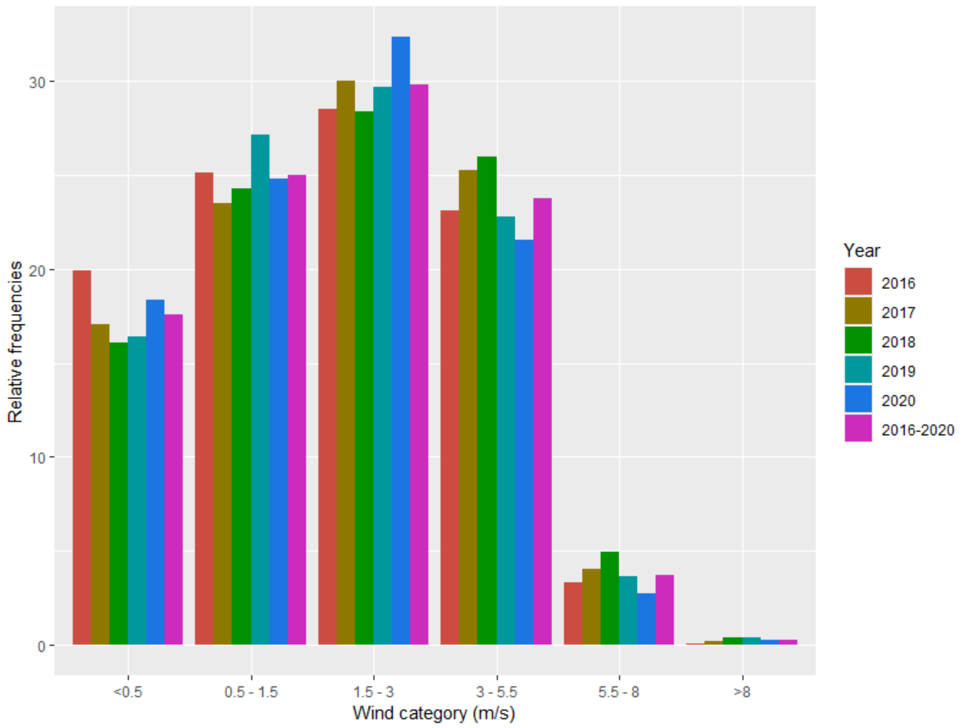


Figure A3 Annual wind speed distribution Horsley Park Equestrian Centre AWS



Meteorological Processing

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

In absence of any measured onsite meteorological data, site representative meteorological data for this project 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, precipitation 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.

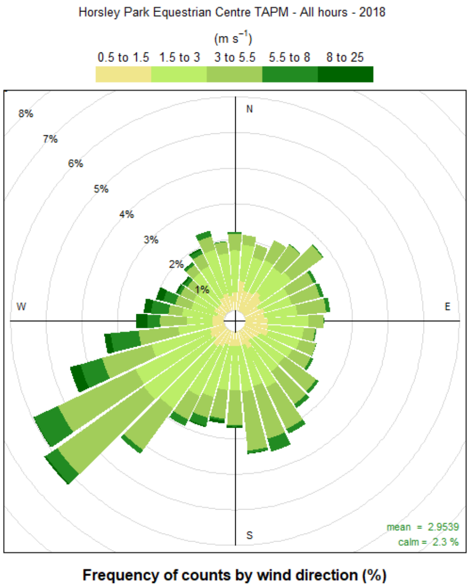
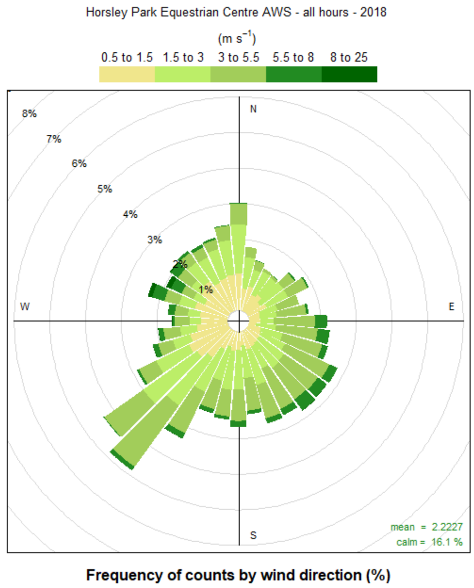
The parameters used in TAPM modelling are presented in Table A1.

Table A1 Meteorological parameters used for this study

TAPM v 4.0.5	
Modelling period	1 January 2018 to 31 December 2018
Centre of analysis	306,484 mE, 6,252,507 mN (UTM Coordinates)
Number of grid points	25 × 25 × 25
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Terrain	AUSLIG 9 second DEM
Data assimilation	-

A comparison of the TAPM generated meteorological data, and that observed at the Holsworthy Aerodrome AWS is presented in Figure A4.

Figure A4 Modelled and observed meteorological data – Horsley Park Equestrian Centre 2018

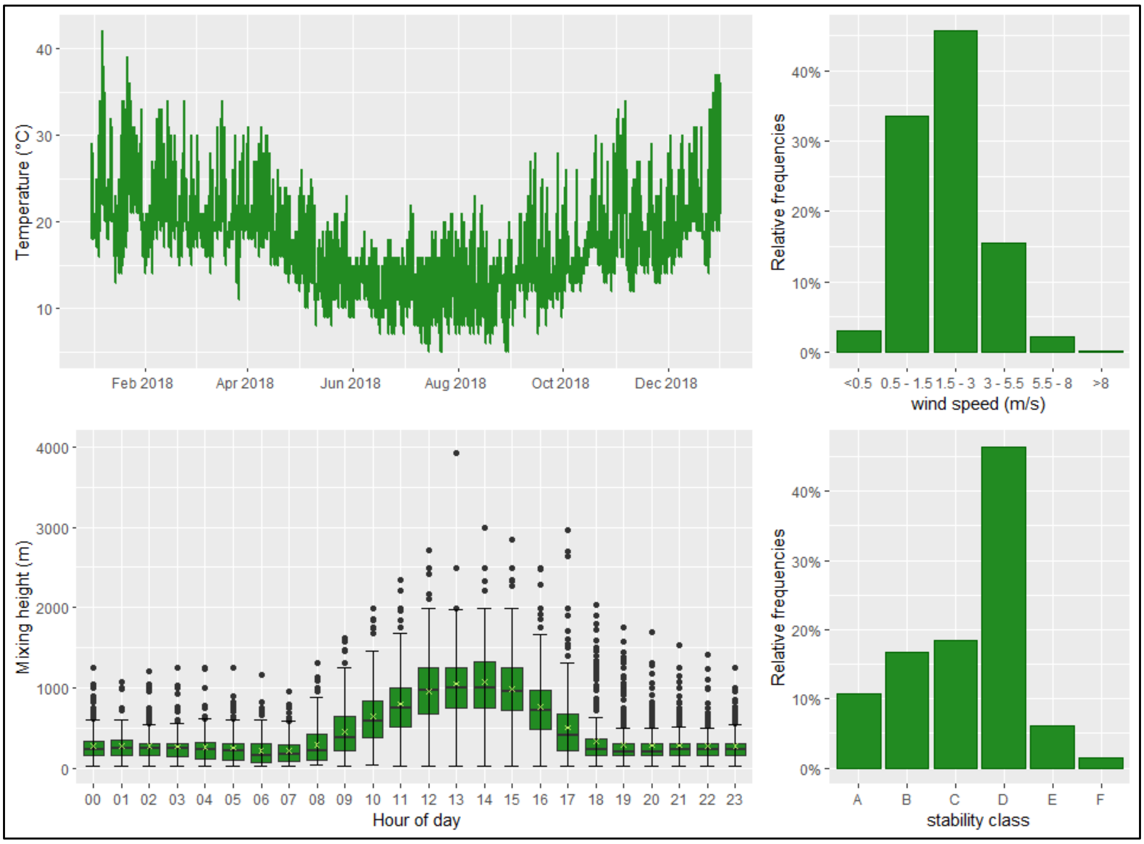
TAPM generated windrose	Observations at Horsley Park Equestrian Centre AWS
	

As generally required by the NSW EPA the following provides a summary of the modelled meteorological dataset. Given the nature of the pollutant emission sources at the Proposal site, detailed discussion of the humidity, evaporation, cloud cover, katabatic air drainage and air recirculation potential of the Proposal site has not been provided. Details of the predictions of wind speed and direction, mixing height and temperature at the Proposal site are provided in Figure A5.

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.

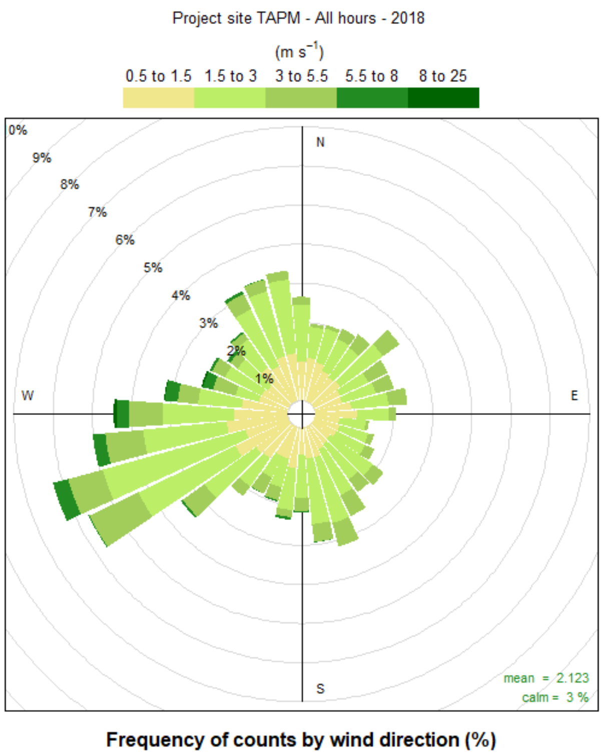
The modelled temperature variations predicted at the Proposal site during 2018 are presented in Figure A5. The maximum temperature of 42°C was predicted on 7 January 2018 and the minimum temperature of 5°C was predicted on 15 July 2018.

Figure A5 Predicted meteorological parameters – Proposal site 2018



The modelled wind speed and direction at the Proposal site during 2018 are presented in Figure A6.

Figure A6 Predicted wind speed and direction – Proposal site 2018



APPENDIX B

Background Air Quality Data

Air quality is not monitored at the Proposal site and therefore air quality monitoring data measured at a representative location has been adopted for the purposes of this 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 three air quality monitoring station (AQMS) within a 10 km radius of the Proposal site. Details of the monitoring performed at these AQMS is presented in Table 7.

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.

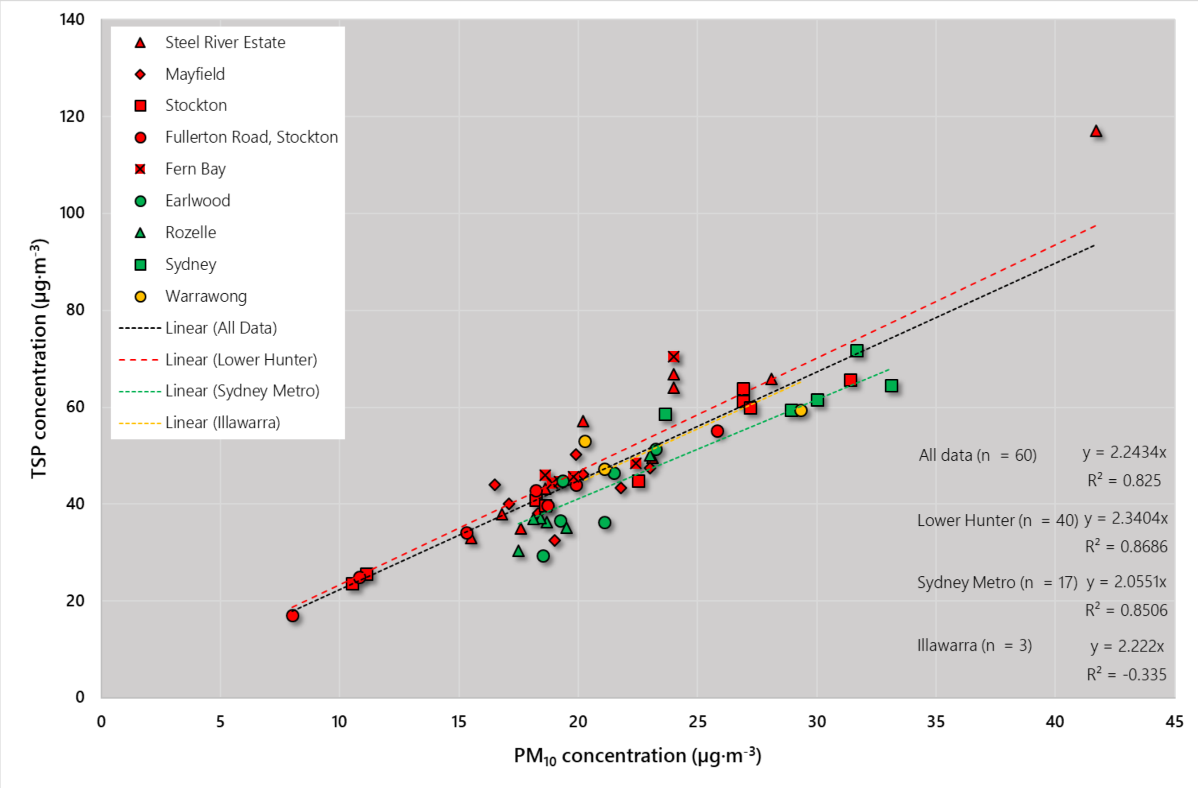
Summary statistics are for PM_{10} and $PM_{2.5}$ data are presented in Table B1.

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 (consistent with the selected meteorological period) is presented in Table B1.

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 B1 Summary of background air quality data (Prospect 2018)

Pollutant	TSP (µg·m^{-3})	PM_{10} (µg·m^{-3})	$PM_{2.5}$ (µg·m^{-3})
Averaging Period	Annual	24-Hour	24-Hour
Data Points (number)	363	363	352
Mean	45.0	21.9	8.5
Standard Deviation	-	10.9	4.9
Skew[1]	-	*+2.7*	*+3.0*
Kurtosis[2]	-	*+15.6*	*+17.7*
Minimum		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	45.0	113.3	47.5
Data Capture (%)	99.5	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.

Figure B2 PM_{10} Measurements, Prospect 2018

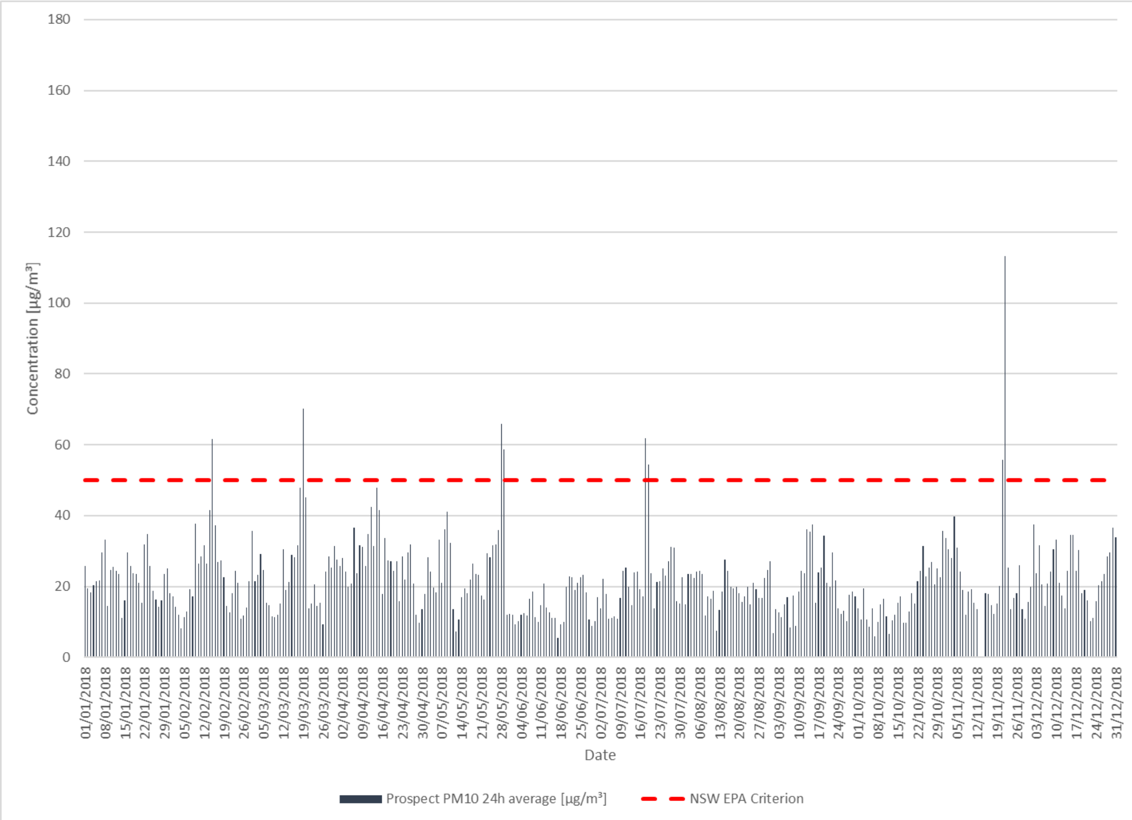
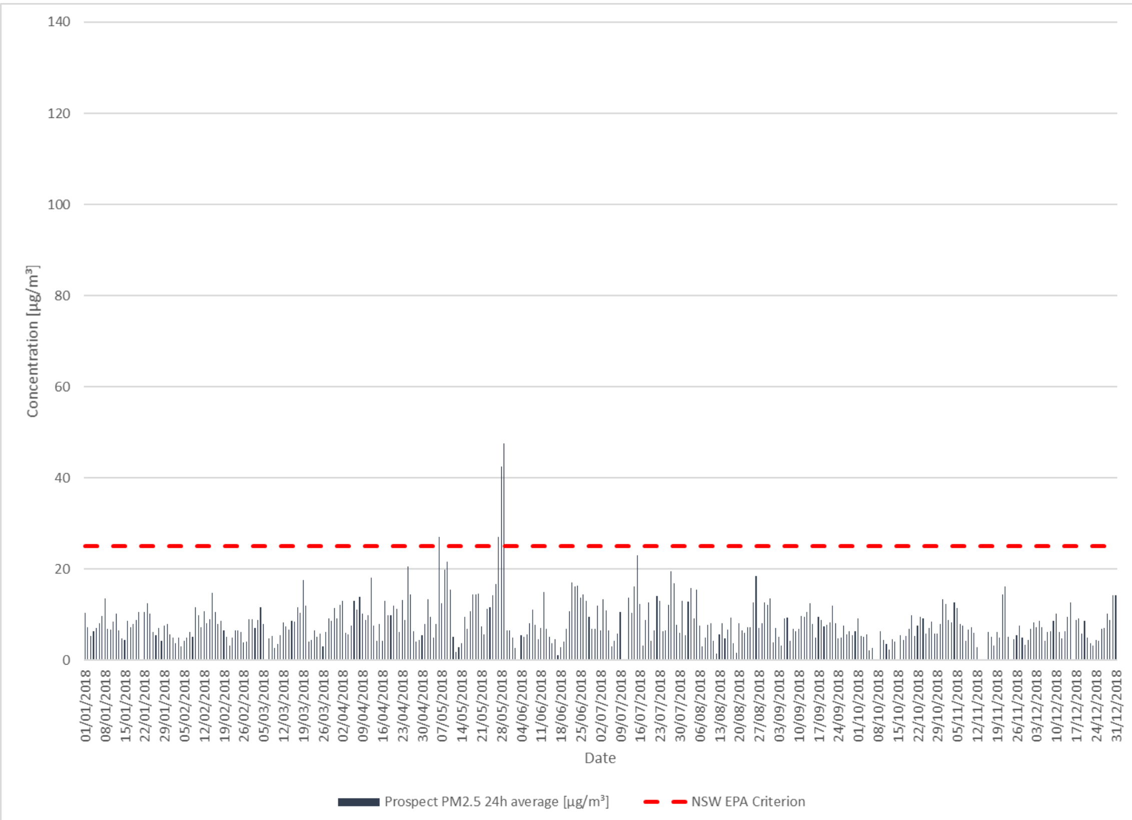


Figure B3 $PM2_{.5}$ Measurements, Prospect 2018



APPENDIX C

Emissions Estimation

The activity rates as presented in Table 2 have been used in the development of the particulate emissions inventory for the Proposal.

Emissions resulting from the loading of materials, transfer of materials (except for road transport) have been estimated using the US EPA AP-42 emission factor for batch drop. The emissions of particulate matter from these processes have been estimated using emission factors presented in Section 13.2.4.3 of AP-42 (Aggregate Handling and Storage Piles) (US EPA, 2006b).

This emission factor can result from several distinct source activities because the adding or removal of aggregate material from a storage pile or receiving surface results in batch drop operations and in other cases continuous drop operations. Either type of drop events emission factor can be estimated through:

$$EF\ (kg\,.\,tonne^{-1}) = k(0.0016)\,\frac{(\frac{U}{2.2})^{1.3}}{(\frac{M}{2})^{1.4}}$$

where:

$EF_{(kg \cdot tonne^{-1})}$ = emission factor

k = particle size multiplier, where TSP = 0.74; PM_{15} = 0.48; PM_{10} = 0.35; PM_{5} = 0.20; $PM_{2.5}$ = 0.053;

U = mean wind speed, meters per second ($m.s^{-1}$)

M = material moisture content (%)

The quality rating for this application is rated A.

Note: Silt content is not included in this equation. It is reasonable to expect that silt content and emission factors are interrelated however no significant correlation was found under the parameters conducted by the US EPA. Hence it is recommended that if the source parameters lie outside of the studied range, that the equations quality rating be reduced by 1 level. The parameters of the study are: Silt Content (%) = 2; Moisture Content (%) = 2; Wind Speed ($m \cdot s^{-1}$) = 2.2 (external environment), 0.5 (inside the building, which represents an 85 % control factor).

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

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

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

where:

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

k = particle size multiplier (dimensionless)

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

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

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

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

The emissions of particulate matter from materials processing activities including conveying and operating the air separator and metals magnet have been estimated using emission factors presented in Section 11.19.2-1 of AP-42 (Crushed Stone Processing and Pulverised Mineral Processing) (US EPA, 2004).

The emission factors within table 11.19.2-1 have been adopted for the operations outlined above. PM2.5 emission factors are not available for conveyor transfer point sources in AP-42 although have been taken to be 10% of PM10 as per aggregate handling sources (MRI, 2006). The control efficiency used for conveyor transfer points is 95.3% as calculated in AP-42 (US EPA, 2004).

For uncontrolled fines screening:

$$EF_{TSP}\ (kg.tonne^{-1}) = 0.0015$$

$$EF_{PM_{10}}\ (kg.tonne^{-1}) = 0.00055$$

$$EF_{PM_{2.5}}\ (kg.tonne^{-1}) = 0.000055$$

For controlled fines screening:

$$EF_{TSP}\ (kg.tonne^{-1}) = 0.00007$$

$$EF_{PM_{10}}\ (kg.tonne^{-1}) = 2.3\ \times 10^{-5}$$

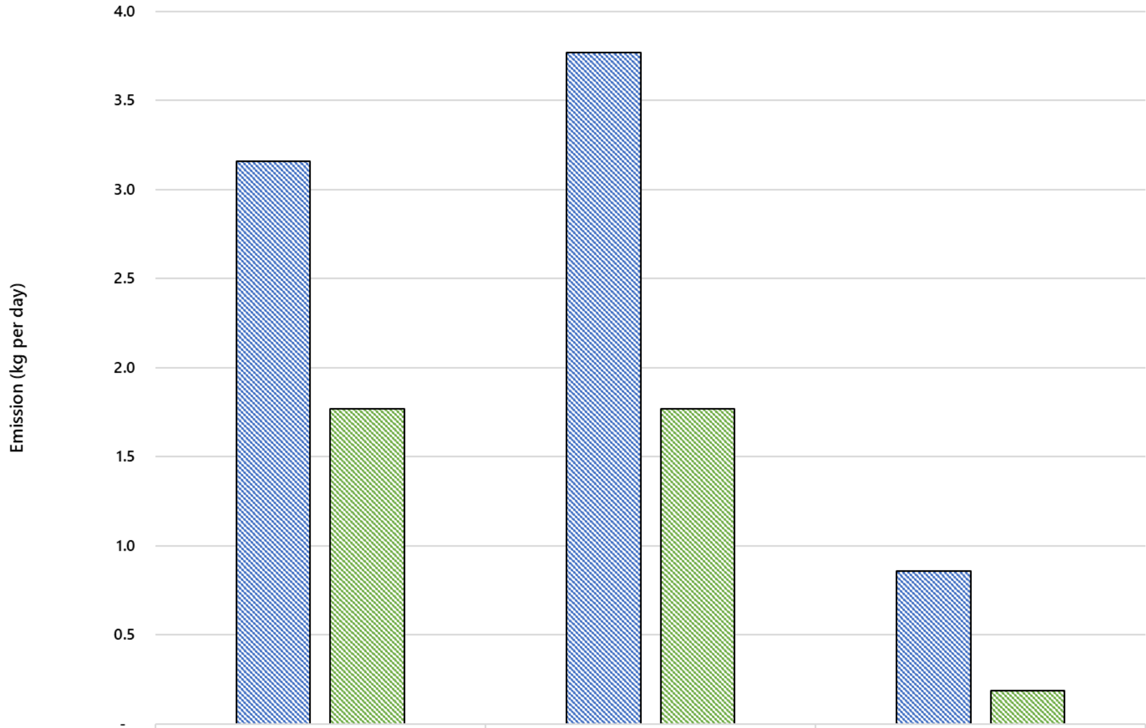
$$EF_{PM_{2.5}}\ (kg.tonne^{-1}) = 6.5\ \times 10^{-6}$$

The quality rating for these emission factors is: conveyor transfer point (uncontrolled) = E & D (TSP & PM_{10} respectively), and conveyor transfer point (controlled) = E, D & E (TSP, PM_{10} & $PM_{2.5}$ respectively). All other conveyor transfer point emission factors calculated have a quality rating of U (no rating).

Emissions controls will be employed at the Proposal site as discussed in Section 5.3. The application of these controls results in quantifiable reductions in the quantity of particulate matter being emitted as part of the Proposal operation. A description of each emission reduction method to be employed as part of the Proposal is presented in Section 5.3.

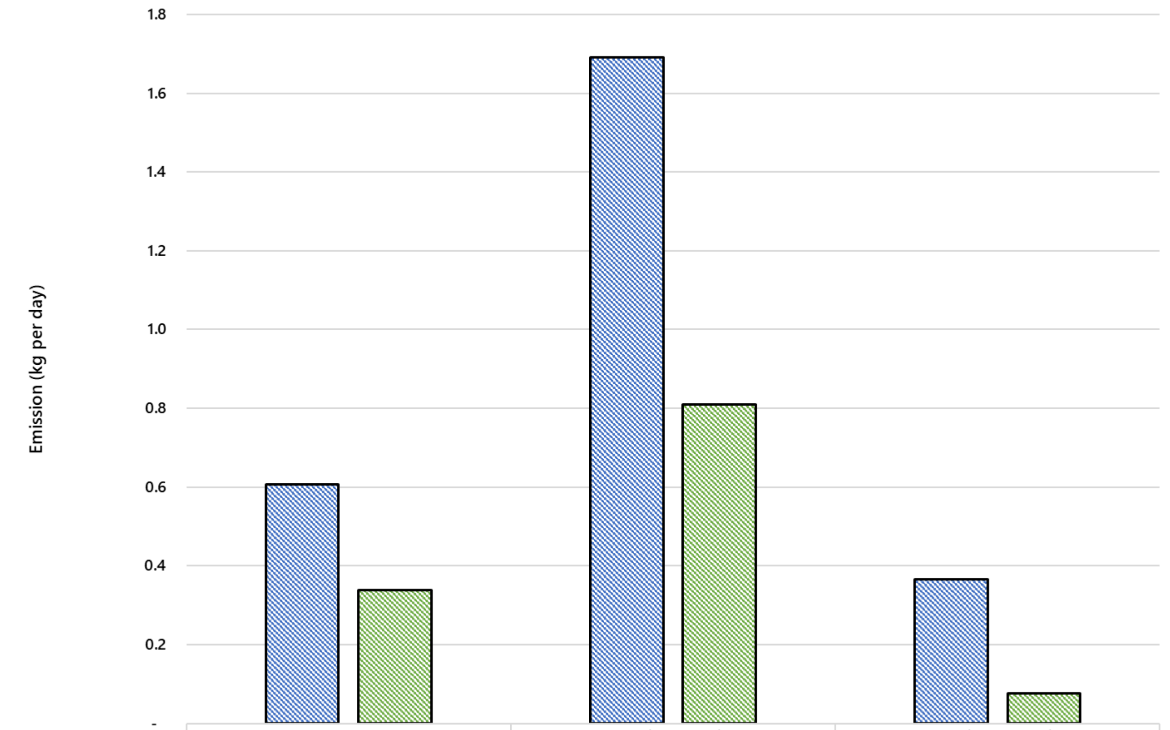
Based on the foregoing, the distribution of particulate emission across broad emissions categories is presented in Figure C1 (TSP) Figure C2 (PM_{10}) and Figure C3 ($PM_{2.5}$). The results are presented for the inventory associated with annual activity rates although the distribution is broadly similar for 24-hour maximum activity rates.

Figure C1 Calculated uncontrolled & controlled daily TSP emissions



	Haulage	Materials Handling	Materials Processing
Uncontrolled TSP	3.2	3.8	0.9
Controlled TSP	1.8	1.8	0.2

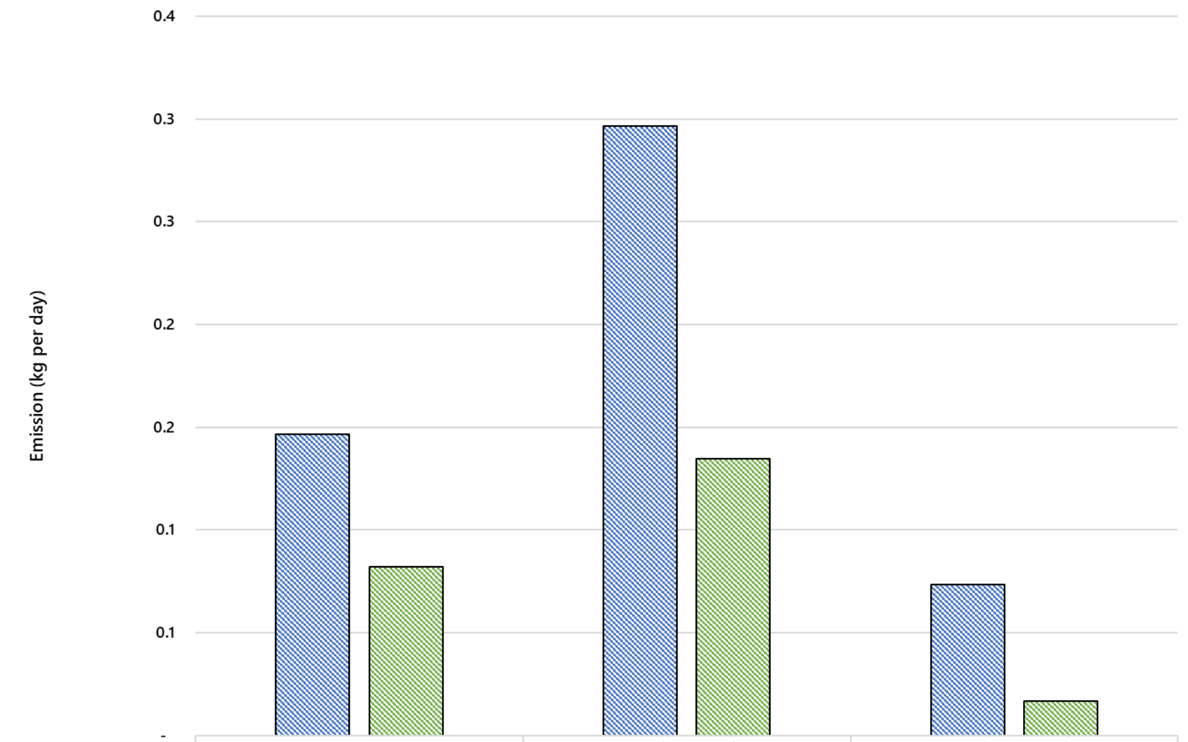
Figure C2 Calculated uncontrolled & controlled daily PM_{10} emissions



	Haulage	Materials Handling	Materials Processing
Uncontrolled PM10	0.6	1.7	0.4
Controlled PM10	0.3	0.8	0.1

Uncontrolled PM10 Controlled PM10

Figure C3 Calculated uncontrolled & controlled daily $PM_{2.5}$ emissions



	Haulage	Materials Handling	Materials Processing
Uncontrolled PM2.5	0.1	0.3	0.1
Controlled PM2.5	0.1	0.1	0.0

Uncontrolled PM2.5 Controlled PM2.5

Particulate emissions have been modelled based on the groupings outlined in Table C1 below:

Table C1 Modelled particulate fractions

Fraction	Representing	Geometric mass mean diameter (microns)	Geometric standard deviation (microns)
Coarse	TSP minus PM_{10} fraction	20	1.24
Intermediate	PM_{10} minus $PM_{2.5}$ fraction	5	1.24
Fine	$PM_{2.5}$ fraction	1.25	1.24

Source: (Government of Newfoundland and Labrador, 2012)

By adopting this approach, the dispersion model separates out the larger particulates which are more rapidly deposited from the atmosphere, closer to the site. This is a more realistic approach than the default adopted in CALPUFF (geometric mass mean diameter of 0.48 microns for all particulate size fractions) and results in the predicted off-site suspended and deposited particulate levels decreasing more rapidly with increasing distance from the source.

Table C3 Maximum 24hr activity rates (refer Table 2) – presented as annual emissions

Description	Factor	Emission Rate			Units	Activity Rate	Units	Emission Controls (% efficiency)	Controlled Emissions (kg·year^{-1})		
		TSP	PM_{10}	$PM_{2.5}$					TSP	PM_{10}	$PM_{2.5}$
Unloading material	AP-42 - Batch drop - Section 13.2.4.3	0.001	0.001	0.000	kg·t-1	577	t		6.3513E-01	3.0040E-01	4.5489E-02
FEL pick up	AP-42 - Batch drop - Section 13.2.4.3	0.001	0.001	0.000	kg·t-1	577	t		6.3513E-01	3.0040E-01	4.5489E-02
FEL loading infeed hopper	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	577	t	Reduced for internal wind speed	9.5269E-02	4.5060E-02	6.8233E-03
Paper and Carboard - conveyor	AP-42 - Conveyor transfer point - Table 11.19.2.1	0.0015	0.0006	0.00015	kg·t-1	225	tonnes	Direct load to hopper	1.0126E-01	3.7130E-02	1.0396E-02
Paper and cardboard - air separator	AP-42 - Conveyor transfer point - Table 11.19.2.1	0.0015	0.0006	0.00015	kg·t-1	225	tonnes	Within building	1.0126E-01	3.7130E-02	1.0396E-02
Paper and cardboard - baler	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	225	t	Reduced for internal wind speed	3.7155E-02	1.7573E-02	2.6611E-03
Glass - conveyor	AP-42 - Conveyor transfer point - Table 11.19.2.1	0.0015	0.0006	0.00015	kg·t-1	179	tonnes	Within building	8.0492E-02	2.9514E-02	8.2638E-03
Glass - breaker	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	179	t	Reduced for internal wind speed	2.9533E-02	1.3968E-02	2.1152E-03
Glass - balistic separator	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	179	t	Reduced for internal wind speed	2.9533E-02	1.3968E-02	2.1152E-03
Glass - loading bunker	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	179	t	Reduced for internal wind speed	2.9533E-02	1.3968E-02	2.1152E-03
Glass - FEL on glass	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	179	t	Reduced for internal wind speed	2.9533E-02	1.3968E-02	2.1152E-03
Glass - FEL loading truck	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	179	t	Reduced for internal wind speed	2.9533E-02	1.3968E-02	2.1152E-03
Plastic - conveyor	AP-42 - Conveyor transfer point - Table 11.19.2.1	0.0015	0.0006	0.00015	kg·t-1	101	tonnes	Within building	4.5439E-02	1.6661E-02	4.6650E-03
Plastic - separator	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	101	t	Reduced for internal wind speed	1.6672E-02	7.8854E-03	1.1941E-03
Plastic - baler	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	101	t	Reduced for internal wind speed	1.6672E-02	7.8854E-03	1.1941E-03
Metals - conveyor	AP-42 - Conveyor transfer point - Table 11.19.2.1	0.0015	0.0006	0.00015	kg·t-1	20	tonnes	Within building	9.0878E-03	3.3322E-03	9.3301E-04
Metals - magnet	AP-42 - Conveyor transfer point - Table 11.19.2.1	0.0015	0.0006	0.00015	kg·t-1	20	tonnes	Within building	9.0878E-03	3.3322E-03	9.3301E-04
Metals - baler	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	20	t	Reduced for internal wind speed	3.3344E-03	1.5771E-03	2.3882E-04
Residual - conveyor	AP-42 - Conveyor transfer point - Table 11.19.2.1	0.0015	0.0006	0.00015	kg·t-1	52	tonnes	Within building	2.3369E-02	8.5685E-03	2.3992E-03
Residual - baler	AP-42 - Batch drop - Section 13.2.4.3	0.0011	0.0005	0.00008	kg·t-1	52	t	Reduced for internal wind speed	8.5742E-03	4.0554E-03	6.1410E-04
Materials haulage IN and OUT	AP-42 Paved roads - Section 13.2.1	0.083	0.016	0.004	kg·VKT-1	38	VKT	Speed restrictions	1.8	0.3	0.1
								Total	**3.7**	**1.2**	**0.2**