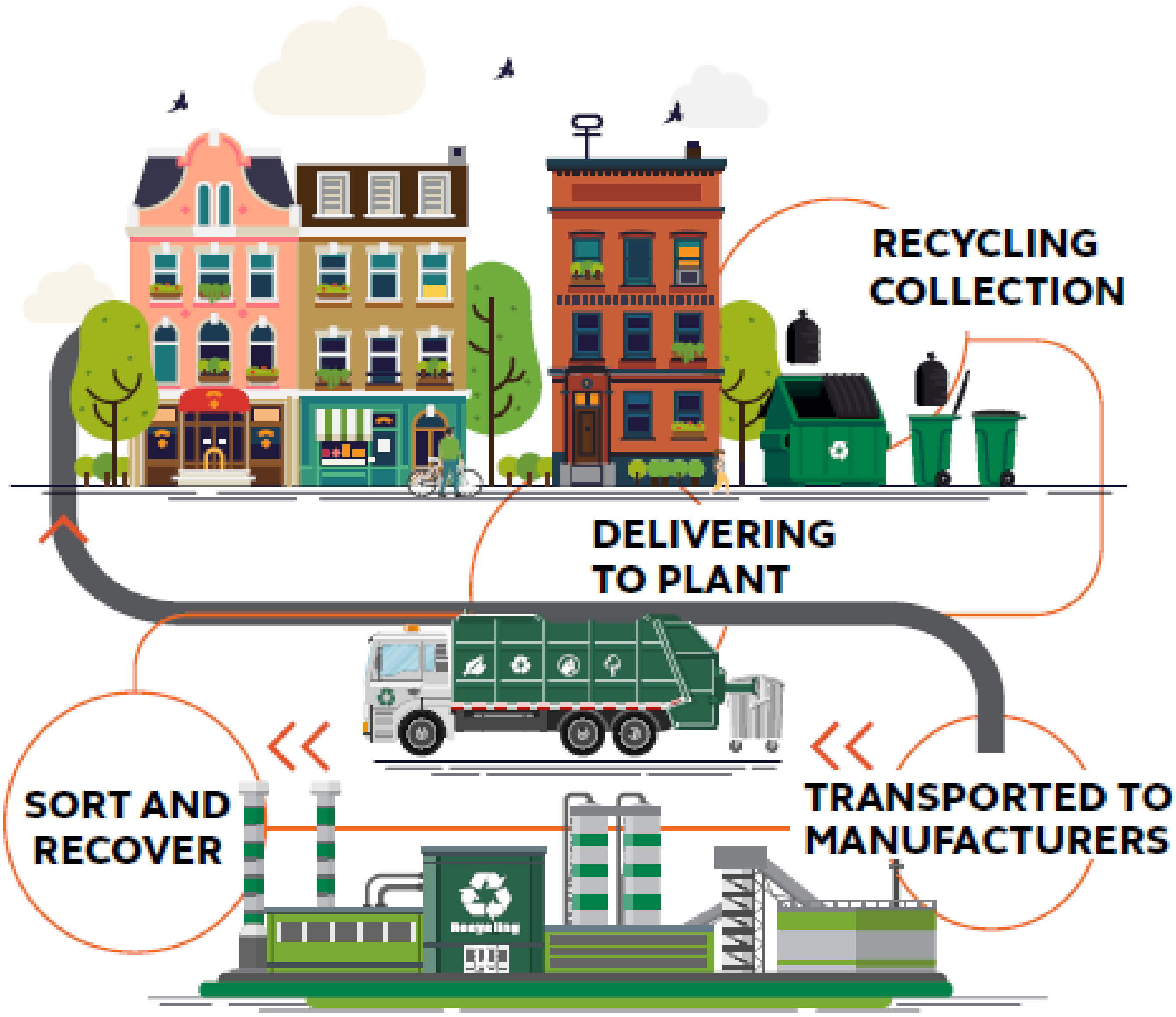
Chullora Materials Recycling Facility

Environmental Impact Statement (SSD-10401)

Appendix K Air Quality Impact Assessment



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Air Quality Assessment of the Chullora Material Recovery Facility

Prepared for:

Arcadis

May 2020

Final

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Glossary

Term	Definition
µg/m^3	micrograms per cubic metre
µm	microns
°C	degrees Celsius
km	kilometre
km/h	kilometre per hour
m	metre
m/s	metres per second
g/m^2/month	grams per metre squared per month
m^2	square metres
m^3	cubic metres
m^3/s	cubic metres per second
Nomenclature	**Definition**
PM_{10}	particulate matter with a diameter less than 10 micrometres
$PM_{2.5}$	particulate matter with a diameter less than 2.5 micrometres
TSP	Total suspended particulates
Abbreviations	**Definition**
C&I	Commercial and industrial waste
CBD	Central Business District
DPIE	Department of Planning, industry and Environment
Approved Methods for Modelling	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW
Clean Air Regulation	*Protection of the Environment Operations (Clean Air) Regulation 2010*
E	East
EPA	Environment Protection Authority
EPL	Environmental Protection Licence
EF	Emission factor
EIS	Environmental Impact Statement
MRF	Materials Recycling Facility
N	North
NE	Northeast
NPI	National Pollutant Inventory database
NW	Northwest
OEH	Office of Environment and Heritage
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development
W	West

EXECUTIVE SUMMARY

Proposal overview

SUEZ Recycling & Recovery Pty Ltd (SUEZ - the Applicant) is seeking to establish the state-of the art Chullora RRP located at 21 Muir Road, Chullora in Sydney. The Applicant are proposing to develop and operate the first phase of the Chullora RRP as a Materials Recycling Facility (MRF). This would comprise the construction and operation of an MRF with a material handling capacity of up to 172,000 tonnes per annum (tpa). Waste streams that would be processed at the MRF would all comprise dry recyclables from municipal and C&I sources, including:

- Co-mingled material collected from municipal and C&I sources
- Source separated paper and cardboard
- Mixed plastics.

General operational activities are proposed to occur concurrently with the MRF within designated operational activities area, including truck parking, container storage and other ancillary activities as required.

Purpose of this assessment

This Air Quality Impact Assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) as they related to air quality and odour, including:

- A quantitative assessment of the potential air quality, dust and odour impacts of the development
- Details of buildings and air handling systems
- Details of proposed mitigation, management and monitoring measures.

Construction impacts

Any emissions to air during the construction phase would be due to diesel exhaust emissions of vehicles bringing material to site or operating on site. These emissions would be minor and insignificant. Therefore, the construction phase of the Proposal would not cause exceedance of the relevant air quality assessment criteria.

Operational impacts

The assessment has shown:

- 1-hour and annual average ground-level concentrations of NO_2 due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- 15-minute, 1-hour and 8-hour average ground-level concentrations of CO due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- 1-hour, 24-hour and annual average ground-level concentrations of SO_2 due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- 1-hour average ground-level concentrations of individual VOCs due to the MRF are predicted to ***comply*** with the relevant air quality assessment criteria.
- For 24-hour average ground-level concentrations of PM_{10}, the MRF is not predicted to result in any additional exceedance days compared to existing ambient background levels.
- For 24-hour average ground-level concentrations of $PM_{2.5}$, the MRF is not predicted to result any additional exceedance days compared to existing ambient background levels.

- Annual average ground-level concentrations of TSP, PM_{10} and $PM_{2.5}$ due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- Dust deposition rates due to the MRF are predicted to ***comply*** with the air quality assessment criterion of 2 g/m^2/month.
- Ground-level concentrations of odour are predicted to ***comply*** with the odour criteria.

Mitigation measures

The operation of the MRF will include misting sprays on all transfer points and screens, and enclosure as well as misting sprays on all major transfer points. All processing will occur within the MRF building. The haul road will be sealed. These mitigation measures have been accounted for in the air quality assessment.

Conclusions

Overall, the MRF is predicted to have a minimal impact on air quality in the local area.

1. INTRODUCTION

SUEZ Recycling & Recovery Pty Ltd (SUEZ – the Applicant) is seeking to establish the state-of-the art Chullora Resource Recovery Park (Chullora RRP) located at 21 Muir Road (Lot 2 DP1227526), Chullora in Sydney (Figure 1). SUEZ is proposing to design build and operate the first phase of the Chullora RRP as a Materials Recycling Facility (MRF) (the Proposal) to process co-mingled recyclable municipal solid waste (MSW) and dry commercial and industrial (C&I) waste; with a material processing capacity of up to 172,000 tonnes per annum (tpa).

The Proposal would be considered state significant development (SSD) under Clause 23 (waste and resource management facilities) of Schedule 1 of the *State Environmental Planning Policy (State and Regional Development) 2011* being a recycling facility that handles more than 100,000 tonnes of waste per year. Accordingly, an Environmental Impact Statement (EIS) has been prepared to support the SSD Application for the Proposal. This Air Quality Impact Assessment has been prepared by Katestone to support the preparation of the EIS and assess the Proposal's impact on air quality.

1.1 Proposal overview

The Proposal would comprise the construction and operation of a MRF with a material handling capacity of up to 172,000 tonnes per annum (tpa), comprising:

- Up to 115,000 tpa of co-mingled recyclables collected from municipal and C&I sources
- Up to 50,000 tpa of source separated paper and cardboard for baling
- Up to 7,000 tpa of external mixed plastics for secondary processing.

Once operational, the Proposal would receive waste from locally generated sources as well as the greater Sydney area. The total input in any year would not exceed 172,000 tpa, with the exact throughput from each source varying subject to the market conditions in that year and different Councils' recycling collection regimes.

The Proposal would represent a critical piece of waste management infrastructure that would mitigate significant capacity constraints currently impacting the Sydney region. The Proposal would provide advanced recycling processes to build resilience within the current network of recycling facilities as well as promote the principles of a circular economy through implementation of a pull-through model that conceives of the sorting, reprocessing and specified end uses of processed materials as an integrated, closed loop solution.

The key construction components of the Proposal would include:

- Establishment of a hardstand area and internal road network
- Construction of the enclosed MRF shed
- Installation and commissioning of fixed plant and equipment
- Installation of ancillary infrastructure, including weighbridges, pedestrian overbridge, and fire systems
- Installation and connection of site service infrastructure (electrical, water, sewer, gas and telecommunication services
- Installation of signage.

The key operational components of the Proposal would include:

- Operation of a MRF 24 hours per day, seven days per week (including processing and waste delivery and collection)
- Product storage.

The key components of the Proposal are shown in Figure 2**Error! Reference source not found.**.

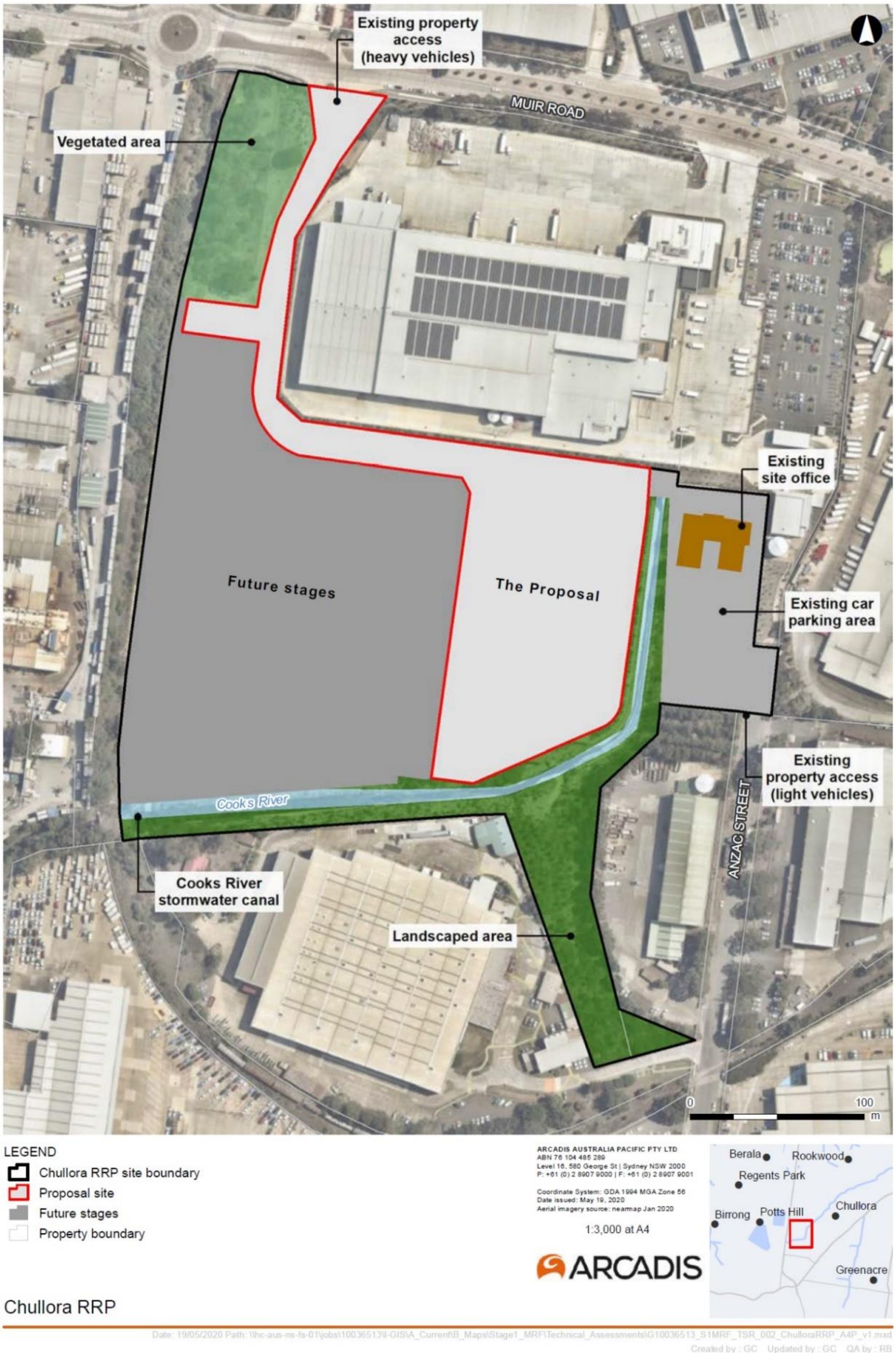

Figure 1 **Chullora RRP (provided by Arcadis)**

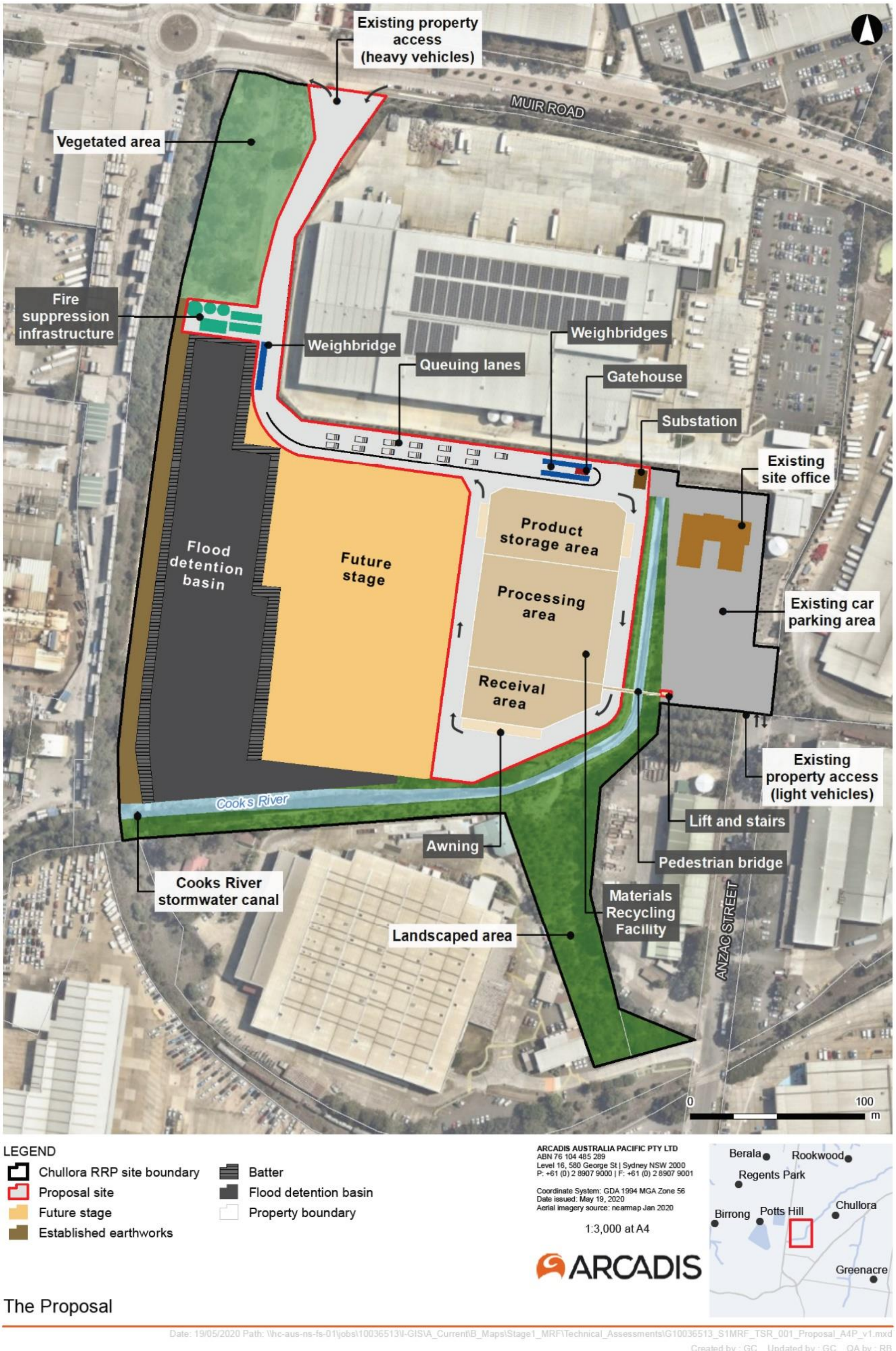

Figure 2 Proposed MRF layout (provided by Arcadis)

1.2 Site location

The Chullora RRP site boundary including the Proposal site, shown in Figure 3, comprises one parcel of land being 21 Muir Road, Chullora (Lot 2 in DP 1227526)). The Proposal site is located in the Canterbury-Bankstown Local Government Area (LGA) and is approximately 2.5 hectares (ha) in size and is located approximately 18 kilometres (km) west of Sydney Central Business District (CBD) and 10 km east of Parramatta CBD.

The Chullora site is bounded by Muir Road to the north, Anzac Street to the east and existing industrial development further east and to the south. A disused freight railway line forms the site's boundary to the west. The Proposal site forms the central portion of the Chullora RRP site.

The Chullora site is located within the Chullora Technology Park, and surrounded by a range of industrial developments including PFD Storage Warehouse, Tip Top Bakery, News Limited, Fairfax, Volkswagen Distribution Centre, Bluescope Steel and Veolia transfer station. Directly to the west of the Proposal site is a narrow strip of land owned by the State Railway Authority, which formed part of the former railway through this area. A number of other businesses are located further to the west, including a service station, fitness centre and a range of other industrial warehouses (refer to Figure 3).

The closest residential receivers are located approximately 455 m to the southwest and 600 m to the east of the site (refer to Figure 3).

The Proposal site currently has two vehicular access points. The access point for heavy vehicles is via Muir Road, west of the roundabout at Muir Road/Dasea Street. A secondary access point for light vehicles is provided from Anzac Street. The Proposal site would utilise these existing access points. Primary access to the Proposal site from the north will remain via Muir Road from both directions, and egress will be via left turn only. There are four major intersections along Muir Road including linkages to Rookwood Road (Metroad 6) and the Hume Highway:

- Two-lane roundabout at the intersection of Muir Road and Dasea Street
- Signalised intersection at Muir Road and Worth Street
- Signalised intersection at Muir Road and Rookwood Road
- Signalised intersection at Muir Road and Hume Highway.

Figure 3 Surrounding land uses and residential receivers

1.3 Site history

In 1996, the Waste Recycling and Processing Service of NSW took ownership of the Chullora RRP site and neighbouring site to the north (now occupied by the PFD storage warehouse). WSN Environmental Solutions, a State-owned corporation, operated the site in 1997 until 2011 when they were acquired by SITA Australia Pty Ltd (now SUEZ). From this time SUEZ, operated the previous Chullora RRC site which included a Transfer Station, MRF, Garden Organics platform and glass processing shed. In 2016, Frasers Property acquired both the Chullora RRP site and the site to the north, leasing the previous Chullora RRC back to SUEZ for ongoing use as a waste facility.

In 2017, the MRF component of the previous Chullora RRC, was subject to a fire and subsequently demolished, along with the former glass processing building and other waste infrastructure. At this time the site was subdivided with the northern portion developed as the PFD storage warehouse. Since demolition of the previous Chullora RRC, the Proposal site has been used for storage of residential waste bins, maintenance and parking of waste trucks, a heavy vehicle workshop, 5000 L diesel tank and wash bay to support truck maintenance activities.

On 12 May 2020, SUEZ lodged a development application (DA) (DA366/020) with Council for the development of flood mitigation works across the Chullora RRP site (the flood mitigation works). The DA is seeking approval for early works and site establishment across the Chullora RRP site to provide flood immunity and stormwater infrastructure. The flood mitigation works include:

Site clearance, including:

- Demolition of temporary structures and general clean-up of the proposed site fill area and flood storage area
- Removal of tress and other vegetation (within fill area and flood storage area)
- Crushing of the existing concrete slab, temporary stockpiling of crushed material and reuse of it as a fill material.

Earthworks, including:

- Cut and fill for the flood storage area
- Construction of a flood detention basin and installation of stormwater infrastructure
- Filling the area to the required level using existing crushed recycled concrete material and imported shale / sandstone material.

The commencement of the construction of the Proposal would occur following completion of the flood mitigation works. Figure 4 shows the flood mitigation works; depicting the features of the Chullora RRP site upon commencement of the construction of the Proposal.

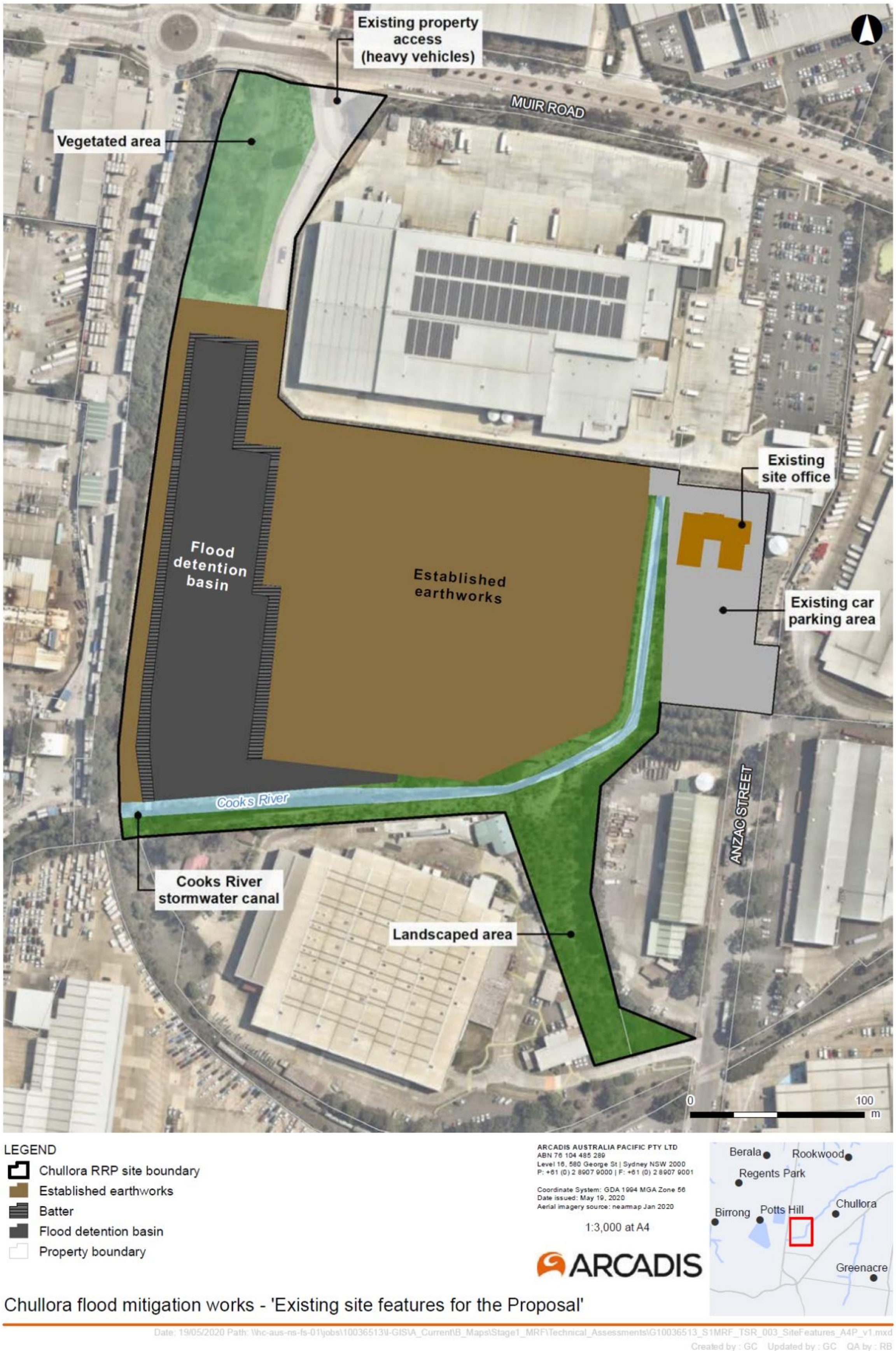

Figure 4 **Chullora RRP site – current conditions**

1.4 Purpose of this report

This Air Quality Assessment supports the EIS for the Proposal and has been prepared as part of an SSD Application for which approval is sought under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) (SSD-10401) for the Proposal, issued by NSW Department of Planning, industry and Environment (DPIE) on 20 December 2019.

Table 1 provides a summary of the relevant SEARs that relate to air quality, and where these have been addressed in this report.

Table 1 SEARs

SEARs	Where Addressed
5. Air Quality and Odour	
A quantitative assessment of the potential air quality, dust and odour impacts of the development in accordance with relevant Environment Protection guidelines. This is to include the identification of existing and potential future sensitive receivers and consideration of approved and/or proposed developments in the vicinity	Results presented in Section 4.
The details of buildings and air handling systems and strong justification (including quantitative evidence) for any material handling, processing or stockpiling external to a building	Discussed in Section 4.2.1.1
Details of proposed mitigation, management and monitoring measures.	Section 5

Further to the above, NSW Environment Protection Authority requires further details on specific requirements relating to their authority. These requirements are discussed throughout the report as indicated in Table 2.

Table 2 Local and State authority requirements and relevant report sections

Environmental Protection Authority	Where Addressed
Air quality including proposed mitigation measures to minimise the generation and emission of dust during the operational phase.	Section 4 and Section 5.
Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data.	Section 3
Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.	Section 4
Estimate the resulting ground level concentrations of all pollutants. Where necessary (e.g. potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations.	Section 4

Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.	Section 4
For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate. Note: With dust and odour, it may be possible to use data from existing similar activities to generate emission rate	Section 4
Air quality including proposed mitigation measures to minimise the generation and emission of dust during the operational phase.	Section 4

2. ASSESSMENT APPROACH

This section outlines the air quality policy framework, assessment approach and methodology for the Proposal.

2.1 Policy framework

2.1.1 Overview

The regulation of air pollution in NSW is provided for in the *Protection of the Environment (Operations) Act 1997* (POEO Act), which is underpinned by a number of regulatory instruments that address air quality including:

- *Protection of the Environment Operations (Clean Air) Regulation 2010* (Clean Air Regulation) – imposes generic operational requirements for activities and plant.
- Environmental Protection Licence (EPL) – A licence held by the operator of a scheduled activity that details the activities that may be carried out at the premises and the conditions that must be met to retain that permission.
- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (Approved Methods for Modelling) – provides statutory requirements for the assessment and modeling of air emissions from a premises.
- *Approved Methods for Sampling and Analysis of Air Pollutants in NSW* (Approved Methods for Sampling) – provides statutory requirements for the measurement of air emissions from a premises.
- Load-based licensing (LBL) – an incentive-based scheme where licence fees are linked to pollutant loads.

2.1.2 Protection of the Environment (Operations) Act 1997

The POEO Act provides a framework for the:

- Licensing and imposition of licence conditions by EPA in relation to activities that are defined under Schedule 1 of the POEO Act
- Development of Protection of the Environment Policies
- Definition of offences and penalties in relation to air pollution under Sections 124-129
- Definition of offences relating to licensing and conditions
- Development of regulations and guidelines that promulgate impact assessment criteria and emission standards for industry
- Provision of a mechanism for public participation in the environmental assessment of activities that may be licensed by EPA, in conjunction with the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The management of air pollution in NSW is dealt with in *Part 5.4 (sectio*ns 124-135) of the POEO Act. This includes the general requirement that non-residential premises do not cause air pollution by failing to operate or maintain plant, carry out work or deal with materials in a proper and efficient manner (sections 124-126).

Section 128 of the POEO Act requires each premises to comply with any air emission standards prescribed by applicable regulations; where standards are not prescribed for a particular air impurity, all practical means must be taken to prevent or minimise air pollution.

2.1.3 Approved operations

As discussed in Section 1.3, the site operated as the previous Chullora RRC until 2017. The previous Chullora RRC hosted a range of waste infrastructure over time including:

- A putrescible waste transfer station and green waste platform (DA 897/1994) with approval to process up to 66,000 tpa of putrescible waste
- A materials recovery facility (DA 287/1996) with approval to recycle up to 100,000 tpa of recyclable material
- A Glass processing facility (DA 973/2002) with approval to process glass fines
- Supporting infrastructure, including workshops, offices, weighbridges, a leachate pond, a small vehicle drop off area, and a trade waste area.

Each of the above approvals remain active for the Proposal site (a review of which/if approvals are to be surrendered will be carried out at a later date). The current approved operational activities for the above operations are:

- 2am-5pm weekdays
- 8am-5pm on weekends and public holidays except for Good Friday and Christmas Day.

The previous Chullora RRC holds Environmental Protection Licence (EPL) 5893, which authorises a number of scheduled activities including composting, recovery of general waste, and waste storage. The existing EPL could either be revised via a variation application or a new EPL sought for the Proposal.

2.1.4 Approved Methods for Modelling

In NSW, air quality impact assessments of new activities or amendments to existing activities are carried out in accordance with the Approved Methods for Modelling, which lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources. The Approved Methods for Modelling is subordinate legislation under Part 4 of the Clean Air Regulation.

The purpose of an air quality impact assessment is to demonstrate that the proposal is designed, constructed and operated in a manner that minimise air quality impacts (including nuisance dust and odour) and minimises risks to human health and the environment to the greatest extent practicable.

The Approved Methods for Modelling lists the statutory methods for modelling and assessing emissions of air pollutants from major projects in NSW. The Approved Methods for Modelling is referred to in:

- Conditions attached to statutory instruments including environmental assessment requirements under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act)
- Part 5: Air Impurities Emitted from Activities and Plant in the Clean Air Regulation.

In general, the Approved Methods for Modelling includes information and methods for the following:

- preparation of emissions inventory data
- preparation of meteorological data
- accounting for background concentrations and dealing with elevated background concentrations
- dispersion modelling
- interpretation of dispersion modelling results
- impact assessment criteria for:

- sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), lead (Pb), $PM_{2.5}$, PM_{10}, total suspended particulates (TSP), deposited dust, carbon monoxide (CO) and hydrogen fluoride (HF)
    - individual and complex mixtures of toxic air pollutants
    - individual and complex mixtures of odorous air pollutants
- modelling of chemical transformation
- procedures for developing site-specific emission limits, including hydrogen sulfide.

This air quality assessment has been conducted in accordance with the Approved Methods for Modelling.

The Approved Methods for Modelling requires that an air quality assessment addresses the potential for cumulative impacts with existing activities by the addition of site specific or site representative background concentrations of the following air pollutants: SO_2, NO_2, O_3, Pb, $PM_{2.5}$, PM_{10}, TSP, deposited dust, CO and HF. Therefore, the potential for cumulative impacts with future projects is required to be assessed for these air pollutants. Impact assessment criteria that are relevant to the assessment are reproduced in Table 3. Pollutants O_3, Pb and HF are not included as these will not be emitted due to the Proposal.

Table 3 Impact assessment criteria (Approved Methods for Modelling)

Pollutant	Averaging period	Impact assessment criteria (µg/m³)
NO_2	1-hour	246
	Annual	62
SO_2	10-minutes	712
	1-hour	570
	24-hour	228
	Annual	60
CO	15-minute	100,000
	1-hour	30,000
	8-hours	10,000
TSP	Annual	90
PM_{10}	24-hour	50
	Annual	25
$PM_{2.5}$	24-hour	25
	Annual	8
Deposited dust *	Annual	2 g/m^2/month [1]
	Annual	4 g/m^2/month [2]

Table notes:
[1] Maximum increase in deposited dust level
[2] Maximum total deposited dust level

The Approved Methods for Modelling specifies impact assessment criteria for several volatile organic compounds (VOCs). Individual VOCs associated with diesel combustion are presented in Table 4.

Table 4 Impact assessment criteria for VOCs (Approved Methods for Modelling)

Pollutant	Averaging period	Impact assessment criteria (µg/m³)
1,3-butadiene	1-hour	40
Acetaldehyde	1-hour	42
Benzene	1-hour	29
Formaldehyde	1-hour	20
Polycyclic Aromatic Hydrocarbons	1-hour	0.4
Toluene	1-hour	360
Xylene	1-hour	190

In relation to odour, the Approved Methods for Modelling provides criteria based on the size of an affected community, as follows:

> *"...the impact assessment criteria for complex mixtures of odours have been designed to take into account the range of sensitivity to odours within the community and to provide additional protection for individuals with a heightened response to odours. This is achieved by using a statistical approach dependent upon population size. As the population density increases, the proportion of sensitive individuals is also likely to increase, indicating that more stringent criteria are necessary in these situations."*

A summary of the criteria for various affected populations is presented in Table 5. These odour criteria are concerned with controlling odours to ensure offensive odour impacts will be effectively managed but are not intended to achieve 'no odour'. Given the location of the Chullora RRP, the relevant criteria from Table 5 is 2.0 ou (nose-response-time average, 99th percentile).

Table 5 Impact assessment criteria for complex mixtures of odorous air pollutants (nose-response-time average, 99th percentile) (Approved Methods for Modelling)

Population of affected community	Impact assessment criteria for complex mixtures of odorous air pollutants (ou)
Urban (≥~2000) and/or schools and hospitals	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single rural residence (≤~2)	7.0

2.2 Assessment methodology

2.2.1 Surrounding environment

The location of the Proposal and surrounding environment has been described in terms of local meteorology, air quality, and land use including sensitive receptor locations. Details are provided in Sections 3.2, 3.3 and 3.4.

2.2.2 Site specific meteorology

A meteorological windfield was developed for the Proposal site using the TAPM and CALMET models. The 2015 calendar year was selected for meteorological modelling as this was considered a representative year based on an analysis of data from the Bureau of Meteorology's monitoring station at Sydney Airport in the period from 2011 to 2016. This was done in accordance with NSW EPA's requirements as detailed in the Approved Methods for Modelling and NSW EPA's associated CALPUFF guidance (TRC, 2011).

Technical details of the configuration of the TAPM and CALMET models are discussed in Appendix A, along with an evaluation of the generated meteorological data file. A summary of meteorology for the site is provided in Section 3.2.

2.2.3 Emissions

The main pollutants associated with the MRF would be:

- Combustion gases (NO_2, CO, SO_2, VOCs, and particulates) associated with diesel exhaust engines
- Dust and odour from the operation of the facility.

Dust and combustion gas emission rates were estimated using the base equation:

$$ER = A \times EF \times (1 - CF)$$

where:

ER	emission rate
A	activity / operations data
EF	emission factor
CF	reduction in emissions due to the implementation of control measures.

Emissions of NO_2, CO, SO_2, VOCs, and particulates associated with diesel exhaust were estimated using emission factors from NPI emissions estimation technique handbook for combustion engines and diesel usage for the site. VOCs were speciated based on VOC profile for diesel from the Air Emissions Inventory for the Greater Metropolitan region in New South Wales (EPA, 2008).

Emissions of TSP, PM_{10} and $PM_{2.5}$ from the Proposal were estimated using recognised and accepted methods of dust emissions estimation. These include approximation of emission rates from NPI emissions estimation technique handbooks and the United States Environmental Protection Agency (US EPA) AP42 emission handbooks.

The emissions estimation techniques applied in this assessment are based on standard methods that are applied throughout Australia and in the United States. The size distribution of dust particles was derived from the emission rates estimated for TSP, PM_{10}, and $PM_{2.5}$.

Emissions of odour have been estimated using publicly available information on odour sampling from other waste processing facilities.

Emissions inventories are detailed in Section 4.

The activity data, methodology and assumptions that were used to estimate emissions are detailed in Appendix B.

2.2.4 Dispersion modelling

Dispersion modelling was conducted using the CALPUFF model. The CALPUFF configuration was developed in accordance with NSW EPA's requirements as detailed in the Approved Methods for Modelling and NSW EPA's associated CALPUFF guidance (TRC, 2011). Ground-level concentrations of key pollutants were predicted across the model domain.

Details of model configuration are provided in Appendix A.

2.2.5 Cumulative impacts

In order to assess the potential cumulative impacts of the MRF upon the surrounding environment in conjunction with existing sources of air emissions in the region, ambient background concentrations of pollutants have been added to dispersion modelling predictions for the Proposal. These levels are derived in Section 3.3.3. The ambient background concentrations have been determined, where possible, from data collected at NSW EPA's nearby monitoring station at Chullora.

The assessment of cumulative impacts for 24-hour average PM_{10} and $PM_{2.5}$ has been conducted using the Level 2 assessment methodology outlined in the Approved Methods for Assessment. This is required in instances where ambient monitoring data shows exceedances of the air quality criteria, and the methodology allows an assessment of whether a proposal is likely to contribute to additional exceedances.

Cumulative 1-hour and annual average concentrations of NO_2 have been estimated using Method 2: NO to NO_2 conversion limited by ambient ozone concentration (OLM) as detailed in the Approved Methods for Modelling.

2.2.6 Presentation of results

Modelling results for combustion gases, dust and odour have been presented as ground-level concentrations across the model domain. The maximum predicted concentration in each nearby sensitive receptor zone have also been determined.

The results of dispersion modelling are presented in Section 4. The predicted results have been assessed by comparison with the air quality criteria detailed in Section 2.1.3.

2.2.7 Limitations and uncertainty

A limitation of this study is that it relies on the accuracy of a number of data sets that feed into the dispersion model. These data sets have been sourced from the following:

- Meteorological monitoring observations from the Bureau of Meteorology
- Air quality monitoring observations from the NSW EPA Chullora monitoring station
- Dust emission factors from the National Pollutant Inventory (NPI)
- Publicly available odour emission rates measured from similar facilities
- Synoptic and surface information datasets from CSIRO
- Operational parameters from SUEZ.

It is also important to note that numerical models are based on an approximation of governing equations and will inherently be associated with some degree of uncertainty. The more complex the physical model, the greater the number of physical processes that must be included. There may be physical processes that are not explicitly accounted for in the model and, in general, these approximations tend to lead to an over prediction of air pollutant levels.

3. EXISTING ENVIRONMENT

3.1 Current site conditions

On 12 May 2020, SUEZ lodged a development application (DA) (DA366/020) with Council for the development of flood mitigation works across the Chullora RRP site (the flood mitigation works). The DA is seeking approval for early works and site establishment across the Chullora RRP site to provide flood immunity and stormwater infrastructure. The flood mitigation works include:

Site clearance, including:

- Demolition of temporary structures and general clean-up of the proposed site fill area and flood storage area
- Removal of tress and other vegetation (within fill area and flood storage area)
- Crushing of the existing concrete slab, temporary stockpiling of crushed material and reuse of it as a fill material.

Earthworks, including:

- Cut and fill for the flood storage area
- Construction of a flood detention basin and installation of stormwater infrastructure
- Filling the area to the required level using existing crushed recycled concrete material and imported shale / sandstone material.

The commencement of the construction of the Proposal would occur following completion of the flood mitigation works. Figure 4 shows the flood mitigation works; depicting the features of the Chullora RRP site upon commencement of the construction of the Proposal.

3.2 Local meteorology

The local meteorological conditions are important for an assessment of potential air quality impacts associated with the Proposal as they dictate the direction of transport of pollutants. Meteorological conditions that have a significant impact on the dispersion of pollutants from the site include wind speed, wind direction, temperature, atmospheric stability and mixing height. The following sections provide an analysis of these parameters at the location of the MRF as generated by TAPM and CALMET meteorological models and used in the dispersion model. The meteorological data is for the 1 January 2015 to 31 December 2015 period.

The following summary includes a description of the wind speed, wind direction, temperature, atmospheric stability and mixing height.

3.2.1 Wind speed and wind direction

The annual, diurnal and seasonal distribution of winds predicted by TAPM/CALMET for the site are presented in Figure 5, Figure 6 and Figure 7, respectively. As the model simulation covered a period of 12 months to coincide with the observation data (1 January 2015 to 31 December 2015).

On average, 63.5% of winds at the site are from the northwest through to the southwest. The winds are predominately moderate between 3 and 7 m/s, averaging 3.31 m/s, with a predicted maximum during the modelled period of 8.61 m/s.

The dominant winds from the northwest and southwest are predicted to occur during winter and autumn, with a reduced frequency occurring during spring. Minimal winds from this direction are predicted to occur at the Proposal site during summer. Summer winds at the site are predicted to be predominantly moderate to strong (3 to 7 m/s) and from the northeast sector.

Winds at the site are strongest during the day, particularly during the early morning period (Midnight to 6am). The dominant winds from the northwest and southwest are predicted to occur during the periods of midnight to midday. Additionally, the dominant winds from the northeast and southeast are predicted to occur during the periods of midday to midnight.

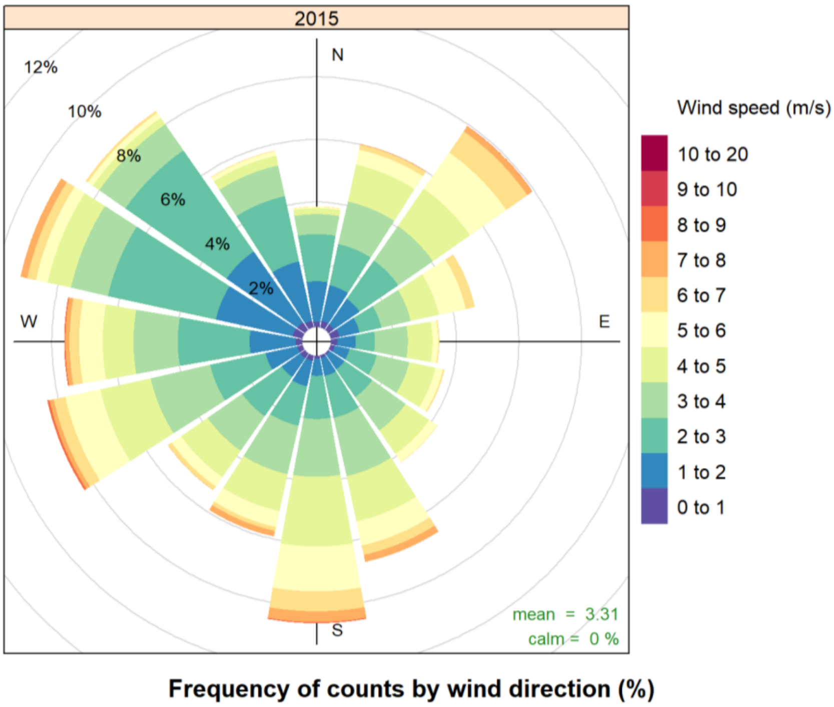

Figure 5 **Annual distribution of the TAPM/CALMET generated winds for the Proposal site**

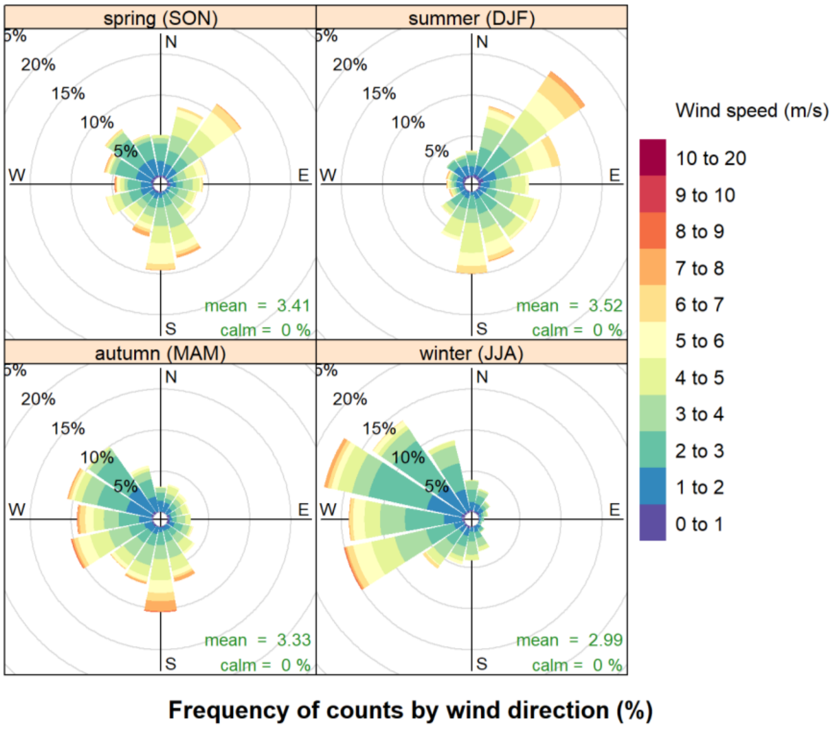

Figure 6 **Diurnal distribution of the TAPM/CALMET generated winds for the Proposal site**

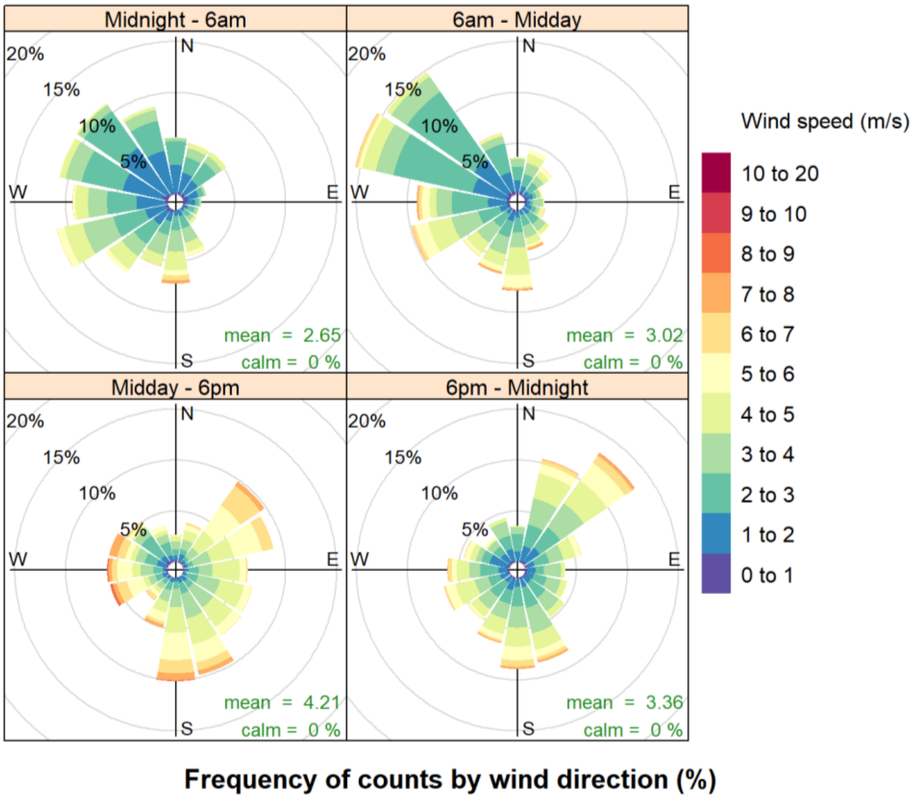

Figure 7 **Seasonal distribution of the TAPM/CALMET generated winds for the Proposal site**

3.2.2 Temperature

The hourly and monthly distribution of temperatures predicted by TAPM/CALMET for the Proposal site are presented in Figure 8 and Figure 9, respectively. The model simulation covers a period of 12 months to coincide with the observation data. The temperature at the site during the model simulation period ranges between 4.4°C and 39.5°C (average 17.3°C).

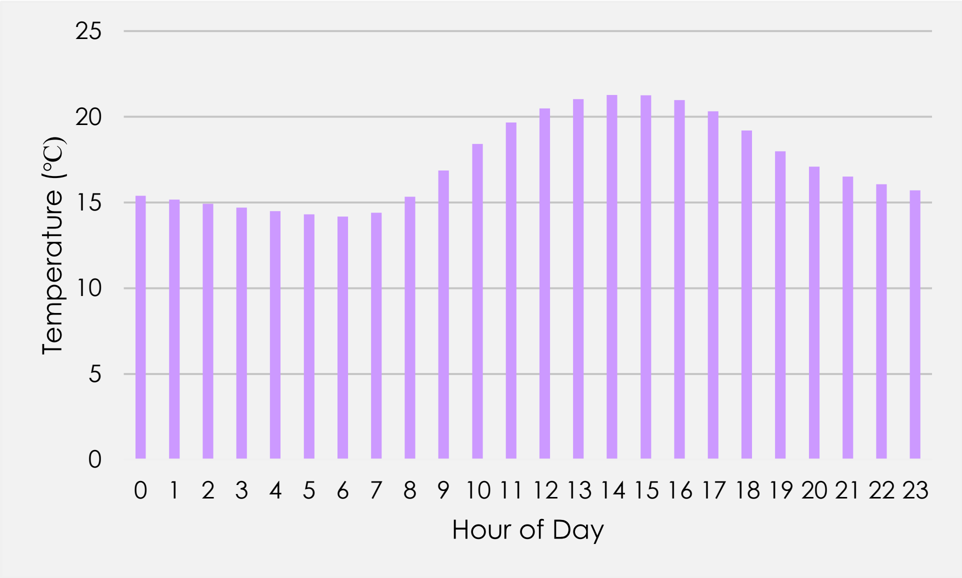

Figure 8 **Hourly distribution of TAPM/CALMET predicted temperature at the Proposal site**

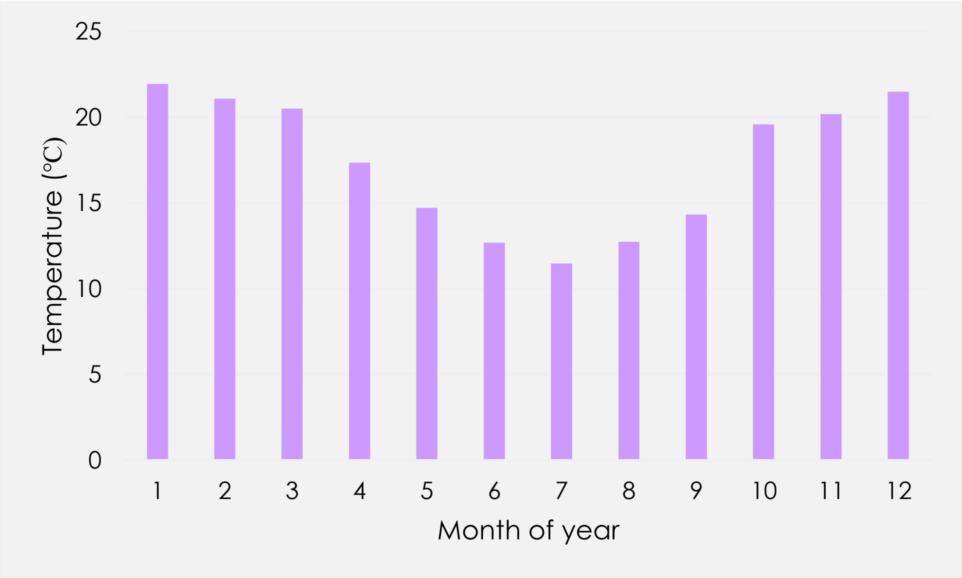

Figure 9 **Monthly distribution of TAPM/CALMET predicted temperature at the Proposal site**

3.2.3 Atmospheric stability

Atmospheric stability is classified under the Pasquil-Gifford scheme and ranges from Class A, which represents very unstable atmospheric conditions that may typically occur on a sunny day, to Class F which represents very stable atmospheric conditions that typically occur during light wind conditions at night. Unstable conditions (Class A-C) are characterised by strong solar heating of the ground that induces turbulent mixing in the atmosphere close to the ground, which usually results in material from a plume reaching the ground closer to the source than it does for neutral conditions or stable conditions.

This turbulent mixing is the main driver of dispersion during unstable conditions. Dispersion processes for neutral conditions (Class D), are dominated by mechanical turbulence generated as the wind passes over irregularities in the local surface, such as terrain features and building structures. During night-time, the atmospheric conditions are generally neutral or stable (Class D, E and F) with cloud cover enhancing stability. Stability refers to the vertical movement of the atmosphere and is therefore an important factor in the dispersion and transport of a plume within the boundary layer.

Stability class is calculated by WRF/CALMET and has been extracted at the site. Table 6 shows the distribution of stability classes for the site and Figure 10 shows the distribution of stability class predicted at the site by hour of day.

Table 6 Frequency distribution of surface atmospheric stability conditions at the Site

Pasquil-Gifford Stability Class	Frequency (%)	Classification
A	0.8	Extremely unstable
B	6.0	Unstable
C	12.6	Slightly unstable
D	45.2	Neutral
E	14.2	Slightly stable
F	21.2	Stable

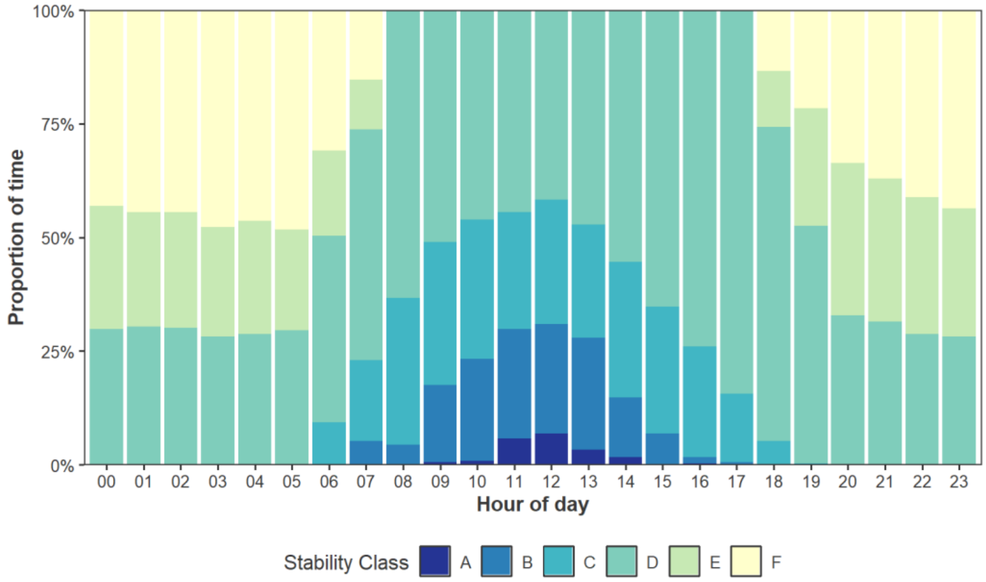

Figure 10 Proportion of stability class predicted at the Proposal site by hour of day

3.2.4 Mixing height

The mixing height defines the height of the mixed atmosphere above the ground (mixed layer), which varies diurnally. Air pollutants released at or near the ground, will become dispersed within the mixed layer. During stable atmospheric conditions, the mixing height is often quite low and particulate dispersion is limited to within this layer. During the day, solar radiation heats the ground and causes the air above it to warm, resulting in convection and an increase to the mixing height. The growth of the mixing height depends on meteorological factors such as the intensity of solar radiation and wind speed. During strong wind speeds, the air will be well mixed, resulting in an elevated mixing height.

Mixing height information has been extracted from the TAPM/CALMET dataset at the Proposal site and is presented in Figure 11. The data shows that the mixing height develops at around 6am, increases to a peak around 4pm before descending rapidly between 4-6 pm.

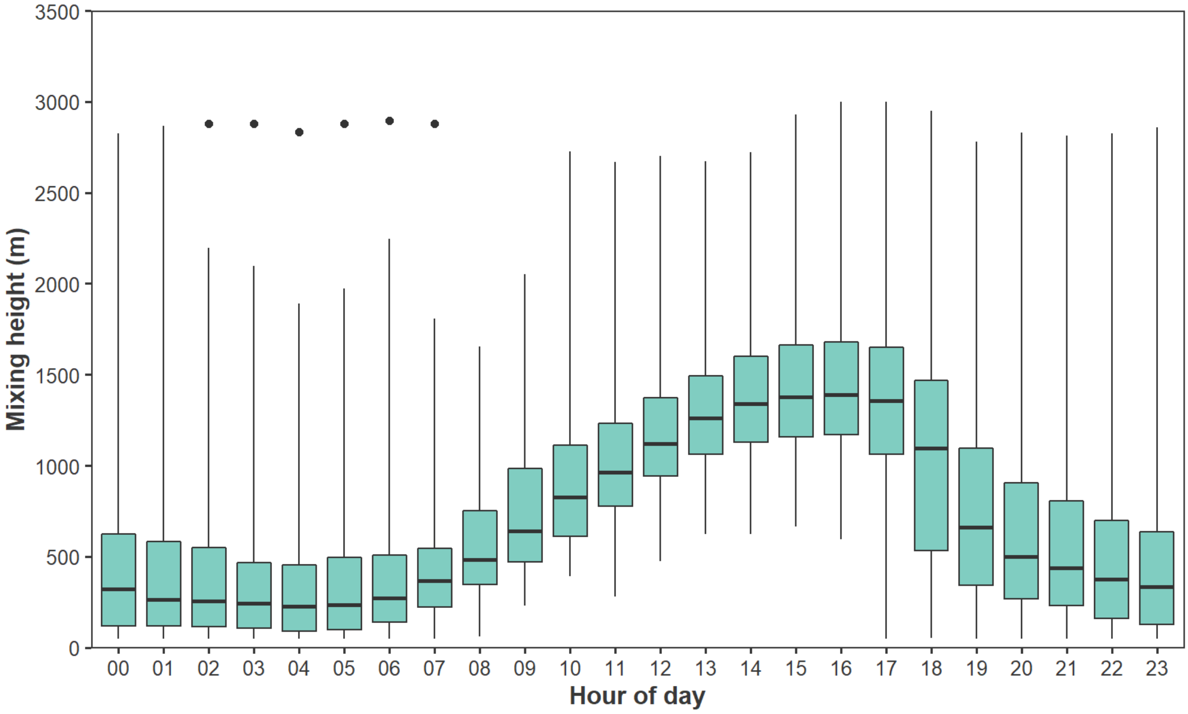

Figure 11 **Box and whisker plot of mixing height data extracted from TAPM/CALMET at the Proposal site by hour of day**

3.2.5 Local terrain and land-use

Located 15km to the west of the Sydney CBD, the MRF is at an elevation of approximately 35-40m above sea level. The land surrounding the Proposal site shows a decrease in elevation in all directions.

The MRF is located within an industrial area. Outside of this industrial boundary, the site is surrounded by residential areas to the north, east, south and west with the nearest residential area located 300m to the southwest of the Proposal site.

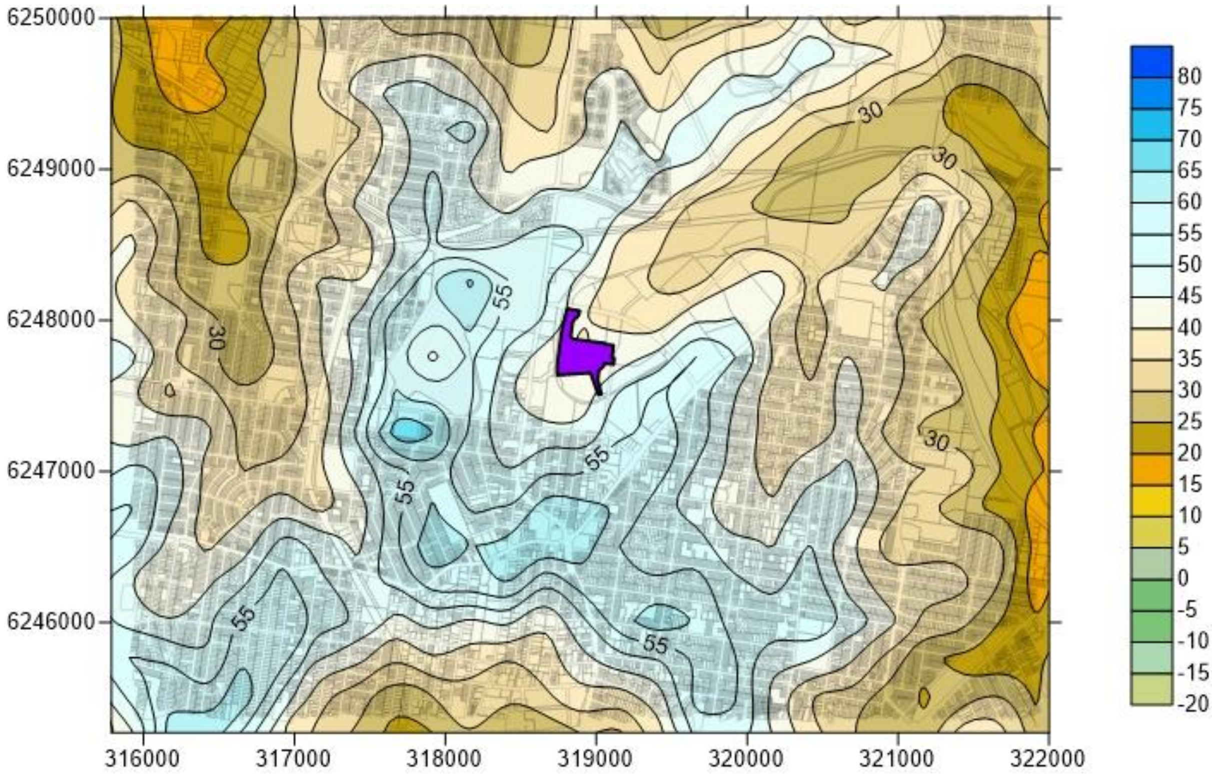

Figure 12 **Elevation across the model domain**

3.3 Existing air quality

3.3.1 Existing sources of emissions

Existing industrial activities in the area have been identified through a review of the National Pollutant Inventory (NPI) for the 2017-2018 reporting year. The facilities within 5km that reported emissions of key pollutants associated with the Proposal are summarised in Table 7. Industrial activities include manufacturing, storage, wastewater treatment and stevedoring and transportation services.

Austral Bricks Punchbowl has the most significant emissions of PM_{10} and SO_2. The facility with the most significant emissions of $PM_{2.5}$ within the vicinity is Pacific National Chullora. Tooheys Brewery at Lidcombe has the most significant emissions of NOx and CO. These facilities are located approximately 5km southeast, 4.8km north and 1km northeast of the Proposal site, respectively.

Table 7 Emissions to air for facilities within a 5km range of the SUEZ Chullora Site as reported to the NPI for the 2017/2018 reporting year

Facility name	Main activity	Distance and direction from Site	PM_{10} (kg/year)	$PM_{2.5}$ (kg/year)	NOx (kg/year)	CO (kg/year)	SO_2 (kg/year)
Austral Bricks Punchbowl	Brick making	5km SE	32,300	430	20,900	8,000	12,004
Boral Asphalt Enfield	Bitumen pre-mix production	2.3km E	2,826	328	9,672	116,83	639
Galvanising Services Yagoona	Galvanising and metal processing	0.2km W	86	86	2,098	2,460	13
Pacific National Chullora (Sydney freight terminal)	Railway yard operations	1km NE	1,198	1,143	15,042	8,399	6
Parmalat Lidcombe	Dairy Manufacturing	4.3km NE	204	204	2,820	3,657	30
Primo Chullora	Meat Processing	0.8km E	1.491	379	5,783	4,690	56
Spotless Facility Services Punchbowl	Industrial laundry	4.6 SE	66	66	450	755	10
Tip Top Bakeries Chullora	Bread production and packaging	0.4km E	596	596	13,682	1,938	88
Tooheys Brewery Lidcombe	Brewing and packaging of beer	4.8km N	491	491	155,371	29,164	109
VIP Packaging Granville	Steel packaging manufacturing	4.1km NW	76	76	1190	964	11
Weston Animal Nutrition Enfield	Animal feed production and packaging	2.7km NE	17,799	91	2154	330	14
Weston Milling - Enfield	Grain mill and product manufacturing	2.8km NE	1,100	8	1,190	709	0

3.3.2 Existing ambient air quality

NSW Environment, Energy and Science (EES) operates a number of air quality monitoring stations around Sydney. The closest monitoring station to the Proposal site is located at Chullora, approximately 300m west, which monitors concentrations of a variety of air pollutants, the most important to this Proposal being PM_{10} and $PM_{2.5}$. Concentrations of PM_{10} and $PM_{2.5}$ from 2015 to 2019 are summarised in Table 8, and concentrations of NO_2, SO_2 and CO are summarised in Table 9.

Measured concentrations of NO_2, CO and SO_2 measured from 2015 to 2019 were well below the impact assessment criteria. Daily average concentrations of PM_{10} and $PM_{2.5}$ were above the impact assessment criteria. In 2019, there were 20 and 22 days of the year above the impact assessment criteria for PM_{10} and $PM_{2.5}$, respectively, whereas the preceding years saw a maximum of 7 and 8 days, respectively per year. The increase in number of days where PM_{10} and $PM_{2.5}$ concentrations were above the assessment criteria in 2019 were likely due to the prevailing drought and bushfires. The annual average concentrations of PM_{10} and $PM_{2.5}$ measured from 2015 to 2019 have also been included in Table 8.

Table 8 Ambient concentrations of PM_{10} and $PM_{2.5}$ measured at the NSW air monitoring station at Chullora

Year	PM_{10}			$PM_{2.5}$		
	24-hour average maximum	No. days > 50 µg/m^3	Annual average	24-hour average maximum	No. days > 25 µg/m^3	Annual average
2015	64.6	1	17.5	37.2	1	8.0
2016	63.5	1	18.1	49.4	5	8.0
2017	63.0	4	20.1	44.6	8	9.5
2018	90.7	7	21.9	29.1	3	8.6
2019	140.4	20	24.6	97.6	22	11.5
Criteria	**50**	**-**	**25**	**25**	**-**	**8**

Table 9 Ambient concentrations of NO_2, SO_2 and CO measured at the NSW air monitoring station at Chullora

Year	NO_2		SO_2			CO	
	Maximum 1-hour average	Annual average	Maximum 1-hour average	24-hour average	Annual average	Maximum 1-hour average	Maximum 8-hour average
2015	110.7	25.7	40.0	8.7	1.5	2,750	1,750
2016	94.3	25.8	40.0	9.0	1.7	3,000	2,000
2017	123.0	25.0	40.0	8.5	1.6	2,250	1,500
2018	116.9	24.1	60.1	9.1	1.8	4,500	4,250
2019	143.5	23.5	74.4	11.4	2.0	5,750	1,750
Criteria	**246**	**62**	**570**	**228**	**60**	**30,000**	**10,000**

3.3.3 Ambient background concentrations

The Approved Methods for Modelling specifies two methods of accounting for background concentrations. Level 1 assessment requires the inclusion of the maximum background concentration of the pollutant being assessed for each relevant averaging period. Level 2 assessment requires the addition of hourly contemporaneous data to ground-level concentrations of pollutants at each receptor. In instances where ambient air pollutant concentrations exceed the impact assessment criteria, the Approved Methods for Modelling requires a proposed development to not cause additional exceedances of the criteria.

The maximum measurement for each air pollutant (NO2, SO2 and CO) and averaging period from 2015 to 2019 has been selected for use as an ambient background concentration in the air quality assessment. These concentrations are summarised in Table 10.

Table 10 Ambient background concentrations used in the assessment

Pollutant	Averaging period	Statistic	Ambient background concentration (µg/m³)	Number of exceedances	Impact assessment criteria (µg/m³)
NO_2	1-hour	Maximum	143.5	0	246
	Annual	Average	25.8	0	62
O_3*	1-hour	Maximum	377	5	NA
	Annual	Average	35.2	NA	NA
CO	1-hour	Maximum	5,750	0	30,000
	8-hour	Average	4,250	0	10,000
SO_2	1-hour	Maximum	74.4	0	570
	24-hour	Maximum	11.4	0	228
	Annual	Average	2.0	0	60
PM_{10}	24-hour	Maximum	Contemporaneous	5	50
	Annual	Average	Contemporaneous	0	25
$PM_{2.5}$	24-hour	Maximum	Contemporaneous	1	25
	Annual	Average	Contemporaneous	0	8

Table note:
* Used to determine cumulative NO_2 concentration due to the Proposal plus ambient background concentrations

Due to the exceedances of 24-hour average PM_{10} and $PM_{2.5}$ recorded at the NSW EPA Chullora monitoring station; a Level 2 assessment has been conducted for these indicators.

The 24-hour average concentrations of PM_{10} and $PM_{2.5}$ recorded during 2015 are presented in Figure 13 and Figure 14. These datasets have been used in the Level 2 assessment, as the modelling period used is 1 January 2015 to 31 December 2015. The Level 2 assessment requires the model prediction to be added to the measured pollutant concentration for each day of the year. This has been used to determine whether there would be any additional days on which 24-hour average concentrations would exceed the relevant criteria, as well as for evaluation of the cumulative annual average PM_{10} and $PM_{2.5}$ concentrations.

An ambient average concentration for TSP has been estimated as twice the annual average PM_{10} concentration in 2015, as TSP is not monitored at the Chullora EPA site.

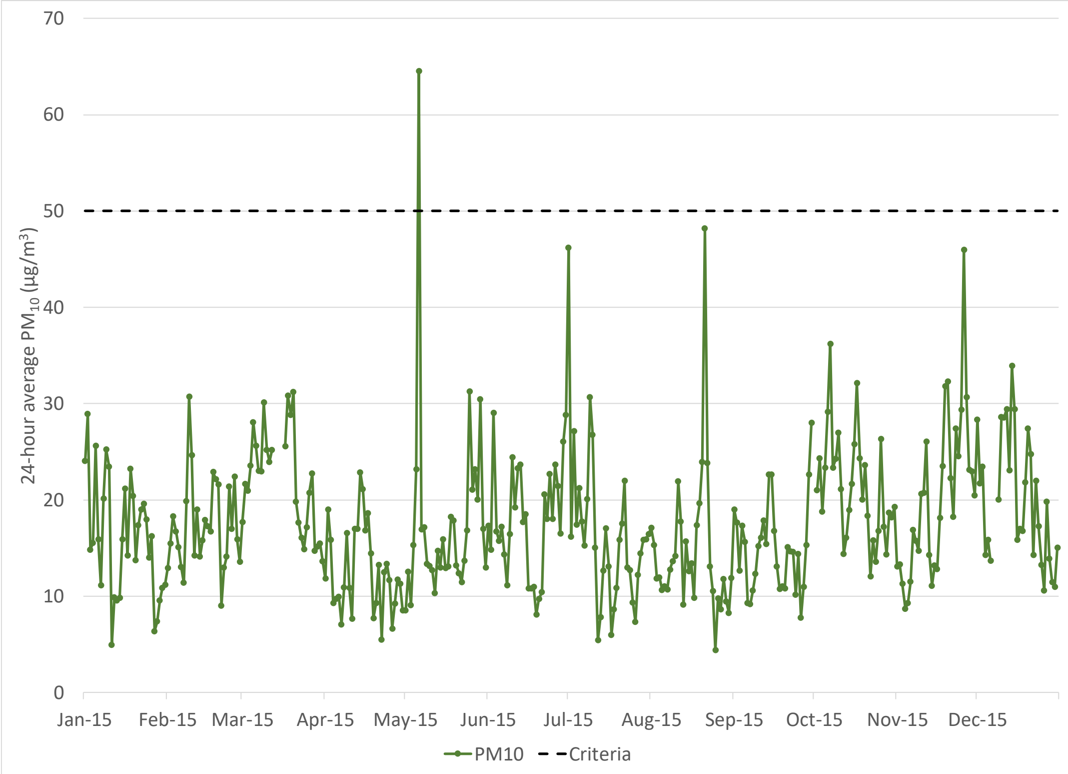

Figure 13 **24-hour average PM_{10} concentrations from the NSW EPA Chullora monitoring station**

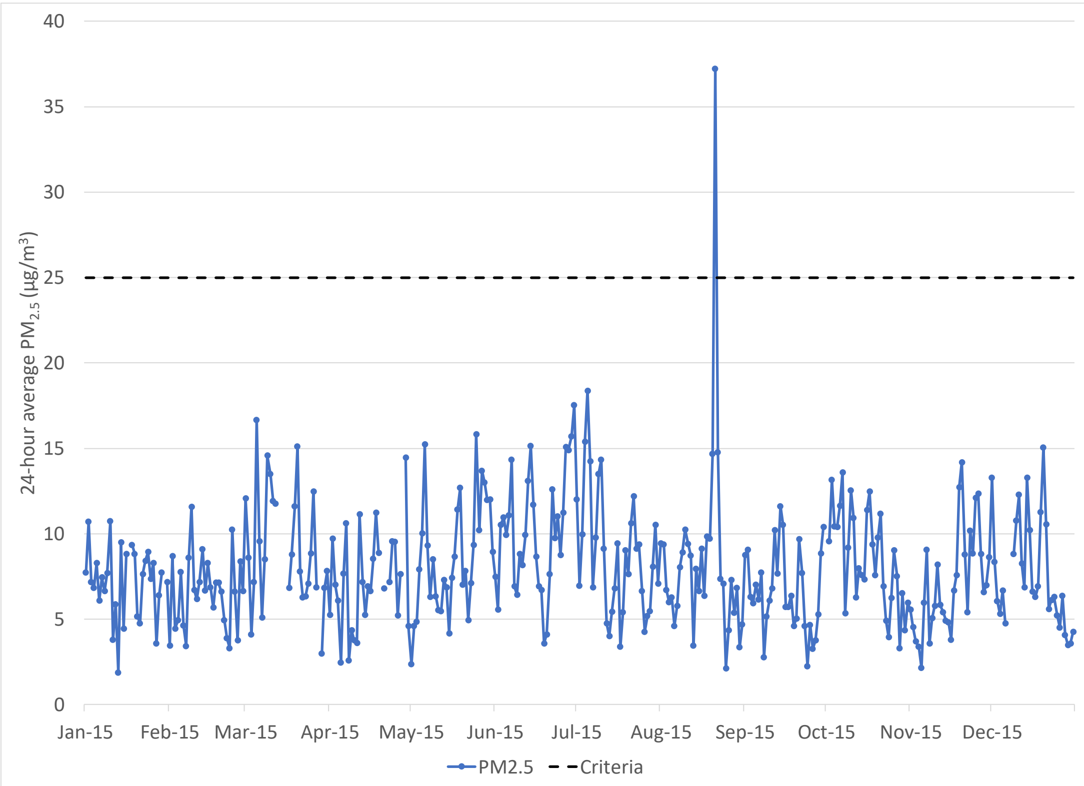

Figure 14 **24-hour average $PM_{2.5}$ concentrations from the NSW EPA Chullora monitoring station**

3.4 Sensitive receptors

The Approved Methods for Modelling defines sensitive receptors as:

> "*…a location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. An air quality impact assessment should also consider the location of known or likely future sensitive receptors.*"

To assist in the assessment of the potential impacts of the Proposal, the nearest residential areas have been identified through a review of aerial imagery. The predicted impacts of the Proposal within each of these residential areas has been assessed in Section 4. The predicted impacts of the Proposal have also been assessed by comparing the maximum ground-level concentrations predicted outside the Proposal site with the relevant impact assessment criteria.

The sensitive receptors located in the vicinity of this Proposal have been grouped into sensitive zones. These are shown in Figure 15. A total of 18 sensitive zones have been identified. Parks and recreational areas, education facilities and major roads have been identified. The closest residential zone to the site is sensitive zone 1 which is approximately 300m southwest of the Proposal site. For this assessment the maximum concentrations within each sensitive zone would be representative of the entire zone.

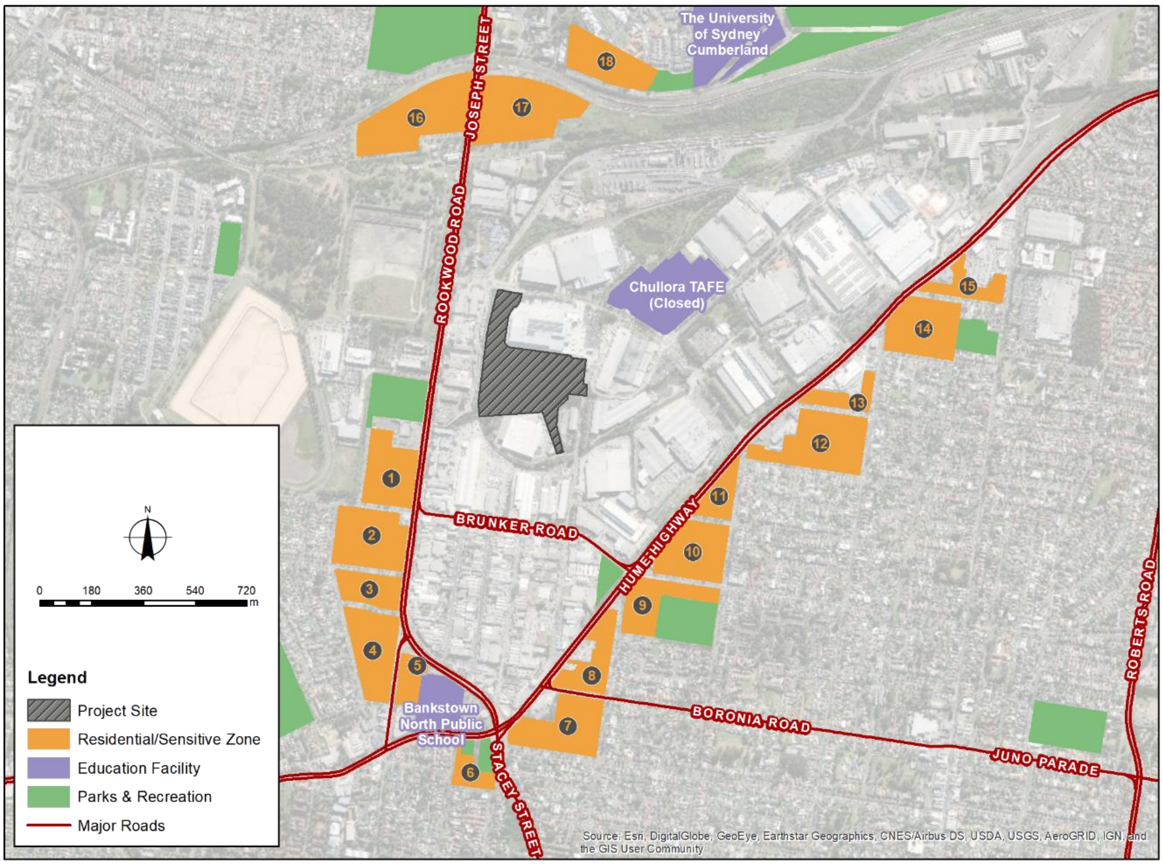

Figure 15 The location of the sensitive receptors, recreational areas and education facilities in the vicinity of the Proposal site

4. IMPACT ASSESSMENT

4.1 Construction

Construction phase activities at the Proposal site are as follows:

- Provision of parking and queuing spaces for trucks
- External works such installation of inbound and outbound weighbridges
- Construction of an enclosed 10,000 m^2 MRF shed, which would be approximately 125 m by 80 m and 15 m in height
- Installation and commissioning of fixed plant and equipment
- Construction of ancillary infrastructure such as fire safety infrastructure (storage tanks, pumps and valve room) and site services infrastructure (electrical, water, sewer, gas and telecommunication services)
- Installation of landscaping and signage.

As the construction phase would be temporary and no earthworks would be conducted, any emissions to air during the construction phase would be due to diesel exhaust emissions of vehicles bringing material to site or operating on site. These emissions would be minor. Therefore, the construction phase of the Proposal would not cause exceedance of the relevant air quality assessment criteria.

4.2 Operations

4.2.1 Dust and exhaust pollutants

4.2.1.1 Emissions inventory

Emissions due to the following activities associated with the Proposal have been calculated:

- Wheel generated dust from transport of incoming and outgoing waste along the sealed road to and from the MRF
- Dust due to screening, shredding, crushing and other material transfers within the MRF
- Emissions of exhaust pollutants including NOx, SO_2, CO and particulates from vehicle movements on-site and mobile equipment within the MRF.

Emissions were calculated from published emission factors based on the National Pollutant Inventory Emission Estimation Technique Manual for Mining (NPI, 2012), National Pollutant Inventory Emission Estimation Technique Manual for Combustion Engines (NPI, 2008) and the USEPA - AP42 documents (USEPA, 2004; USEPA, 2006b; USEPA, 2011) and operating information provided by Arcadis.

A number of air quality management features have been incorporated into the design of the MRF to minimise the potential for air quality impacts, including:

- Handling of incoming waste and outbound materials within a fully enclosed shed. The only exception to this would be loading of curtain-sider vehicles adjacent to the product storage area. The nature of curtain siders is that, while the truck would be outside the MRF building, loading occurs via an open side of the vehicle from within the shed and therefore minimising potential air quality impacts outside the shed.
- Major transport points within the processing area are fully enclosed as part of the fixed plant
- All transfer points and screens are misted to minimise dust generation

- All haul roads are sealed
- Fast closing roller doors.

The dispersion modelling of emissions accounts for the proposed 24/7 operations of the MRF. All material handling and processing activities would occur inside the MRF building. To provide a conservative assessment it has been assumed that four doors would remain open to the south of the MRF building for receipt of waste. Four doors would remain open (two on the eastern side and two on the western side of the MRF building) for the processing area and four doors (two on the eastern side and two on the western side of the MRF building at the northern end) for the product area. This is considered a worst-case assessment scenario as it is likely that roller shutter door, particularly those in the processing area of the shed, could be closed for the majority of operational hours.

The emissions inventory is based on the anticipated daily maximum throughput, which is 130% of the average expected daily throughput. The dispersion modelling assessment has assumed this rate throughout the entire year, representing a worst-case scenario.

A summary of emission rates is presented in Table 11.

Figure 16 illustrates the location of the emission sources, which would be at the doors of the MRF building. Emissions due to all material handling and processing within the MRF have been modelled these locations.

Activity data, methodologies and assumptions used to calculate emissions during operation of the MRF are presented in Appendix B.

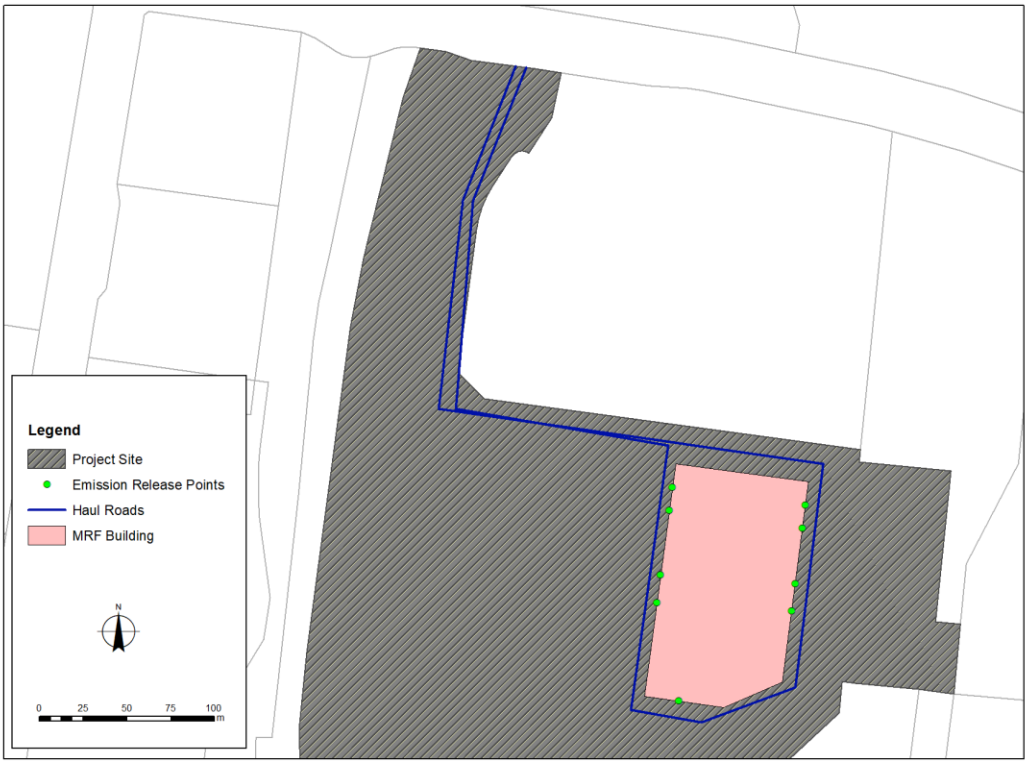

Figure 16 Location of emission sources during operations

Table 11 Emission rates from the MRF during operations

Source of emissions	Emissions (g/s)						
	TSP	PM_{10}	$PM_{2.5}$	SO_2	NOx	CO	VOC
Incoming waste haulage	0.12	0.022	0.0054	-	-	-	-
Dumping of waste	0.0003	0.0001	0.00002	-	-	-	-
FEL transfer of waste from receival to processing	0.0003	0.0001	0.00002	-	-	-	-
Processing of cardboard and paper	0.0007	0.0003	0.00005	-	-	-	-
Processing of glass and metal	0.0004	0.0002	0.00003	-	-	-	-
Processing of plastics	0.00006	0.00003	0.000005	-	-	-	
Residuals processing	0.0001	0.00006	0.000009	-	-	-	-
Fuel combustion - mobile processing equipment	-	0.013	0.012	0.00009	0.2	0.05	0.018
Loading to trucks	0.0003	0.0001	0.00002	-	-	-	
Product haulage	0.095	0.02	0.004	-	-	-	
Fuel combustion - waste and product trucks	-	0.002	0.002	0.00003	0.04	0.02	0.002
Total	**0.22**	**0.058**	**0.024**	**0.00012**	**0.24**	**0.07**	**0.020**

4.2.1.2 Results

Table 12 presents the predicted ground-level concentrations of PM_{10} and $PM_{2.5}$ due to the MRF and background concentrations at the sensitive receptor zones, using the Level 2 assessment method where the model prediction is added to the measured background concentration from the EPA's Chullora monitoring site for each day of the year. Therefore, the maximum predicted concentrations due to the MRF in isolation (as presented in Table 12) do not necessarily occur on the same day that the maximum background concentration for PM_{10} and $PM_{2.5}$ occur.

The predicted ground-level concentrations of TSP and dust deposition rates in each sensitive receptor zone are presented in Table 13.

The predicted ground-level concentrations of NO_2, SO_2 and CO due to the MRF and background concentrations in each sensitive receptor zone are presented in Table 14.

The predicted ground-level concentrations of VOCs due to the MRF in each sensitive receptor zone are presented in Table 15.

Contour plots due to the MRF in isolation are presented in Plate 1 to Plate 7.

The results show that:

- 1-hour and annual average ground-level concentrations of NO_2 due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- 15-minute, 1-hour and 8-hour average ground-level concentrations of CO due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.

- 1-hour, 24-hour and annual average ground-level concentrations of SO_2 due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- 1-hour average ground-level concentrations of individual VOCs due to the MRF are predicted to ***comply*** with the relevant air quality assessment criteria.
- For 24-hour average ground-level concentrations of PM_{10}, the MRF is not predicted to result in any additional exceedance days compared to existing ambient background levels.
- For 24-hour average ground-level concentrations of $PM_{2.5}$, the MRF is not predicted to result any additional exceedance days compared to existing ambient background levels.
- Annual average ground-level concentrations of TSP, PM_{10} and $PM_{2.5}$ due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- Dust deposition rates due to the MRF are predicted to ***comply*** with the air quality assessment criterion of 2 g/m^2/month.

Table 12 Predicted 24-hour average ground-level concentrations of PM_{10} and $PM_{2.5}$ at sensitive receptors due to the MRF

Receptor zone	Maximum 24-hour average PM_{10} (µg/m^3)			Maximum 24-hour average $PM_{2.5}$ (µg/m^3)		
	MRF	MRF + Background[1]	No. of additional exceedances due to MRF	MRF	MRF + Background[2]	No. of additional exceedances due to MRF
1	2.3	64.56	0	1.23	37.23	0
2	1.6	64.56	0	0.94	37.24	0
3	0.7	64.56	0	0.47	37.23	0
4	0.5	64.56	0	0.29	37.23	0
5	0.4	64.56	0	0.19	37.27	0
6	0.3	64.56	0	0.16	37.24	0
7	0.6	64.56	0	0.26	37.22	0
8	0.6	64.56	0	0.32	37.24	0
9	0.8	64.56	0	0.37	37.30	0
10	1.1	64.56	0	0.54	37.39	0
11	1.5	64.57	0	0.73	37.33	0
12	0.8	64.60	0	0.39	37.22	0
13	0.6	64.65	0	0.30	37.21	0
14	0.4	64.65	0	0.16	37.21	0
15	0.2	64.63	0	0.11	37.21	0
16	0.9	64.62	0	0.42	37.21	0
17	1.0	64.56	0	0.47	37.21	0
18	0.8	64.56	0	0.35	37.21	0
Criteria	**-**	**50**	**0**	**-**	**25**	**0**

Table notes:
[1] On this day the MRF contributes0.2% to the total ground-level concentration
[2] On this day the MRF contributes 0.5% to the total ground-level concentration

Table 13 Predicted annual average ground-level particulate concentrations and dust deposition rates at sensitive receptors due to the MRF

Receptor zone	Annual average TSP(µg/m³)		Annual average PM_{10} (µg/m³)		Annual average $PM_{2.5}$ (µg/m³)		Annual average dust deposition (g/m²/month)
	MRF	**MRF + background**	**MRF**	**MRF + background**	**MRF**	**MRF + background**	**MRF**
1	0.27	35.28	0.10	17.27	0.04	7.77	0.033
2	0.20	35.22	0.08	17.25	0.04	7.76	0.024
3	0.13	35.15	0.05	17.22	0.03	7.75	0.015
4	0.11	35.12	0.05	17.22	0.02	7.75	0.012
5	0.09	35.10	0.04	17.21	0.02	7.74	0.009
6	0.05	35.06	0.02	17.20	0.01	7.74	0.005
7	0.08	35.09	0.04	17.21	0.02	7.74	0.007
8	0.13	35.14	0.06	17.23	0.03	7.75	0.011
9	0.17	35.18	0.07	17.25	0.04	7.76	0.015
10	0.25	35.26	0.11	17.28	0.05	7.78	0.023
11	0.33	35.34	0.14	17.31	0.07	7.79	0.031
12	0.21	35.22	0.09	17.26	0.04	7.77	0.021
13	0.15	35.16	0.06	17.24	0.03	7.75	0.018
14	0.09	35.11	0.04	17.21	0.02	7.74	0.012
15	0.06	35.07	0.03	17.20	0.01	7.74	0.008
16	0.13	35.15	0.05	17.22	0.02	7.74	0.023
17	0.15	35.17	0.05	17.23	0.02	7.75	0.026
18	0.08	35.09	0.03	17.20	0.02	7.74	0.012
Air quality criteria	**-**	**90**	**-**	**50**	**-**	**8**	**2 g/m²/month**

Table 14 Predicted annual average ground-level concentrations of NO2, CO and SO2 at sensitive receptors due to the MRF

Receptor zone	NO_2				SO_2								CO					
	1-hour		Annual		10-minute		1-hour		24-hour		Annual		15-minute		1-hour		8-hour	
	MRF	MRF + bkgd	MRF	MRF + bkgd	MRF	MRF + bkgd	MRF	MRF + bkgd	MRF	MRF + bkgd	MRF	MRF + bkgd	MRF	MRF + bkgd	MRF	MRF + bkgd	MRF	MRF + bkgd
1	74.7	218.2	0.26	26.1	0.06	106.5	0.04	74.4	0.006	11.4	0.0002	2.0	34.4	7,622	26.1	5,776	10.3	4,260
2	69.0	212.5	0.25	26.1	0.06	106.5	0.04	74.4	0.005	11.4	0.0001	2.0	31.8	7,619	24.1	5,774	8.5	4,258
3	40.1	183.6	0.19	26.0	0.03	106.5	0.02	74.4	0.002	11.4	0.0001	2.0	18.5	7,606	14.0	5,764	4.4	4,254
4	23.8	167.3	0.15	26.0	0.02	106.5	0.01	74.4	0.002	11.4	0.0001	2.0	11.0	7,598	8.3	5,758	2.7	4,253
5	20.3	163.8	0.14	25.9	0.02	106.5	0.01	74.4	0.001	11.4	0.0001	2.0	9.3	7,596	7.1	5,757	1.4	4,251
6	15.5	159.0	0.08	25.9	0.01	106.5	0.01	74.4	0.001	11.4	0.00005	2.0	7.1	7,594	5.4	5,755	1.1	4,251
7	22.3	165.8	0.13	25.9	0.02	106.5	0.01	74.4	0.001	11.4	0.0001	2.0	10.3	7,597	7.8	5,758	1.7	4,252
8	34.9	178.4	0.19	26.0	0.03	106.5	0.02	74.4	0.001	11.4	0.0001	2.0	16.1	7,603	12.2	5,762	2.4	4,252
9	39.6	183.1	0.25	26.1	0.03	106.5	0.02	74.4	0.002	11.4	0.0001	2.0	18.2	7,605	13.8	5,764	2.5	4,253
10	43.0	186.5	0.37	26.2	0.04	106.5	0.03	74.4	0.002	11.4	0.0002	2.0	19.8	7,607	15.0	5,765	3.9	4,254
11	49.6	193.1	0.46	26.3	0.04	106.5	0.03	74.4	0.003	11.4	0.0003	2.0	22.8	7,610	17.3	5,767	4.4	4,254
12	29.7	173.2	0.29	26.1	0.02	106.5	0.02	74.4	0.002	11.4	0.0002	2.0	13.7	7,601	10.4	5,760	2.4	4,252
13	23.0	166.5	0.20	26.0	0.02	106.5	0.01	74.4	0.001	11.4	0.0001	2.0	10.6	7,598	8.0	5,758	2.0	4,252
14	17.4	160.9	0.13	25.9	0.01	106.5	0.01	74.4	0.001	11.4	0.0001	2.0	8.0	7,595	6.1	5,756	1.2	4,251
15	10.0	153.5	0.09	25.9	0.01	106.5	0.01	74.4	0.0004	11.4	0.0001	2.0	4.6	7,592	3.5	5,753	0.8	4,251
16	26.9	170.4	0.11	25.9	0.02	106.5	0.02	74.4	0.001	11.4	0.0001	2.0	12.4	7,600	9.4	5,759	1.8	4,252
17	30.3	173.8	0.14	25.9	0.03	106.5	0.02	74.4	0.002	11.4	0.0001	2.0	13.9	7,601	10.6	5,761	2.6	4,253
18	22.4	165.9	0.09	25.9	0.02	106.5	0.01	74.4	0.001	11.4	0.0001	2.0	10.3	7,597	7.8	5,758	2.2	4,252
Air quality criteria	**-**	**246**	**-**	**62**	**-**	**712**	**-**	**570**	**-**	**228**	**-**	**60**	**-**	**100000**	**-**	**30,000**	**-**	**10,000**

Table 15 Predicted annual average ground-level concentrations of VOCs at sensitive receptors due to the MRF

Receptor Zone	1-hour concentrations (µg/m³)						
	1,3 butadiene	Benzene	Acetaldehyde	Formaldehyde	PAH	Toluene	Xylene
1	0.002	0.005	0.020	0.051	0.008	0.002	0.002
2	0.002	0.006	0.021	0.054	0.009	0.003	0.002
3	0.002	0.004	0.015	0.038	0.006	0.002	0.001
4	0.001	0.003	0.012	0.032	0.005	0.002	0.001
5	0.001	0.003	0.012	0.030	0.005	0.001	0.001
6	0.001	0.002	0.008	0.021	0.004	0.001	0.001
7	0.001	0.004	0.013	0.035	0.006	0.002	0.001
8	0.002	0.006	0.021	0.054	0.009	0.003	0.002
9	0.003	0.008	0.027	0.071	0.012	0.003	0.003
10	0.004	0.010	0.036	0.094	0.016	0.004	0.004
11	0.005	0.013	0.046	0.120	0.020	0.006	0.005
12	0.003	0.008	0.028	0.072	0.012	0.003	0.003
13	0.002	0.005	0.017	0.044	0.007	0.002	0.002
14	0.001	0.003	0.010	0.027	0.004	0.001	0.001
15	0.001	0.002	0.007	0.018	0.003	0.001	0.001
16	0.001	0.002	0.008	0.020	0.003	0.001	0.001
17	0.001	0.002	0.009	0.023	0.004	0.001	0.001
18	0.001	0.002	0.007	0.017	0.003	0.001	0.001
Air quality criteria	**40**	**29**	**42**	**20**	**0.4**	**360**	**190**

4.2.2 Odour

4.2.2.1 Emissions inventory

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 possible that small amounts of incoming waste may be odorous, depending on the source of the waste, its cleanliness and storage prior to arrival at the MRF. A conservative assessment has therefore been conducted that investigates potential odour impacts that may occur should five percent of waste from the co-mingled recyclables stream be putrescible. This is anticipated to be conservative. The plastics and cardboard incoming waste streams are not expected to be odorous.

The plant can process three different waste streams simultaneously (at 35 tph, 30 tph and 5 tph). An odour emission factor of 113.5 ou.m³/t.s has been used (TOU, 2018) with a maximum processing and handling rate of 120 tonnes per hour to determine an emission rate of 692 ou.m³/s. It should be noted that this odour emission factor was determined from measurements of a municipal solid water transfer station in Sydney and is therefore expected to be conservative.

4.2.2.2 Results

Plate 8 and Table 16 present the predicted ground-level odour concentrations across the model domain and at sensitive receptors due to the MRF. The results show that ground-level odour concentrations due to the MRF are predicted to ***comply*** with the odour criteria. The MRF is predicted to contribute at most 5% of the odour criteria to odour concentrations at any sensitive receptor in the vicinity.

Table 16 Predicted ground-level odour concentrations at sensitive receptors due to the MRF

Receptor zone	1-second average, 99^{th} percentile odour concentration due to the MRF
1	0.05
2	0.05
3	0.04
4	0.03
5	0.03
6	0.02
7	0.03
8	0.05
9	0.07
10	0.09
11	0.11
12	0.06
13	0.04
14	0.02
15	0.02
16	0.02
17	0.02
18	0.02
Odour criteria	**2.0 ou**

5. MITIGATION MEASURES

The operation of the MRF will include misting sprays on all transfer points and screens, and enclosure as well as misting sprays on all major transfer points. All processing will occur within the MRF building. The haul road will be sealed.

These mitigation measures have been accounted for in the air quality assessment. Overall, the assessment has predicted that the MRF with proposed mitigation measures would have a minimal impact on air quality in the local area and that no additional mitigation is required.

Notwithstanding this, during construction potential air quality impacts will be managed through a Construction Environmental Management Plan developed for the Proposal. Where feasible other air quality related measures (beyond those discussed above) will be incorporated into an Operational Environmental Management Plan.

6. AIR QUALITY CONCLUSIONS

This Air Quality Impact Assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) as they related to air quality and odour, including:

- A quantitative assessment of the potential air quality, dust and odour impacts of the development
- Details of buildings and air handling systems
- Details of proposed mitigation, management and monitoring measures.

The assessment has shown:

- 1-hour and annual average ground-level concentrations of NO_2 due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- 15-minute, 1-hour and 8-hour average ground-level concentrations of CO due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- 1-hour, 24-hour and annual average ground-level concentrations of SO_2 due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- 1-hour average ground-level concentrations of individual VOCs due to the MRF are predicted to ***comply*** with the relevant air quality assessment criteria.
- For 24-hour average ground-level concentrations of PM_{10}, the MRF is not predicted to result in any additional exceedance days compared to existing ambient background levels.
- For 24-hour average ground-level concentrations of $PM_{2.5}$, the MRF is not predicted to result any additional exceedance days compared to existing ambient background levels.
- Annual average ground-level concentrations of TSP, PM_{10} and $PM_{2.5}$ due to the MRF and ambient background levels are predicted to ***comply*** with the relevant air quality assessment criteria.
- Dust deposition rates due to the MRF are predicted to ***comply*** with the air quality assessment criterion of 2 g/m^2/month.

Overall, the operational stage of the MRF is predicted to have a minimal impact on air quality in the local area.

7. REFERENCES

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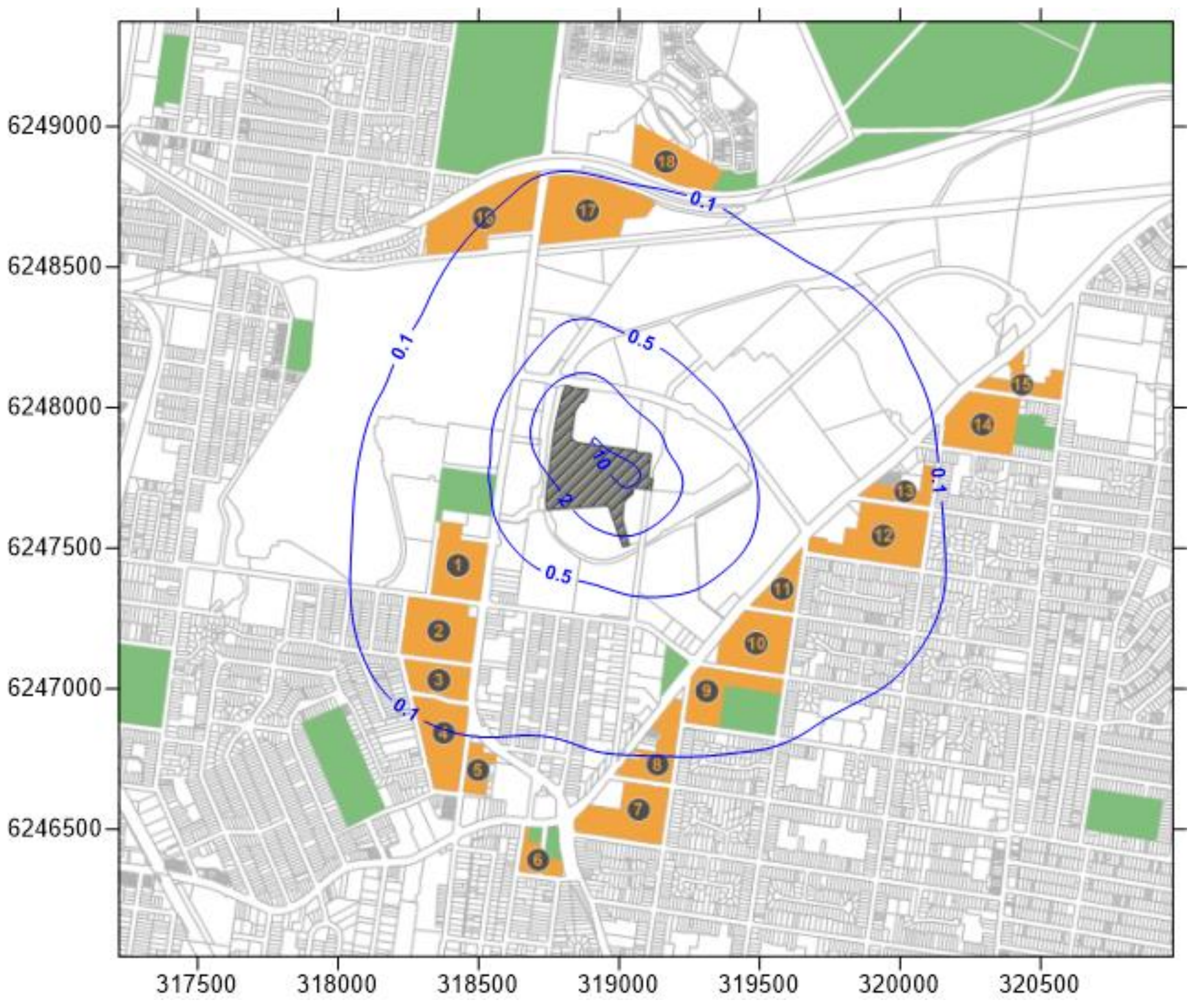


Plate 1	Annual average TSP predicted due to operation of the MRF in isolation		
Location: Chullora, NSW	**Averaging period:** Annual	**Data source:** Calpuff	**Units:** µg/m³
Type: Annual average	**Objective:** 90 µg/m³	**Prepared by:** Padraig McDowell	**Date:** April 2020

Plate 2	Maximum 24-hour average PM_{10} predicted due to operation of the MRF in isolation		
Location: Chullora, NSW	**Averaging period:** 24-hour	**Data source:** Calpuff	**Units:** µg/m³
Type: Maximum	**Objective:** 50 µg/m³	**Prepared by:** Padraig McDowell	**Date:** April 2020

Plate 3	**Annual average PM_{10} predicted due to operation of the MRF in isolation**

Location: Chullora, NSW	**Averaging period:** Annual	**Data source:** Calpuff	**Units:** $\mu g/m^3$
Type: Annual Average	**Objective:** 25 $\mu g/m^3$	**Prepared by:** Padraig McDowell	**Date:** April 2020

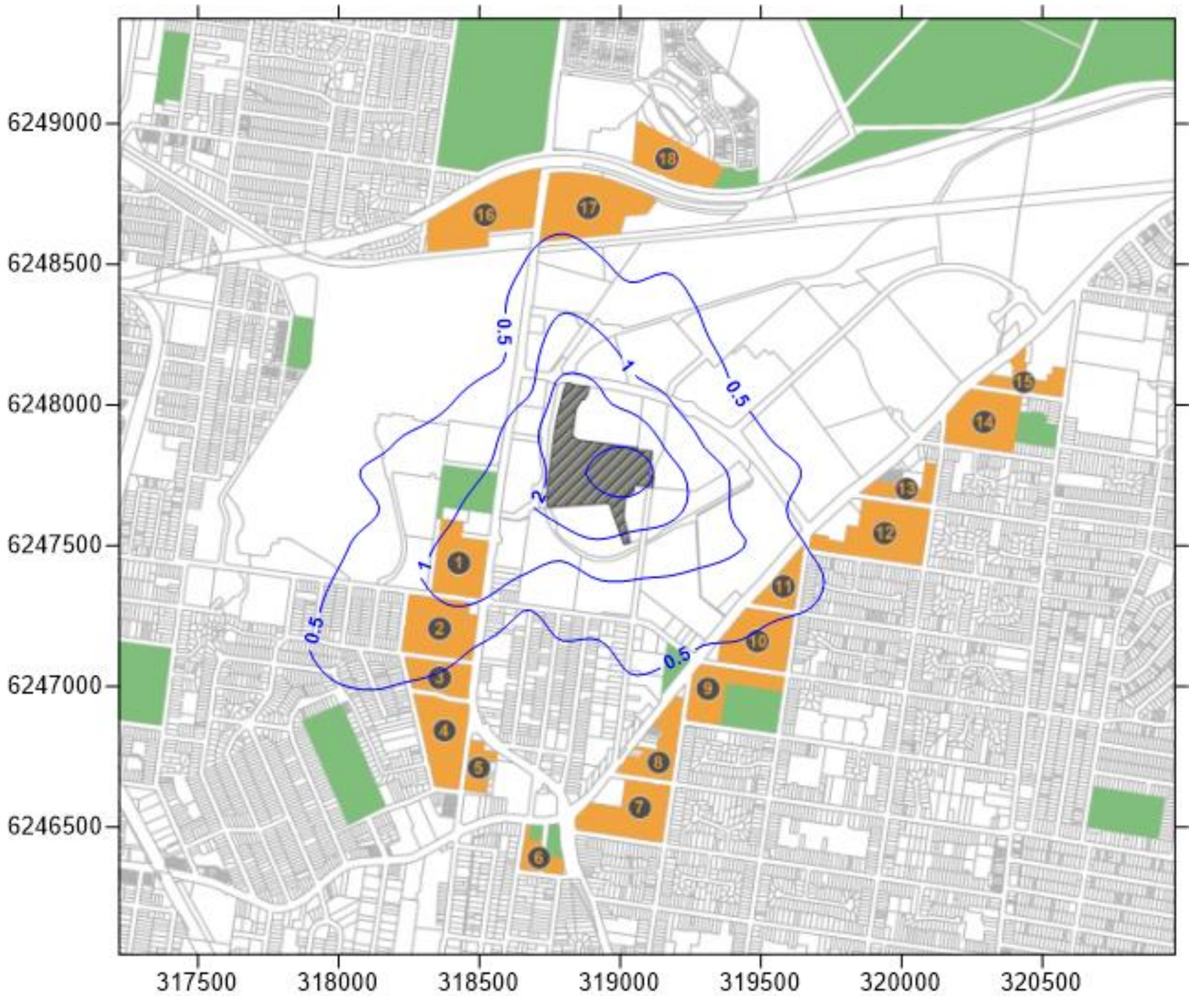


Plate 4	Maximum 24-hour average $PM_{2.5}$ predicted due to operation of the MRF in isolation

Location: Chullora, NSW	**Averaging period:** 24-hour	**Data source:** Calpuff	**Units:** µg/m^3
Type: Maximum	**Objective:** 25 µg/m^3	**Prepared by:** Padraig McDowell	**Date:** April 2020

Plate 5	Annual average $PM_{2.5}$ predicted due to operation of the MRF in isolation

Location: Chullora, NSW	**Averaging period:** Annual	**Data source:** Calpuff	**Units:** µg/m^3
Type: Annual Average	**Objective:** 8 µg/m^3	**Prepared by:** Padraig McDowell	**Date:** April 2020

Plate 6	**Dust deposition rate predicted due to operation of the MRF in isolation**		
Location: Chullora, NSW	**Averaging period:** Annual	**Data source:** Calpuff	**Units:** $g/m^2/month$
Type: Annual Average	**Objective:** 2 $g/m^2/month$	**Prepared by:** Padraig McDowell	**Date:** April 2020

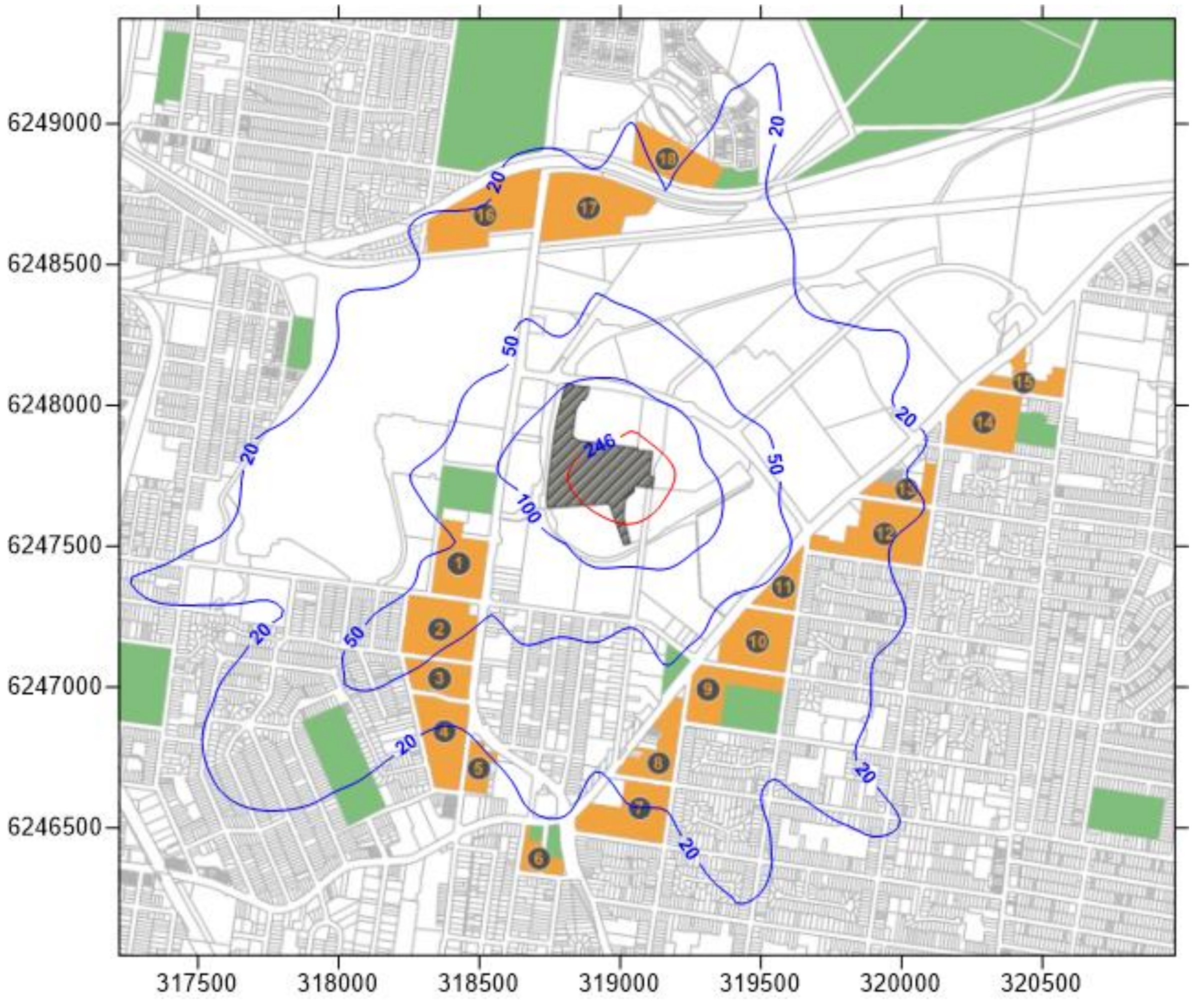


Plate 7 **Maximum 1-hour average ground-level concentration of NO_2 predicted due to operation of the MRF in isolation (assumes 100% NOx to NO_2)**

Location: Chullora, NSW	**Averaging period:** 1-hour	**Data source:** Calpuff	**Units:** µg/m³
Type: Maximum	**Objective:** 246 µg/m³	**Prepared by:** Padraig McDowell	**Date:** April 2020

Plate 8	**99th percentile nose response time average odour concentration predicted due to operation of the MRF**		
Location: Chullora, NSW	**Averaging period:** 1-s nose response time	**Data source:** Calpuff	**Units:** ou
Type: 99th percentile	**Objective:** 2 ou	**Prepared by:** Padraig McDowell	**Date:** April 2020

APPENDIX A METEOROLOGICAL AND DISPERSION MODELLING METHODOLOGY

A1 METEOROLOGY

A1.1 TAPM meteorology

The meteorological model, TAPM (The Air Pollution Model) Version 4.0.5, was developed by the CSIRO and has been validated by the CSIRO, Katestone and others for many locations in Australia, in southeast Asia and in North America (see www.cmar.csiro.au/research/tapm for more details on the model and validation results from the CSIRO). Katestone has used the TAPM model throughout Australia and has performed well for simulating regional winds patterns. TAPM has proven to be a useful model for simulating meteorology in locations where monitoring data is unavailable.

TAPM was configured as follows:

- 50 x 50 grid point domain with an outer grid of 20 km and nesting grids of 6 km, 3 km and 1 km
- 365 days modelled (from 1 January 2015 to 31 December 2015)
- Grid centred at latitude -33°58' and longitude 151°10.5'
- Geoscience Australia 9-second digital elevation model terrain data
- Land-use refined based on comparison with aerial imagery, and all urban land-use reclassified as urban low
- 25 vertical grid levels
- Wind speed and wind direction data from the BoM Sydney Airport and BoM Bankstown Airport monitoring station were assimilated with a radius of influence of 15km and 6km respectively over two vertical levels with a quality factor of 0.9.

A1.2 CALMET meteorological modelling

CALMET is an advanced non-steady-state diagnostic 3D meteorological model with micro-meteorological modules for overwater and overland boundary layers. The model is the meteorological pre-processor for the CALPUFF modelling system. CALMET is capable of reading hourly meteorological data as data assimilation from multiple sites within the modelling domain; it can also be initialised with the gridded three-dimensional prognostic output from other meteorological models such as TAPM. This can improve dispersion model output, particularly over complex terrain as the near surface meteorological conditions are calculated for each grid point.

CALMET (version 6.334) was used to simulate meteorological conditions in the region. The CALMET simulation was initialised with the gridded TAPM 3D wind field data from the 3km grid. CALMET treats the prognostic model output as the initial guess field for the CALMET diagnostic model wind fields. The initial guess field is then adjusted for the kinematic effects of terrain, slope flows, blocking effects and 3D divergence minimisation.

CALMET was set up with twelve vertical levels with heights at 20, 60, 100, 150, 200, 250, 350, 500, 800, 1600, 2600, 4600 metres at each grid point.

Key features of CALMET used to generate the wind fields are as follows:

- Domain of 75 x 75 at 250 m spacing

- Gridded cloud data computed from prognostic relative humidity
- Prognostic wind fields, generated by TAPM, as an initial guess field
- No additional data assimilation.

CALMET has been run in No-Observations mode in accordance with *Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into The Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia* (TRC, 2011).

Critical parameters are detailed in the table below.

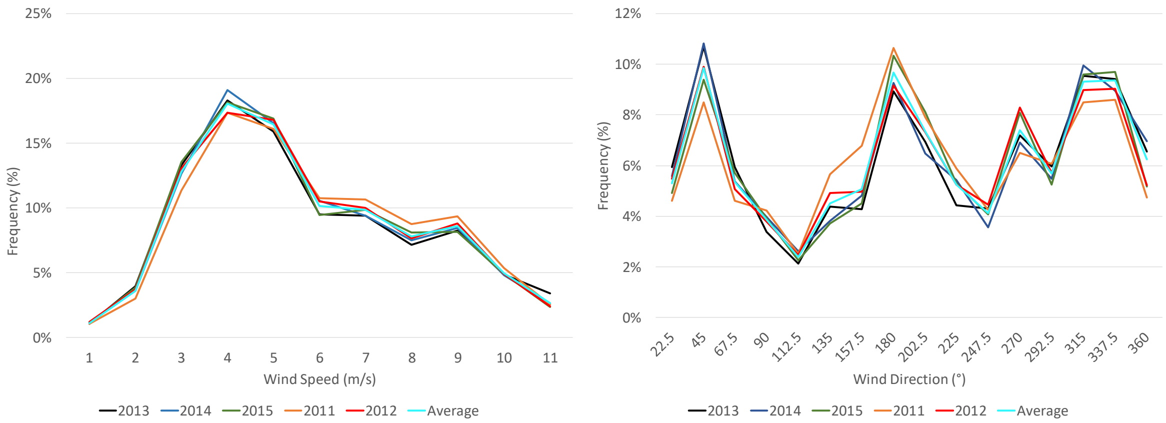
Table A1 Critical parameters for CALMET

User specified parameters	Value
TERRAD	2 km
IPROG	14
MCLOUD	4
NOOBS	2

A1.3 Selection of representative year

Meteorological data measured between 2011 and 2015 at the BoM's monitoring station at Sydney Airport were analysed to determine a representative year. Figure A1 presents probability distribution functions of wind speed, wind direction and temperature for each of the five years from 2011 and 2015, and the five-year period.

The calendar year 2011 was not selected as the probability distributions show a shift towards higher wind speeds and lower temperatures compared to other years, and the wind direction distribution is not similar to the average for the five-year period. The other four years are reasonably similar and therefore 2015 was selected as the most recent of these years.



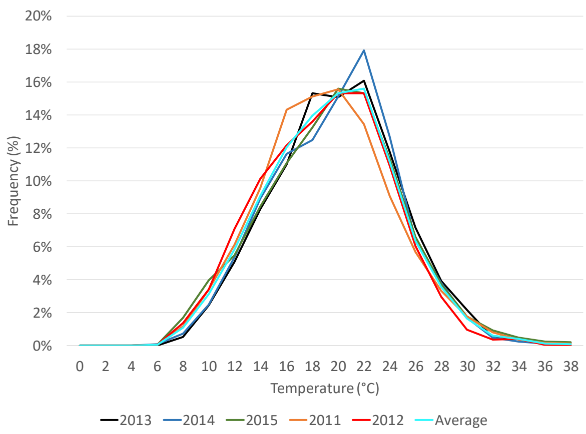


Figure A1 Probability distribution functions for 2011 – 2015 from BoM's Sydney Airport station

Comparison of TAPM output with observational data

The model validation in the following sections compares observational meteorological data with data derived from running TAPM.

Table A1 presents statistical comparisons of TAPM output (wind speed and temperature) to meteorological data recorded at the automatic weather station located at the exploration camp for the CCMP. Figure A1 and Figure A2 show probability density functions that compare statistical distributions of meteorological parameters between the TAPM output (without, and then with data assimilation) and observational data. The TAPM output was extracted from the closest inner grid point to the location of the BoM Sydney Airport monitoring station, from the second vertical level.

The following statistical measures of model accuracy are presented in the tables.

The mean bias, which is the mean model prediction minus the mean observed value. Values of the mean bias close to zero show good prediction accuracy.

The root mean square error (RMSE), which is the standard deviation of the differences between predicted values and observed values. The RMSE is non-negative and values of the RMSE close to zero show good prediction accuracy. The RMSE is given by

$$\mathrm{RMSE} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(P_i - O_i)^2}$$

where N is the number of observations, P_i are the hourly model predictions and O_i are the hourly observations

The index of agreement (IOA), which takes a value between 0 and 1, with 1 indicating perfect agreement between predictions and observations. The IOA is calculated following a method described in Willmott (1982), using the equation

$$\mathrm{IOA} = 1 - \frac{\sum_{i=1}^{N}(P_i - O_i)^2}{\sum_{i=1}^{N}(|P_i - O_{mean}| + |O_i - O_{mean}|)^2}$$

where N is the number of observations, P_i are the hourly model predictions, O_i are the hourly observations and O_{mean} is the observed observation mean.

Whilst the bias and RMSE values are slightly outside the benchmark ranges, the IOA for wind speed and temperature are both greater than the minimum benchmark value, and the probability distribution functions illustrate that assimilating data into TAPM has improved the distribution of wind speeds and wind directions.

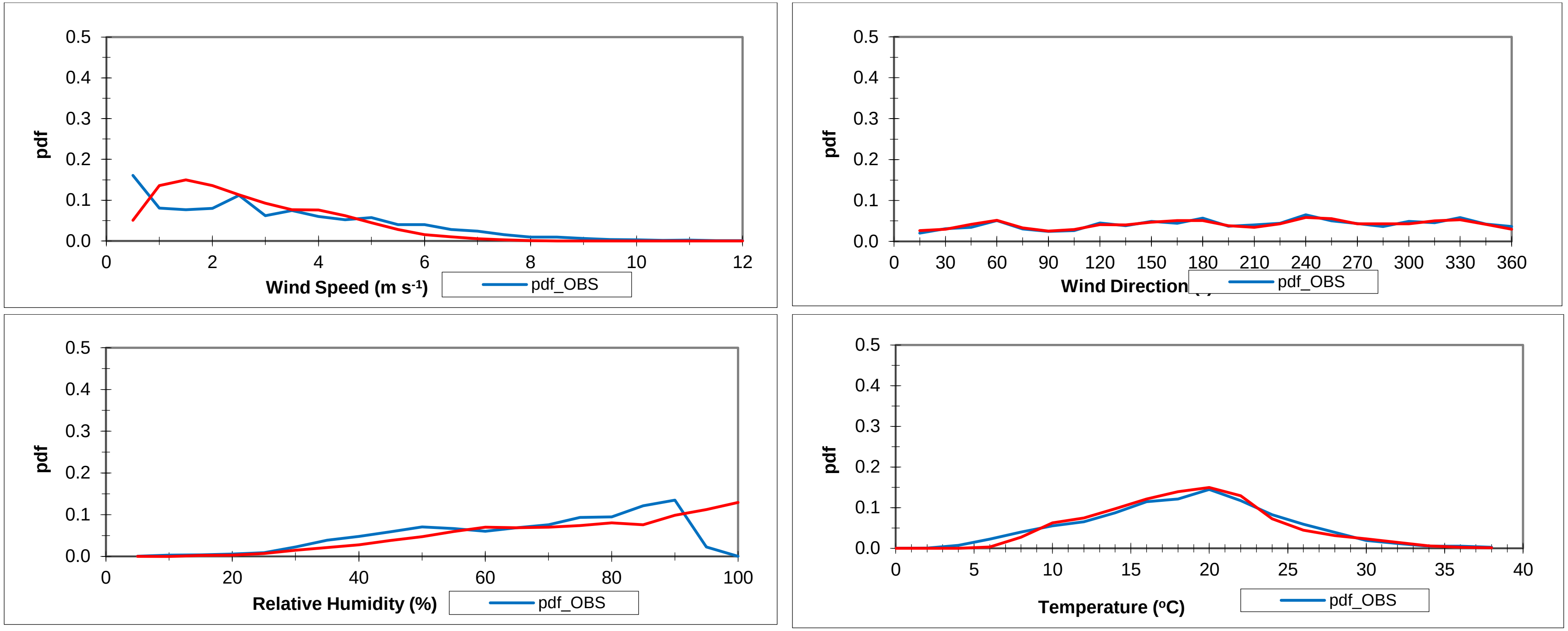


Figure A2 **Probability distribution functions comparing data from the Bankstown Airport BoM monitoring station and TAPM predictions at the same location (with data assimilation)**

Table A2 A comparison of the observed meteorological data with the second level TAPM with data assimilation output

Statistic	"Good" value	Wind speed			Temperature		
		Benchmark	Observational data	TAPM	Benchmark	Observational data	TAPM
Mean	-	-	2.9	2.5	-	17.6	17.7
Standard deviation	-	-	2.3	1.5	-	6.2	5.6
Minimum	-	-	0.0	0.0	-	1.4	4.3
Maximum	-	-	11.8	8.0	-	40.5	39.9
Bias	0	<±0.5 m/s	***0.4***		<±0.5 °C	0.1	
Root mean square error (RMSE)	Close to 0	<2 m/s	1.06		-	2.19	
Index of agreement	Close to 1	>0.6	0.92		≥0.8	0.96	

A2 CALPUFF DISPERSION MODELLING

CALPUFF simulates the dispersion of air pollutants to predict ground-level concentration and deposition rates across a network of receptors spaced at regular intervals, and at identified discrete locations. CALPUFF is a non-steady-state Lagrangian Gaussian puff model containing parameterisations for complex terrain effects, overwater transport, coastal interaction effects, building downwash, wet and dry removal, and simple chemical transformation. CALPUFF employs the 3D meteorological fields generated from the CALMET model by simulating the effects of time and space varying meteorological conditions on pollutant transport, transformation and removal. CALPUFF takes into account the geophysical features of the study area that affects dispersion of pollutants and ground-level concentrations of those pollutants in identified regions of interest. CALPUFF contains algorithms that can resolve near-source effects such as building downwash, transitional plume rise, partial plume penetration, sub-grid scale terrain interactions, as well as the long-range effects of removal, transformation, vertical wind shear, overwater transport and coastal interactions. Emission sources can be characterised as arbitrarily varying point, area, volume and lines or any combination of those sources within the modelling domain.

CALPUFF was configured in accordance with *Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into The Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia* (TRC, 2011). Key features of CALPUFF used to simulate dispersion:

- Computational domain area of 40 by 40 grids at 0.25 km spacing, with a nesting factor of 2
- 365 days modelled (1 January 2015 to 31 December 2015)
- Gridded 3D hourly-varying meteorological conditions generated by CALMET
- Partial plume path adjustment for terrain modelled
- Dispersion coefficients calculated internally from sigma v and sigma w using micrometeorological variables

Source configuration for area and volume sources are provided in Table A3 and Table A4.

Table A3 Volume source configuration for emissions from MRF building

Source	LABEL CALPUFF	X(m)	Y(m)	Z(m)	Eff Ht	Sy	Sz
Product Storage area	PRODUCT_1	319030	6247816	40.5	6	2.1	5.6
	PRODUCT_2	319028	6247803	40.5	6	2.1	5.6
	PRODUCT_3	318954	6247826	39.9	6	2.1	5.6
	PRODUCT_4	318952	6247813	39.8	6	2.1	5.6
Material recovery facility and processing area	PROCESS_1	318947	6247776	39.8	6	2.1	5.6
	PROCESS_2	319024	6247771	40.6	6	2.1	5.6
	PROCESS_3	319022	6247755	40.7	6	2.1	5.6
	PROCESS_4	318945	6247760	39.7	6	2.1	5.6
Receival area	RECEIVE_1	318957	6247704	40.8	6	5	5.6

Table A4 Area source configuration for emissions from onsite haul

Source	Number of area sources	Eff Ht	Sz
Haul	28	4	1

APPENDIX B EMISSIONS ESTIMATION

B1 EMISSION ESTIMATION METHODOLOGIES

B1.1 Paved roads

The emission factors for haulage over the sealed roads onsite during construction and operation were calculated from the AP42 document, chapter 13.2.1 titled “paved roads” dated January 2011.

$$EF_{TSP} = k\ x\ (sL)^{0.91}\ x\ (W)^{1.02}$$

Where:

EF_i	=	Emission factor for substance i	(kg/tonne)
k	=	3.23 for TSP	
k	=	0.62 for PM_{10}	
sL	=	Silt loading of roads at the WICET Facility	g/m²
M	=	Weighted average weight of vehicles using the onsite haul roads	%

B1.2 Material handling and processing

Dust emissions due to material handling during construction and operation, and for each stage of the processing operations (including screening, baling, and all types of separators and sorting stages) have been calculated using the emission factors from the AP42 document (US EPA, 2006) for material handling. This uses the following equation:

$$EF = k \times 0.0016 \times \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

where:

EF	emission factor (kg/Mg)
k	particle size multiplier (dimensionless)
U	mean wind speed (m/s)
M	material moisture content (%)

The particle size multiplier in the equation *k*, varies with aerodynamic particle size range, as follows:

k = 0.74	Particle size < 30 µm
k = 0.35	Particle size < 10 µm
k = 0.053	Particle size < 2.5 µm

B2 ACTIVITY DATA

Table B1 presents the activity data used to calculate emissions during operation of the MRF.

Table B1 Activity data used to calculate dust emissions during operations

Parameter	Value	Units	Source
Operating hours			
Processing hours	24	Hours/day	Arcadis
Processing days	7	Days/week	Arcadis
Throughputs			
Average daily delivery	662	t/day	Arcadis
Co-mingled recyclables (C&I sources)	115,000	tpa	Arcadis
Separated paper and cardboard for baling	50,000	tpa	Arcadis
Mixed plastics for secondary processing	7,000	tpa	Arcadis
Maximum Daily Delivery	130%	% of daily average	Arcadis
Average incoming waste density	180	kg/m^3	Arcadis
Daily throughputs used in emission calculations:			
Total	860	t/day	Arcadis
Co-mingled recyclables (C&I sources)	575	t/day	Calculated
Separated paper and cardboard	250	t/day	Calculated
Mixed plastics	35	t/day	Calculated
Incoming vehicle movements per day – peak scenario			
Co-mingled recyclables - walking floor trailers	25.0	#/day	Arcadis
Co-mingled recyclables - MRVs	52	#/day	Arcadis
Cardboard – walking floor trailer	20.0	#/day	Arcadis
Plastics – curtain-sider	4.0	#/day	Arcadis
Haul distance on site – round trip	1.13	km	Measured from site layout
Vehicle weights			
Empty weight – MRV	5	tonnes	Assumed
Empty weight – walking floor trailer	10	tonnes	Assumed
Empty weight – curtain-sider	10	tonnes	Assumed
Average weight – co-mingled recyclables	12.0	tons	Calculated
Average weight – walking floor trailers and curtain-siders	19.2	tons	Calculated
Product haulage			
Payload – B-double	55	tonnes	Arcadis
Payload – HRV	22.5	tonnes	Arcadis
Payload – truck and dog	42	tonnes	Arcadis
Empty weight – B-double	40	tonnes	Assumed
Empty weight – HRV	15	tonnes	Assumed
Empty weight – truck and dog	30	tonnes	Assumed
Product truck movements per day			
Triple axle vehicles (HRV)	23	#/day	Arcadis
Truck and dog	8	#/day	Arcadis
Haul distance on site – round trip	1.13	km	Measured from site layout
Material characteristics and meteorological data			
Silt loading – sealed roads	2	g/m^2	Assumed
Average wind speed	3.31	m/s	CALMET
Incoming waste – moisture content	11	%	Assumed