Willow Tree Waste Management Facility Expansion

Air Quality Impact Assessment

Liverpool Plains Shire Council

01 December 2022

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Glossary

Term	Meaning
AQIA	Air quality impact assessment
AQMS	Air quality monitoring station
AWS	Automatic weather station
BoM	Bureau of Meteorology
Cumulative impact	The impact due to an emission source (or group of sources), emissions from a nearby source (or group of sources) and existing ambient levels of a pollutant
ha	Hectare
Incremental impact	The impact due to an emission source (or group of sources) in isolation, i.e. without including background levels
LGA	Local government area
OER	Odour emission rate
OU	Odour unit
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than or equal to 2.5 microns
PM_{10}	Particulate matter with an aerodynamic diameter of less than or equal to 10 microns
SOER	Specific odour emission rate
TSP	Total suspended particulate
WMF	Waste management facility

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1. Introduction

Liverpool Plains Shire Council (LPSC) are proposing to expand the Willow Tree Waste Management Facility (WMF) (the project) at Lot 213 DP 1173230, Merriwa Road, Willow Tree (the site) within the Liverpool Plains Local Government Area (LGA).

The project is designated development and requires development consent from Coffs Harbour City Council (Council) under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

As the project would dispose of more than 200 tonnes per year of other waste material it is classified as "Waste management facilities or works" and is classified as 'designated development' in accordance with the requirements of Schedule 3 of the Environmental Planning & Assessment Regulation 2000 (EP&A Regulation).

Waste management facilities or works which are classified as designated development under the EP&A Regulation are also classified as regionally significant development under *State Environmental Planning Policy (State and Regional Development) 2011* (State and Regional Development SEPP).

GHD has been engaged by LPSC to prepare an Air Quality Impact Assessment (AQIA) to support the Willow Tree WMF expansion.

1.1 Purpose of this report

An AQIA has been undertaken to assess the potential impact of dust and odour emissions on the identified nearby sensitive receptors during both construction and operation of the Willow Tree WMF expansion project.

The purpose of this report is to document the results of the AQIA which includes:

– Responding to the SEARs
– Description of potential sources of air emissions during construction and operation
– Assessment of potential air impacts during construction and operation
– Provide mitigation and management measures to reduce any potential impacts

1.2 Scope and limitations

The AQIA scope included:

– Review of site details including terrain, vegetation, land use and receptor locations
– Review of available ambient air quality in the region
– Summarise the meteorological environment and modelling for use in dispersion modelling
– Preparation of an emissions inventory for operation of the project using representative sampling data obtained from similar facilities
– Undertake dispersion modelling using an EPA approved model (CALPUFF)
– Undertake a risk based construction air quality assessment
– Preparation of a standalone air quality impact assessment

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The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Section(s) 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

1.3 Assumptions

The following assumptions were relied upon in preparation of the AQIA:

– Sensitive receptors were identified using aerial photography and land use planning and may not include all existing or future receptors in the project area but are considered representative of receptors. The predicted modelling results were presented as a dispersion contour (in addition to receptor results) so that the results can be interpolated at any location.
– Ambient air quality and meteorological data is considered representative however may vary year to year and be influenced by external factors including climate trends and bushfires.
– Odour emission rates from a similar landfill facility (including similar waste types) were assumed to be representative of odour emission rates for the project. Emission rates for the project may vary depending on waste type and activities undertaken onsite.

2. Project description

2.1 Overview

This section provides a brief description of the project, including the infrastructure required, indicative construction activities, and the proposed operation arrangements.

The key characteristics that make up the project (construction and operation) would continue to be refined and expanded upon following submission of this application. The Environmental Impact Statement (EIS) provides further developed and updated information.

Additional details of the project are contained within the Willow Tree Waste Management Facility Landfill Expansion Masterplan (GHD, 2021).

2.2 Project need

In 2018, LPSC developed a 10-year strategy for the ongoing management of waste within their region (MRA Consulting Group, 2018). The strategy proposes to rationalise the landfilling operations across the region by establishing the Willow Tree WMF as the primary landfill, servicing the Liverpool Plains LGA, via an expansion of this existing landfill site.

2.3 Key features of the project

The project would involve the expansion of the Willow Tree WMF. The project is at concept stage and details of the types and volumes of waste are currently unknown. The proposed expansion of the landfill as detailed in the Masterplan (GHD, 2021) suggests an initial throughput of 4,000 t/yr increasing up to 9,000 t/yr of landfill, based on waste projections contained in Council's Waste Management Strategy (MRA Consulting Group, 2018). It is likely that the facility would operate for 32 years with a capacity of approximately 256,800 m^3 (or approximately 210,000 tonnes).

The expanded WMF would receive a range of wastes including:

– Landfill waste from LPSC 'red bin' garbage collection
– 'Clean fill' (such as soil, sand, gravel, bricks or other excavated or hard material)
– Solid or liquid organic materials

The project would involve:

– Site establishment, including preparation of construction compound, suitable stockpile and bunding areas, and sediment and erosion controls
– Site preparation and vegetation clearing
– Construction of the WMF expansion
– Operation of the expanded WMF to service the Liverpool Plains LGA

The construction footprint covers an area of approximately 3 hectares. Concept plans are contained in Appendix A of the Willow Tree Waste Management Facility Landfill Expansion Masterplan (GHD, 2021).

2.4 Construction of the project

Construction of the project would involve the following activities:

– Site establishment, including preparation of construction compound, suitable stockpile and bunding areas, and sediment and erosion controls
– Vegetation clearing

– Subgrade preparation, including:
  - Remove existing stockpiles
  - Regrade surface to establish suitable levels and grades
  - Decommission one existing pond
– Augment existing pond for use as sediment pond
– Augment existing pond for use as leachate pond
– Construction of landfill cell 1
– Seal site access road from Merriwa Road
– Construct supporting infrastructure consisting of weighbridge, site office, amenities, resource recovery area and small vehicles transfer station
– Decommission construction compound and rehabilitate site

The concept plans for the WMF expansion show the construction of 2 landfill cells. The construction of landfill cells would be staged, with the initial landfill cell located in the former quarry area and initially offset from the existing landfilled waste areas. This cell would provide 10 years of landfilling for the site, based on landfilled waste projections in Council's Waste Management Strategy (MRA Consulting Group, 2018). The cell would be constructed with 2 stages of lining works and would be filled in 2 stages, each providing 5 years of landfilling.

Existing waste would either be moved to a lined cell, or a piggyback liner would be installed over the cell.

Construction is proposed to commence mid-2022 and would take approximately 4 months to complete.

Construction would generally be during the following times:

– Monday to Friday 7:00 am to 6:00 pm
– Saturday 8:00 am to 1:00 pm

Where works are proposed outside of the standard construction hours, this would be documented in the EIS, along with justification for any proposed activities and proposed mitigation measures.

2.4.1 Cell excavation and stockpiling

For the western undeveloped area, based on the geotechnical conditions, excavation may be significantly hampered by the subsurface rock materials. In addition, LPSC has been in contact with the operator of the privately run gravel quarry adjacent to the site and confirmed that arrangements could be made to source cover and capping material from the quarry (using their quarry overburden or similar materials). As such, the cell excavation will be shallow and designed to primarily establish a suitable grading along the landfill base for construction and operation, limiting excavation to a minimum.

For the northern former quarry area, the previous quarrying that has already been undertaken will limit any additional excavation. As such, only very limited excavation will be undertaken where possible to establish a suitable grading along the landfill base for construction and operation.

It is anticipated that the excavated materials will be segregated during cell construction for future reuse, including topsoil for capping, soil materials for cover and capping, and rock material for processing and reuse in access road construction. Given the limited excavation quantities expected, the excavated material will be progressively stockpiled in unused landfill areas, interim covered areas and/or capped areas as the landfilling progresses. It is assumed the same stockpiling process can be used for the cover material sourced from the quarry and that it will be progressively provided to suit landfilling operations.

2.4.2 Facilities

Table 2.1 summarises the landfill facilities that have been allowed for as part of the masterplan alongside the new landfill cells and supporting infrastructure. These facilities are primarily to support the operational staff and domestic customers at the site. The area allocated for these facilities will be based on previous experience with similar sized landfill sites and will be refined as part of the subsequent phases of the project, if deemed feasible.

Table 2.1 Landfill facilities basis summary

Facility	Summary of basis
Weighbridge	Located at site entrance, dual weighbridge preferred.
Site office and amenities	Located near site entrance including parking for 3-5 staff.
Resource recovery area	General area for resource recovery, may include a community recycling centre, and drop-off locations for domestic customers for tyres, concrete, steel, green waste, bulky wastes, etc.
Small vehicles transfer station	Area for waste disposal by domestic customers, for transfer by the site operator or collections contractor to the landfill cells.

2.5 Operation of the project

2.5.1 Leachate management

The concept plan shows that an existing pond at the site would be repurposed as a leachate pond. Based on the climatic data, leachate disposal via evaporation from this pond is feasible and would be implemented. The need for emergency leachate disposal measures (such as irrigation and off-site tankering during or immediately after high rainfall events) would be assessed as part of the subsequent phases of the project, if deemed feasible.

The leachate pond was sized based on high level staging of the landfill operations with consideration to the default rainfall infiltration percentages provided in NSW EPA's Environmental Guidelines: Solid Waste Landfills (2016). The final pond size would be refined as part of the subsequent phases of the project, if deemed feasible.

2.5.2 Landfill gas management

Landfill gas management would be addressed during operation of the cell and not specifically as part of the concept design of the cell which is industry practice.

2.5.3 Resources and waste

Electricity would be required to power the site office and amenities.

Water would be required for the amenities block.

The site is not currently connected to electricity and mains water. These services would be connected to the site.

The site is not currently connected to sewer. This service would be connected to the site.

2.5.4 Access

As the project is at concept stage, no plan is available of the vehicle access, parking and circulation areas.

Access arrangements would comprise the following:

– Access from the Merriwa Road via formalisation of the existing access track running through the site for both domestic and commercial vehicles.
– Combined access to the weighbridge for domestic and commercial vehicles, followed by delineation of these vehicles to separate routes.
– Access road for domestic vehicles to the resource recovery areas (to promote resource recovery in the first instance), followed by access to the small vehicles transfer station for residual waste disposal, and then access to the site exit route.
– Access road for commercial vehicles directly to the landfill cells, and then access to the site exit route. Safety measures to be implemented where commercial vehicles re-join and share domestic vehicle routes. Additional access for commercial vehicles to the small vehicles transfer station for waste transfer to the landfill cells.

2.5.5 Personnel

– Up to 5 staff would be employed at the site at any given time.

2.5.6 Hours of operation

The project would operate 7 days per week between the hours of 7:00 am to 5:00 pm.

3. Legislative and policy context

3.1 Secretary's environmental assessment requirements

The SEARs relevant to air quality, together with reference to where they are addressed in this report, are outlined in Table 3.1.

https://projectsportal.ghd.com/sites/pp01_04/colascoffsharbourasp/ProjectDocs/EIS Appendices/12546524-Appendix_SEARs and summary of agency requirements.docx

Table 3.1 Air quality SEARs

Requirements	Where addressed in this report
Air quality and odour, including	
A quantitative assessment of the potential air quality, dust and odour impacts of the development, during both construction and operation, in accordance with relevant Environment Protection Authority guidelines	Sections 5 and 6
A description and appraisal of air quality and odour impact mitigation and monitoring measures, in line with International Best Practice.	Section 7

3.2 Legislative and policy context to the AQIA

The relevant legislation and government guidance for the air quality assessment of the project are:

– NSW *Protection of the Environment Operations Act 1997* (POEO Act)
– NSW Protection of the Environment Operations (Clean Air) Regulation 2021 (POEO Clean Air Regulation) (NSW Government, 2021)
– National Environment Protection Council (NEPC) National Environment Protection (Ambient Air Quality) Measure 2021 (the Air NEPM) (National Environmental Protection Council, 2021)
– NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (2017) (the 'Approved Methods') (NSW EPA, 2017)
– NSW EPA Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales (2022) (the 'Approved Methods (Sampling)') (NSW EPA, 2022)
– Technical Framework – Assessment and management of odour from stationary sources in NSW (2006) (the 'Technical Framework') (NSW Department of Environment and Conservation, 2006)

The POEO Act provides the statutory framework for managing pollution in NSW, including the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. The POEO Act requires that no occupier of any premises causes air pollution (including odour) through a failure to maintain or operate equipment or deal with materials in a proper and efficient manner. The operator must also take all practicable means to minimise and prevent air pollution (sections 124, 125, 126 and 128 of the POEO Act). The POEO Act includes the concept of 'offensive odour' (section 129) and states it is an offence for scheduled activities to emit 'offensive odour'.

The POEO Clean Air Regulation provides regulatory measures to control emissions from motor vehicles, fuels, and industry.

The National Environment Protection Council of Environmental Ministers, now the National Environment Protection Council (NEPC), updated the Air NEPM in May 2022. The Air NEPM sets uniform national standards for ambient air quality and outlines the framework for state and territory jurisdictions to monitor and report against these standards.

The Approved Methods lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. It considers the above-mentioned legislation and guidance to provide pollutant assessment criteria.

The Approved Methods (Sampling) lists the methods to be used for the sampling and analysis of air pollutants in NSW for statutory purposes. All sampling is required to be conducted in accordance with requirements outlined in the standards outlined in this document. This includes sampling type, duration, location and a number of other requirements.

The Technical Framework provides guidance on assessing and managing activities that emit odour. It is guided by the key provisions of the POEO Act, namely the requirement for no 'offensive odour' to be emitted from EPA-licensed activities but is not a regulatory tool and does not introduce any new environmental requirements. The framework promotes ongoing environment and best management practices to prevent or minimise odours.

3.3 Assessment criteria

3.3.1 Dust assessment criteria

Dust assessment criteria for the project was taken from the Approved Methods. The objective of the criteria is ambient air quality that minimises the risk of adverse health impacts from exposure to air pollution. There is an obligation during construction and operation of the project to comply with the criteria.

Relevant assessment criteria for the primary pollutants associated with construction and operation of the project are presented in Table 3.2. The criteria apply to the total impact (increment plus background) and must be reported as the 100th percentile (maximum).

Table 3.2 Dust assessment criteria

Pollutant	Averaging period	Concentration (µg/m^3)
PM_{10}	24 hours	50
	Annual	25
$PM_{2.5}$	24 hours	25
	Annual	8
Total suspended particulates (TSP)	Annual	90

3.3.2 Odour assessment criteria

For a Level 3 odour assessment, the Technical Framework outlines recommended assessment objective based on the type of facility being assessed (new, existing, upgrading/expanding). For existing facilities, the benchmark for the facility is whether the emission of odour is:

– 'offensive' (for scheduled activities), or
– Being prevented or minimised using best management practices (for scheduled and non-scheduled activities).

Comparison of the sites predicted odour performance against the impact assessment criteria outlined in the Technical Framework is a valuable tool in understanding the potential for off-site odour impacts, assessing the expected level of risk of odour impacts occurring as well as providing a baseline for future plant modifications or future developments surrounding the source of odour.

The odour criteria range from 2 odour units (OU) for densely populated areas up to 7 OU for single isolated residences and can be seen in Table 3.3.

Table 3.3 Odour assessment criteria

Population of affected community	Odour performance criteria (OU) (nose response odour certainty units at 99th percentile[1])
Single Residence (≤ ~2)	7
~ 10	6
~ 30	5
~ 125	4
~ 500	3
Urban (≥~2,000)	2

Note 1: This is a prediction of the odour level that may occur 1% of the time, or one hour in one hundred. Odour performance criteria are designed to be precautionary, so that impacts on sensitive receivers can be minimised

4. Environmental setting

4.1 Project location

The site is Lot 213 DP 1173230, Merriwa Road, Willow Tree, NSW within the Liverpool Plains LGA. The site is 2 kilometres south-west of the town of Willow Tree when measured by direct line, or 3.2 km by road. A regional map is shown in Figure 4.1.

The site is 20.8 ha in size.

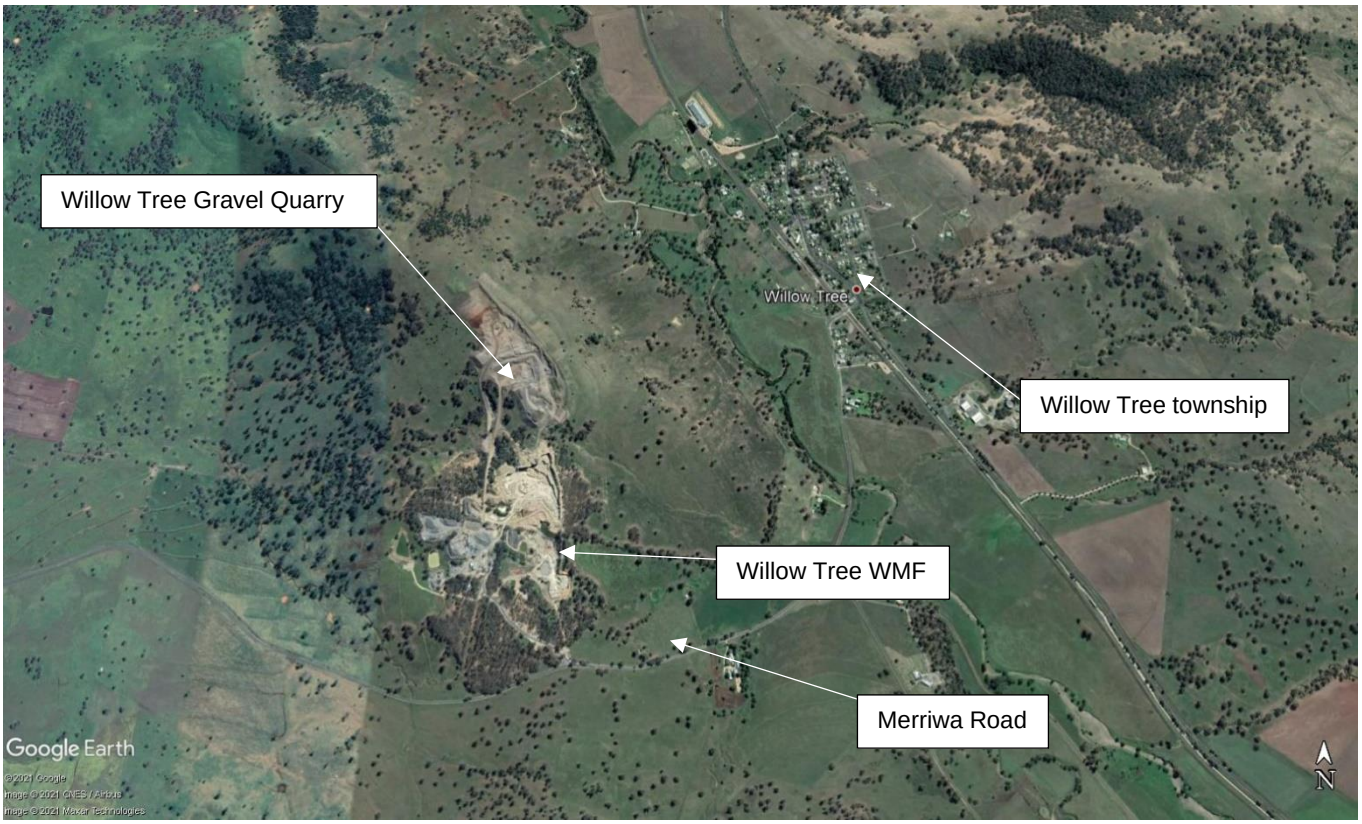


Figure 4.1 Regional context

Source: Google Earth

4.1.1 Topography and land use

The existing site is a former quarry that has been excavated through a roughly north-south trending ridge. In the project area, the northern part of this ridge has been removed by quarrying such that the highest elevation is now in the central western area of the site. The land slopes away from this high point in all directions. The landfill expansion area slopes south-west towards Merriwa Road.

The northern portion of the site has been modified by quarrying and landfilling whereas the southern portion is largely undisturbed.

The topography surrounding the site is generally very low to low undulating hills and rises. The site sits at the top of a hill. Local relief within the area ranges from approximately 480 to 510 m AHD. The area surrounding the site has an elevation of 430 to 450 m AHD.

All land surrounding the site is zoned RU1 Primary Production and is used for general agricultural and rural activities:

– Willow Tree Gravels operates on the adjacent lot to the west, Lot 1 DP 502092, and to the north, Lot 121 DP 857377. The quarry operates under Environmental Protection Licence (EPL) 5154.
– Some native vegetation remains near the project site and quarries.
– All other land in the vicinity of the site is used for grazing.

The closest residence is approximately 500 metres east of the site.

4.2 Sensitive receptors

The Approved Methods defines a sensitive receptor as:

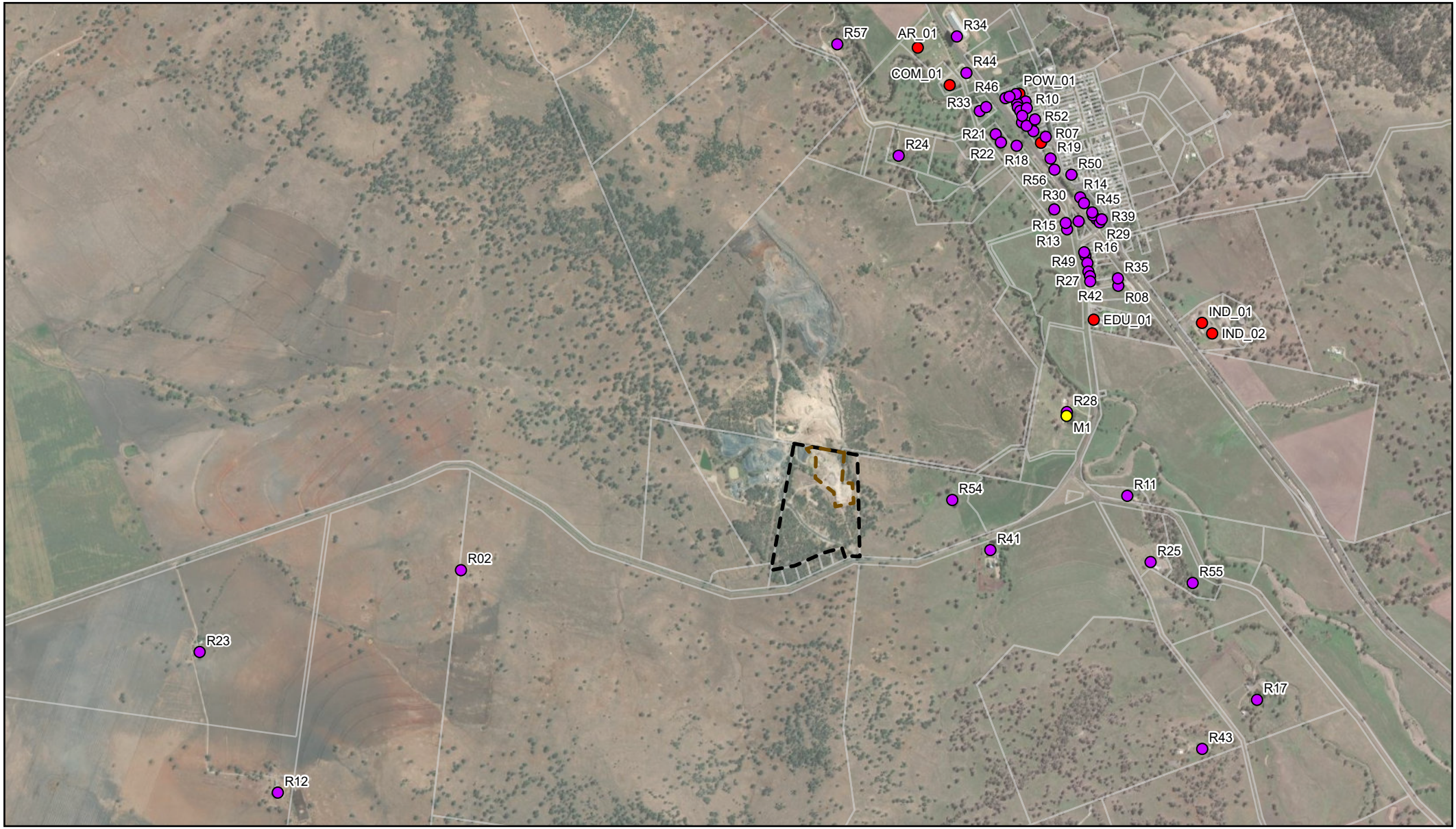
'A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area. An air quality impact assessment should also consider the location of known or likely future sensitive receptors.'

The nearest sensitive receptors in each direction have been reviewed. A total of 64 receptors has been identified, including 57 residential receptors, 1 place of worship, 2 commercial receptors, 1 educational receptor, 2 industrial receptors, and 1 active recreation area. Receptor locations and distance and direction from the site are given in Table 4.1 and shown in Figure 4.2.

Table 4.1 Sensitive receptors

ID	Receptor type	Easting (m)	Northing (m)	Distance (km) and direction from site
AR_01	Active recreation	283713	6496738	2.3 km N
COM_01	Commercial	283873	6496550	2.1 km N
EDU_01	Educational	284596	6495374	1.5 km NE
HA_01	Commercial	284331	6496261	2 km NE
IND_01	Industrial	285139	6495358	1.9 km NE
IND_02	Industrial	285190	6495305	2 km NE
POW_01	Place of worship	284223	6496507	2.2 km NE
R01	Residential	284254	6496468	2.2 km NE
R02	Residential	281421	6494118	2 km SW
R03	Residential	284212	6496457	2.1 km NE
R04	Residential	284520	6495867	1.8 km NE
R05	Residential	284609	6495879	1.8 km NE
R06	Residential	284215	6496439	2.1 km NE
R07	Residential	284355	6496291	2 km NE
R08	Residential	284719	6495544	1.7 km NE
R09	Residential	284227	6496421	2.1 km NE
R10	Residential	284260	6496435	2.1 km NE
R11	Residential	284764	6494491	1.4 km E
R12	Residential	280502	6493003	3.3 km SW
R13	Residential	284462	6495827	1.7 km NE
R14	Residential	284528	6495987	1.9 km NE
R15	Residential	284455	6495859	1.7 km NE
R16	Residential	284554	6495694	1.7 km NE
R17	Residential	285415	6493468	2.3 km SE
R18	Residential	284209	6496246	1.9 km NE

ID	Receptor type	Easting (m)	Northing (m)	Distance (km) and direction from site
R19	Residential	284379	6496182	2 km NE
R20	Residential	284564	6495658	1.7 km NE
R21	Residential	284104	6496304	1.9 km NE
R22	Residential	284130	6496263	1.9 km NE
R23	Residential	280110	6493708	3.4 km SW
R24	Residential	283617	6496196	1.7 km N
R25	Residential	284881	6494159	1.5 km E
R26	Residential	284547	6495958	1.9 km NE
R27	Residential	284569	6495615	1.6 km NE
R28	Residential	284461	6494911	1.1 km E
R29	Residential	284626	6495862	1.8 km NE
R30	Residential	284398	6495927	1.7 km NE
R31	Residential	284577	6495592	1.6 km NE
R32	Residential	284236	6496363	2 km NE
R33	Residential	284024	6496420	2 km N
R34	Residential	283909	6496794	2.4 km N
R35	Residential	284717	6495581	1.7 km NE
R36	Residential	284592	6495897	1.8 km NE
R37	Residential	284205	6496505	2.2 km N
R38	Residential	284281	6496339	2 km NE
R39	Residential	284636	6495877	1.9 km NE
R40	Residential	284237	6496396	2.1 km NE
R41	Residential	284077	6494219	0.7 km E
R42	Residential	284578	6495566	1.6 km NE
R43	Residential	285140	6493222	2.2 km SE
R44	Residential	283957	6496611	2.2 km N
R45	Residential	284588	6495912	1.9 km NE
R46	Residential	284153	6496485	2.1 km NE
R47	Residential	284056	6496440	2.1 km N
R48	Residential	284293	6496319	2 km NE
R49	Residential	284548	6495712	1.7 km NE
R50	Residential	284484	6496101	1.9 km NE
R51	Residential	284259	6496346	2 km NE
R52	Residential	284301	6496378	2.1 km NE
R53	Residential	284173	6496492	2.1 km NE
R54	Residential	283886	6494470	0.5 km E
R55	Residential	285092	6494054	1.8 km E
R56	Residential	284399	6496126	1.9 km NE
R57	Residential	283309	6496755	2.3 km N



Legend

- Tipping area
- Site boundary
- Lot
- Noise monitoring location
- Non-residential receptors
- Residential receptors

Paper Size ISO A4

0 250 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

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Liverpool Plains Shire Council
Willow Tree Waste Management Facility Expansion
Environmental Impact Statement

Project No. **12534581**
Revision No. **0**
Date **1/12/2022**

Sensitive receivers

FIGURE 4.2

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4.3 Ambient air quality

4.3.1 Overview

The WMF is located adjacent to the Willow Tree Gravel quarry. The quarry would likely cause significant dust emissions and lead to a high dust concentration in the area surrounding the project site. No significant odour emissions are expected from the quarry.

No other existing significant sources of dust or odour have been identified in the area surrounding the project site.

The NSW Department of Planning and Environment (DPE) operates air quality monitoring stations (AQMS) in many locations across NSW. The nearest station to the site is the Merriwa AQMS which is located approximately 56 km southwest of the site. Due to the significant distance from the site, data recorded at this station is not considered representative of the site and therefore has not been reviewed.

4.3.2 Facilities reporting to the NPI

The National Pollutant Inventory (NPI), operated under the *National Environment Protection (National Pollutant Inventory) Measure 1998*, provides publicly available information about emissions of 93 pollutants throughout Australia. Facilities that exceed prescribed threshold values are required to report their emissions to the NPI on a yearly basis.

A review of the area surrounding the project site (within 10 km) indicated there are no facilities reporting to the NPI.

4.3.3 State significant projects

A review of the DPE Major Projects website was completed to understand future sources of air pollutants which may contribute to cumulative impacts with the project. Two state significant projects within 10 km of the project site have been identified, as shown in Table 4.2.

Table 4.2 State significant projects

DPE Major Project	Description	Distance and direction from site	Potential cumulative impacts
Yarraman abattoir and feedlot	The Project involves establishment of a modern abattoir and feedlot using current world's best practice systems in construction, equipment, animal handling and environmental considerations.	5.5 km west	Possible odour emissions
Ardglen Quarry	Proposed expansion of existing hard rock quarry at Ardglen, NSW.	10 km southeast	Possible cumulative dust impacts

The Yarraman abattoir and feedlot may cause some odour emissions although these would likely be of a different character to odour emitted that the site and therefore cumulative impacts should not occur. The Ardglen quarry would be a significant source of dust, however due to the distance and topography between the project site and the quarry cumulative impacts are not expected to occur.

4.4 Climate and meteorology

The local climate and meteorology (weather) within the study area is of critical importance when assessing the potential for air quality impacts at sensitive receptors.

The meteorological environment relevant to a project site is best understood through review of data collected from long-running monitoring weather stations, most commonly operated by the Bureau of Meteorology (BoM) as well as state authorities and in some instances private entities. Simulation of the meteorological environment (modelling) is a useful tool in understanding the environment where suitable meteorological observations are not available.

4.4.1 Available observations

The BoM operates a network of automatic weather stations (AWS) across Australia. A BoM AWS typically measures critical meteorological parameters including wind speed, wind direction, temperature, relative humidity, and pressure, with some stations also measuring cloud coverage.

The nearest AWS to the project is the BoM AWS located at the Murrurundi Gap, approximately 11.4km southeast of the site. The observations at this AWS are strongly influenced by its location between two peaks, particularly the wind direction observations. The terrain at the project site is less restrictive as it is located at the top of a hill and therefore these observations are not considered representative of the onsite conditions. However, the observations are still presented here as they are useful for understanding the climatic conditions surrounding the site, particularly temperature and rainfall.

4.4.1.1 Temperature

Figure 4.3 shows monthly mean temperature statistics for data measured at BoM Murrurundi Gap AWS for the period 2017 through 2021. The 50th percentile monthly maximum and minimum temperatures are used to show the typical temperature range for each month of the year, as well as the monthly average temperature.

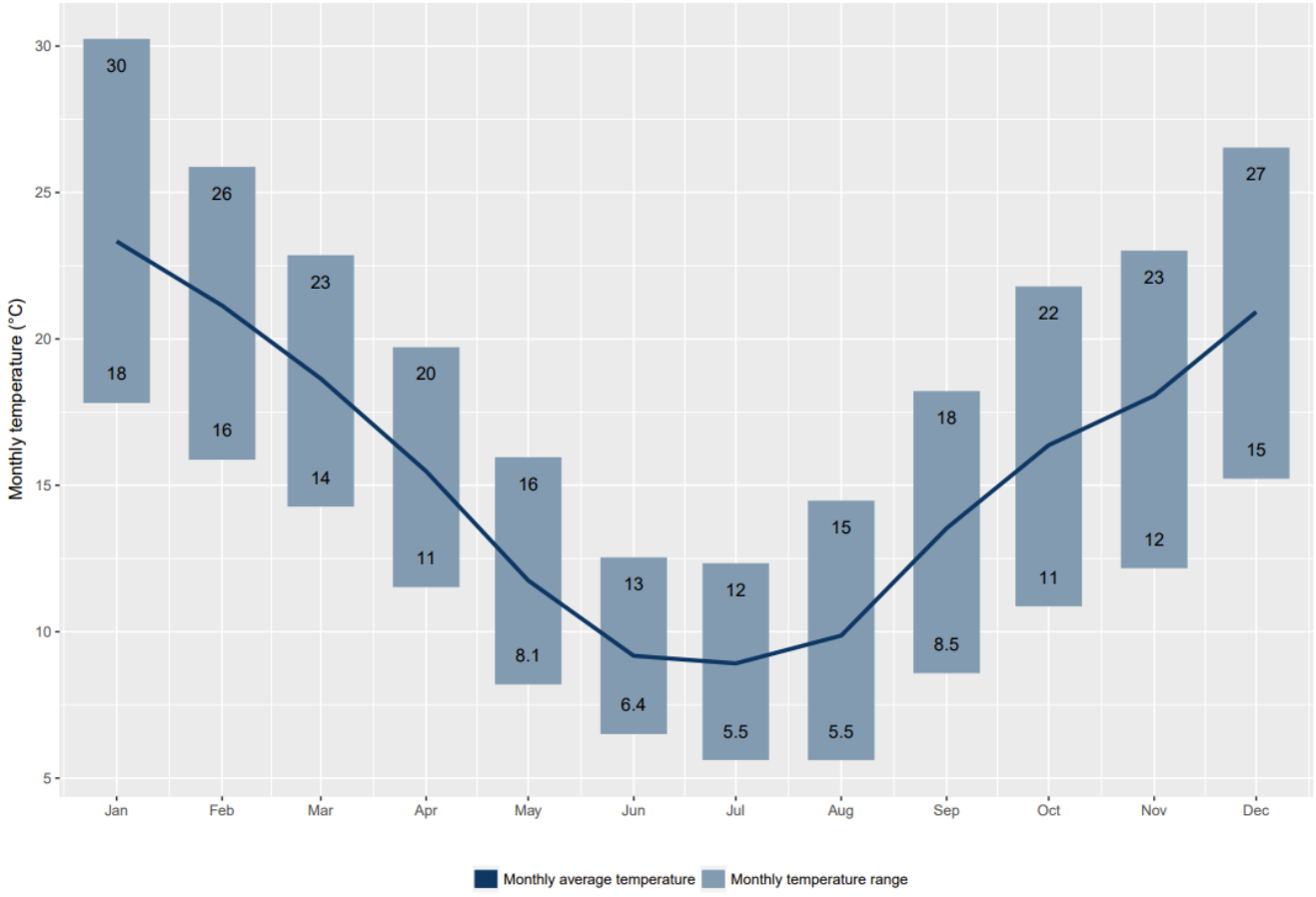

Figure 4.3 Monthly climate temperature statistics from BoM Murrurundi Gap AWS (2017-2021)

4.4.1.2 Rainfall

Figure 4.4 shows monthly rainfall statistics for data measured at BoM Murrurundi Gap AWS for the period 2017 through 2021. The statistics shown include average monthly rainfall amount (mm) and average number of days per month where rainfall is greater than 0.25mm.

The data shows that the total rainfall amounts are greater during the spring and summer months, although the number of rain days was high in June.

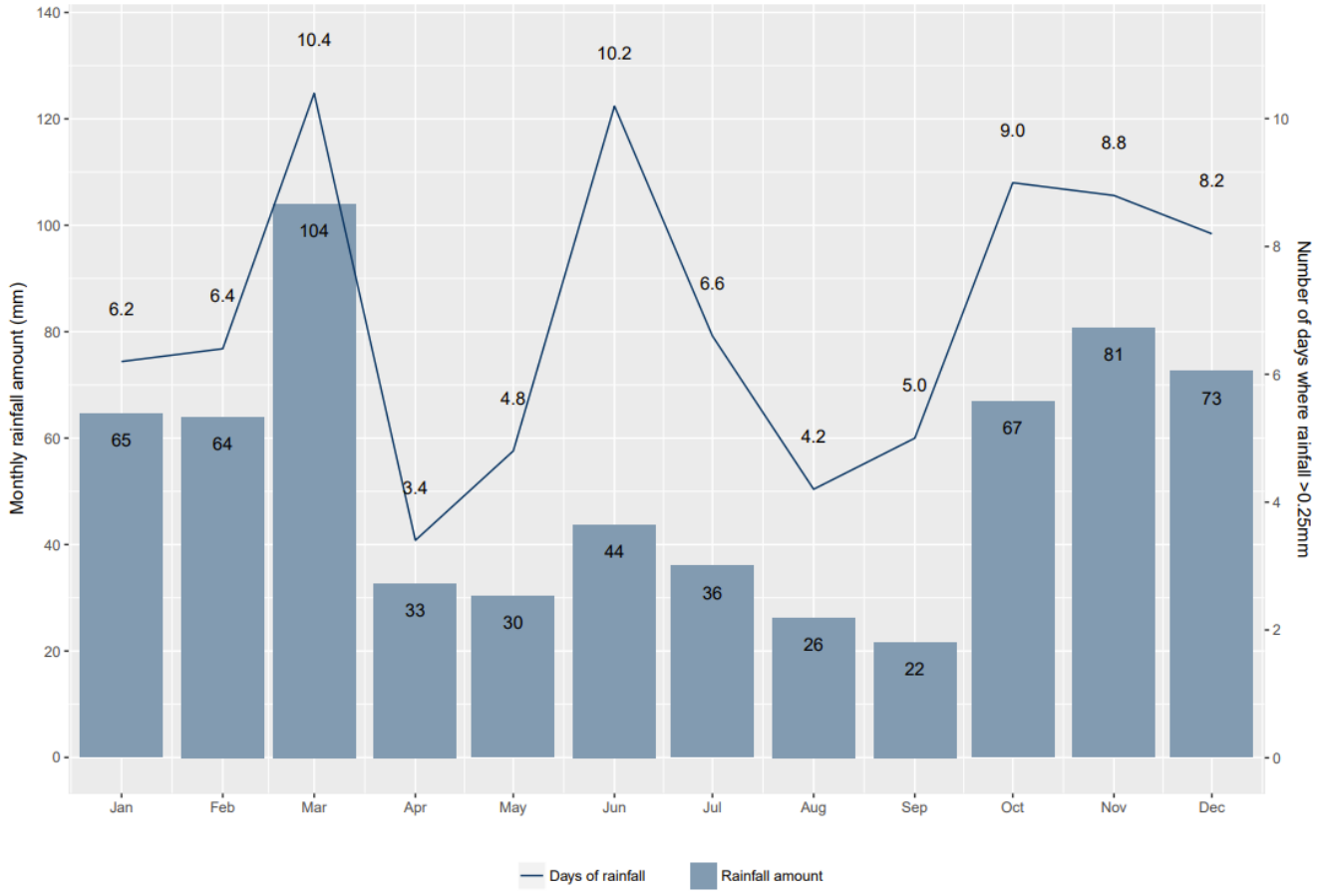

Figure 4.4 Average monthly rainfall collected from BoM Murrurundi Gap AWS (2017-2021)

4.4.1.3 Wind

Figure 4.5 shows the average annual wind rose and Figure 4.6 shows the average seasonal wind roses, both measured at BoM Murrurundi Gap AWS for the period 2017 through 2021. Figure 4.5 shows the following features:

– The predominant annual average wind directions are from the north-west and south-east.
– The average wind speed measured was 6.1 metres per second.
– Calm conditions (wind speeds less than 0.5 m/s) occurred 0.5% of the time.
– High wind speeds (winds greater than 5 m/s which are often attributed to dust lift off) mostly occur from the northwest and southeast.

Figure 4.6 extends these observations, showing that:

– The winds from the north-west mainly occur during spring and winter, while the winds from the southeast mainly occur during summer and autumn
– Autumn has a slightly lower average wind speed than the other seasons
– Summer has the smallest proportion of calm conditions.

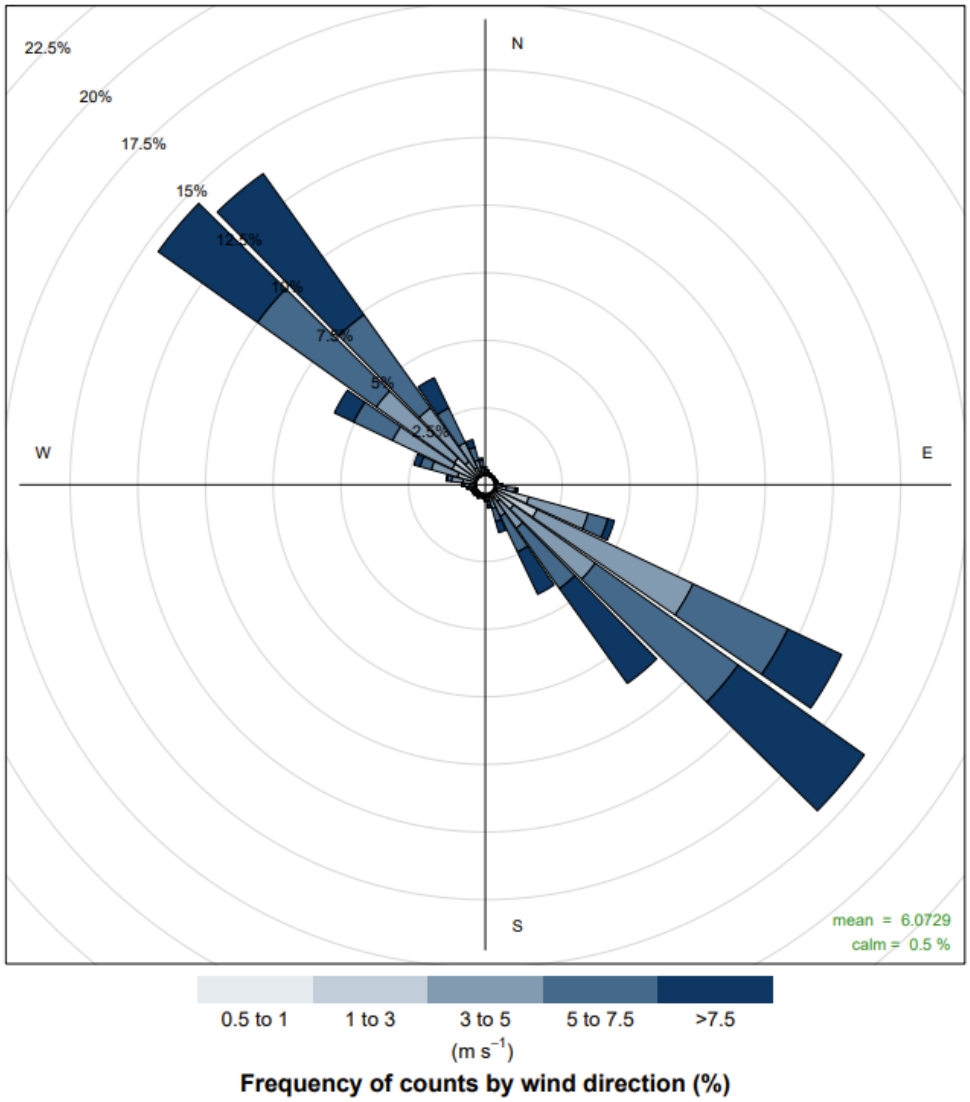

Figure 4.5 Average wind rose collected from BoM Murrurundi Gap AWS (2017-2021)

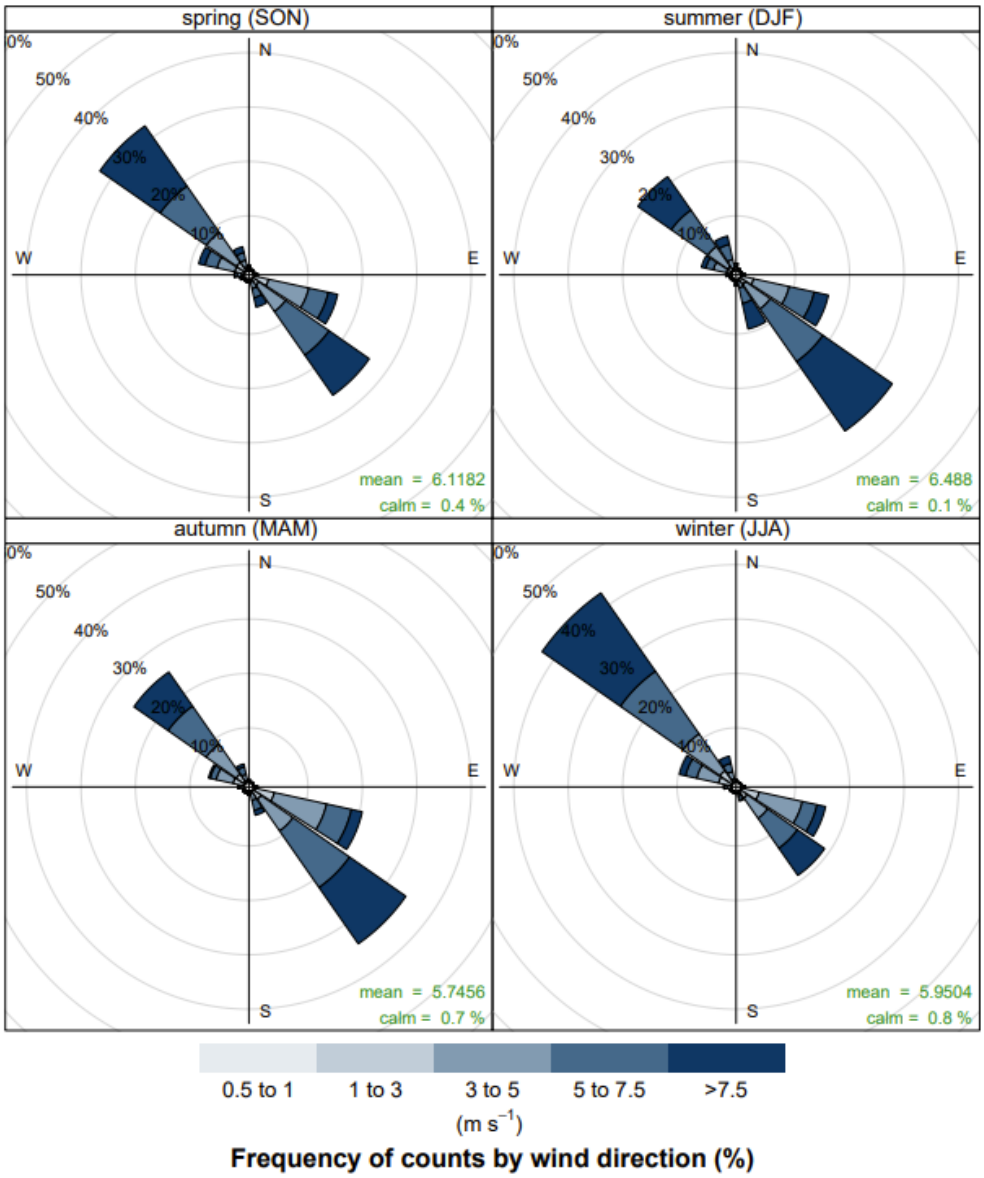

Figure 4.6 Average seasonal wind roses collected from BoM Murrurundi Gap AWS (2017-2021)

5. Dust assessment

5.1 Overview

There is potential for dust emissions during the construction and operational phases of the project. These emissions are expected to be relatively minor and would be largely unchanged compared to current operations of the site. Therefore a qualitative approach was adopted to assessment potential dust impacts.

No background dust (PM_{10}) measurements were available for the site. The prominent source of background dust would be the neighbouring gravel quarry, areas subject to wind erosion, and from urban activities. Pollen and vegetation derived dust would also be expected.

The existing Willow Tree WMF would be a source of dust in the local area due to trucks on internal unpaved roads and earthworks activities at the site. It is expected that the dust emissions from the proposed increased operations would not significantly increase the dust emissions compared to the existing operations. Dust emissions from the quarry would likely be significantly more than those from the WMF.

5.2 Dust emissions

5.2.1 Construction

Sources of dust emission during construction are expected to include:

– Vehicular movements on unsealed roads during working hours
– Clearing of vegetation
– Earthmoving activities (e.g. earthworks required for the leachate dam construction)
– Excavating, spreading and compacting of overburden in preparation for installation of site infrastructure
– Wind erosion dust emissions from exposed and disturbed soil surfaces

Dust emissions during construction would occur for a relatively short period (4 months based on the anticipated construction program) and are expected to vary significantly, in both spatial distribution and intensity, based on the construction works being undertaken.

5.2.2 Operation

Sources of dust emissions during operations are expected to include:

– Vehicular movements on unsealed roads during working hours
– Handling of waste including dumping, transferring, and compacting waste at the tipping face.
– Covering and excavation of cover material on exposed waste
– Handling and screening of product
– Wind erosion from unsealed surfaces and stockpiles

Operational dust emissions are expected to be largely unchanged compared to current operations of the site.

5.3 Assessment of dust impacts

The Environmental Guideline for Solid Waste Landfills (NSW EPA, 2016) provides a list of inappropriate areas for landfilling. The limitations relevant to emissions to air such as dust and odour include:

– Within 250 metres (or other protection zone) of an area of significant environmental or conservation value identified under relevant legislation or environmental planning instruments, including national parks, historic and heritage areas, conservation areas, wilderness areas, wetlands, littoral rainforests, critical habitats, scenic areas, scientific areas and cultural areas
– Within 250 metres of a residential zone or dwelling, school or hospital not associated with the facility

In Victoria and the Australian Capital Territory, buffer (or separation) distances are provided between industrial land uses that emit odour or dust and sensitive land uses. In both states, the recommended separation distance between a landfill cell edge and the nearest sensitive land use is 500 m (EPA Victoria, 2015) (ACT Government, 2018).

The nearest sensitive receptor to the Willow Tree WMF is located approximately 500 m from the site boundary and therefore this site complies with the recommended separation distances, and the NSW EPA limitations. Therefore, dust emissions are not expected to cause significant impacts at the nearby sensitive receptors.

Management and mitigation measures to minimise dust emissions and potential impacts are provided in Section 7.1.

6. Operational odour assessment

6.1 Methodology

The following methodology was used to assess odour impacts from the WMF.

– Odour emissions from the site were estimated based on sampling data from similar facilities and provided waste throughput amounts
– Meteorological modelling for a chosen representative year (2017) was undertaken using CALMET based on an initial guess field provided by TAPM, following NSW EPA guidance (refer Appendix A for more detailed summary)
– Dispersion modelling for typical operations with the future throughput of 9,000 tpa, based on the worst case location for the tip face, was undertaken
– Impact assessment was undertaken by comparison of the predicted odour concentrations with the NSW EPA guidance

6.2 Establishment of project specific objective

The project specific odour assessment criteria were determined based on population density at the identified sensitive receptors in accordance with the Technical Framework (refer Table 3.3). The nearby sensitive receptors include the town of Willow Tree northeast of the site, and several isolated residences. The odour criteria which impacts are required to comply with at each of the sensitive receptors are provided in Table 6.1.

Table 6.1 Project specific odour criteria

Receptor	Receptor ID(s)	Criterion (OU)
Willow Tree Town	All identified sensitive receptors except for those listed below.	2
Isolated residences	R02, R11, R12, R17, R23, R25, R28, R41, R43, R54, R55	7

6.3 Emissions inventory

In lieu of site specific sampling data, GHD has undertaken a review of similar landfill facilities and assessments in order to identify representative odour emission rates for the assessment. Emission rates considered to be representative have been sourced from:

– PAE Holmes (2010) Air quality assessment – odour and dust: proposed modification to the northern extension landfill at eastern creek. Sampling was undertaken at the site to inform the AQIA for an expansion of the landfill. The existing landfill was approved to accept 500,000 tpa of putrescible waste.
– EML (2007) Odour analysis report – 14 and 19 March 2007. Odour sampling was undertaken as part of an odour assessment of current practices at the Australian Native Landscapes (ANL) composting facility. The facility had an approved capacity of 120,000 tpa and an actual operating capacity at the time of sampling of 40,000 tpa. An average SOER for green waste has been estimated based on sampling of one day old green waste and one week old green waste.

The summary of estimated emissions used to model the landfill and leachate pond is provided in Table 6.2.

A peak to mean (P/M) scaling factor of 2.5 has been used to scale up the odour emission rate used in modelling, to account for the estimation of short or peak odour concentrations on a time scale of one second or less. This factor assumes the maximum P/M factor for an area source.

Table 6.2 Emissions summary

Source	Footprint (m^2)	SOER (OU.m/s)	SOER (OU.m/s) with P/M factor applied	OER (OU.m^3/s)	SOER reference
Daily cover (4pm-9am)	600	1.74	4.35	2,610	PAE Holmes (2010)
Active tip face (9am-4pm)	600	3.65	9.125	5,475	PAE Holmes (2010)
Leachate pond	2,000	0.15	0.375	750	PAE Holmes (2010)
Intermediate cover area	4,000	0.04	0.1	400	PAE Holmes (2010)
Green waste	100	4.00	10	1,000	EML (2007)
Total OER (day time, active waste tipping)				**7,625**	
Total OER (night time, daily cover applied)				**4,760**	

6.4 Assessment of predicted impacts

Predicted odour levels for the worst impacted isolated residence and worst impacted Willow Tree Town receptor are shown in Table 6.3, and the predicted odour contours are shown in Figure 6.1.

All results are provided as the 1 second 99th percentile peak odour concentration as per the Technical Framework. The results show that predicted odour from the Willow Tree WMF is well below criteria at all sensitive receptors.

Table 6.3 Predicted odour concentration at the worst impacted sensitive receptors (1 second averaged, 99th percentile odour concentration)

Worst impacted receptor		Predicted odour concentration (OU)	Odour concentration criterion (OU)
Willow Tree Town	R24	0.02	2
Isolated residence	R54	0.2	7

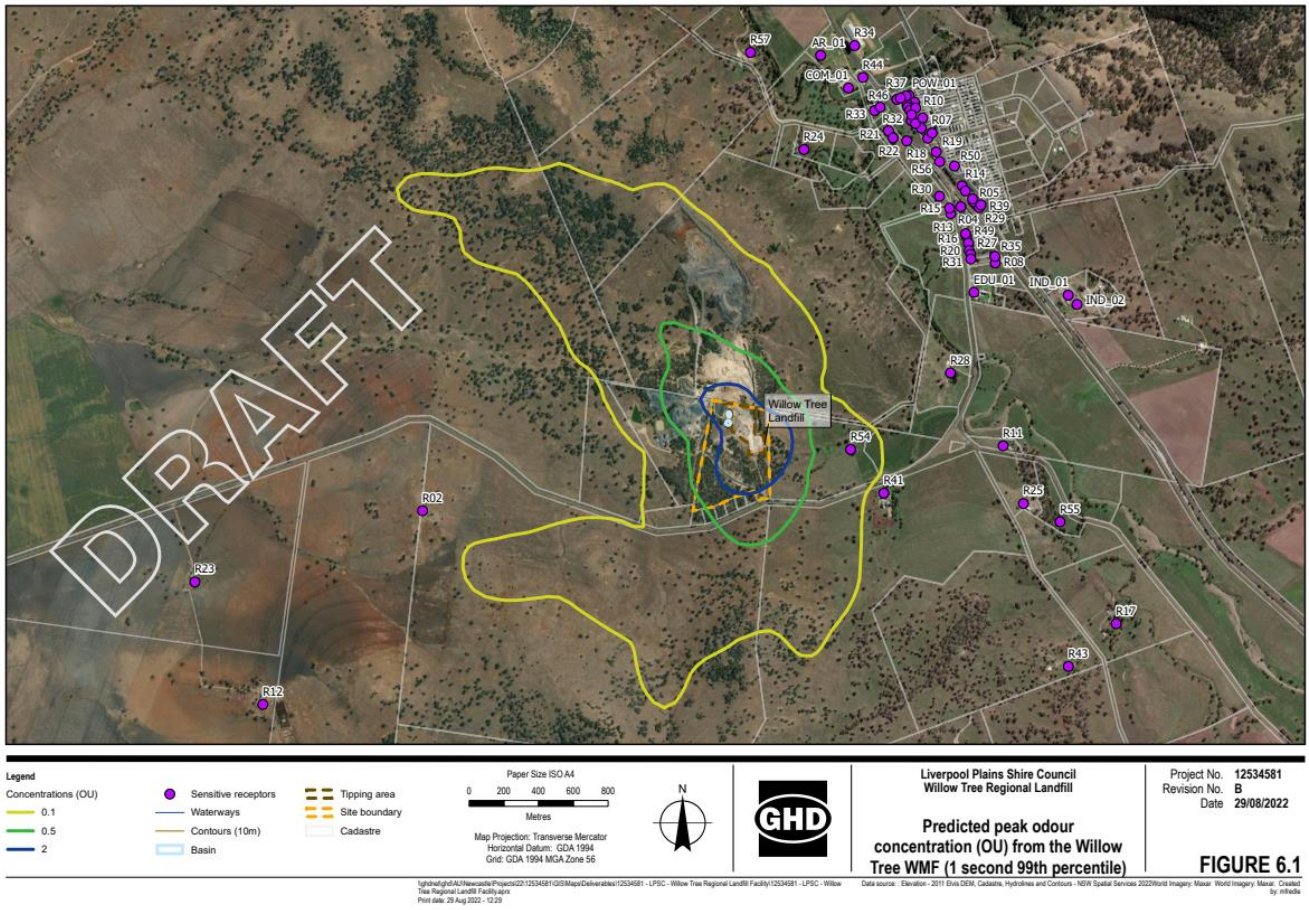

Figure 6.1 Predicted peak odour concentration (OU) from the Willow Tree WMF (1 second 99th percentile)

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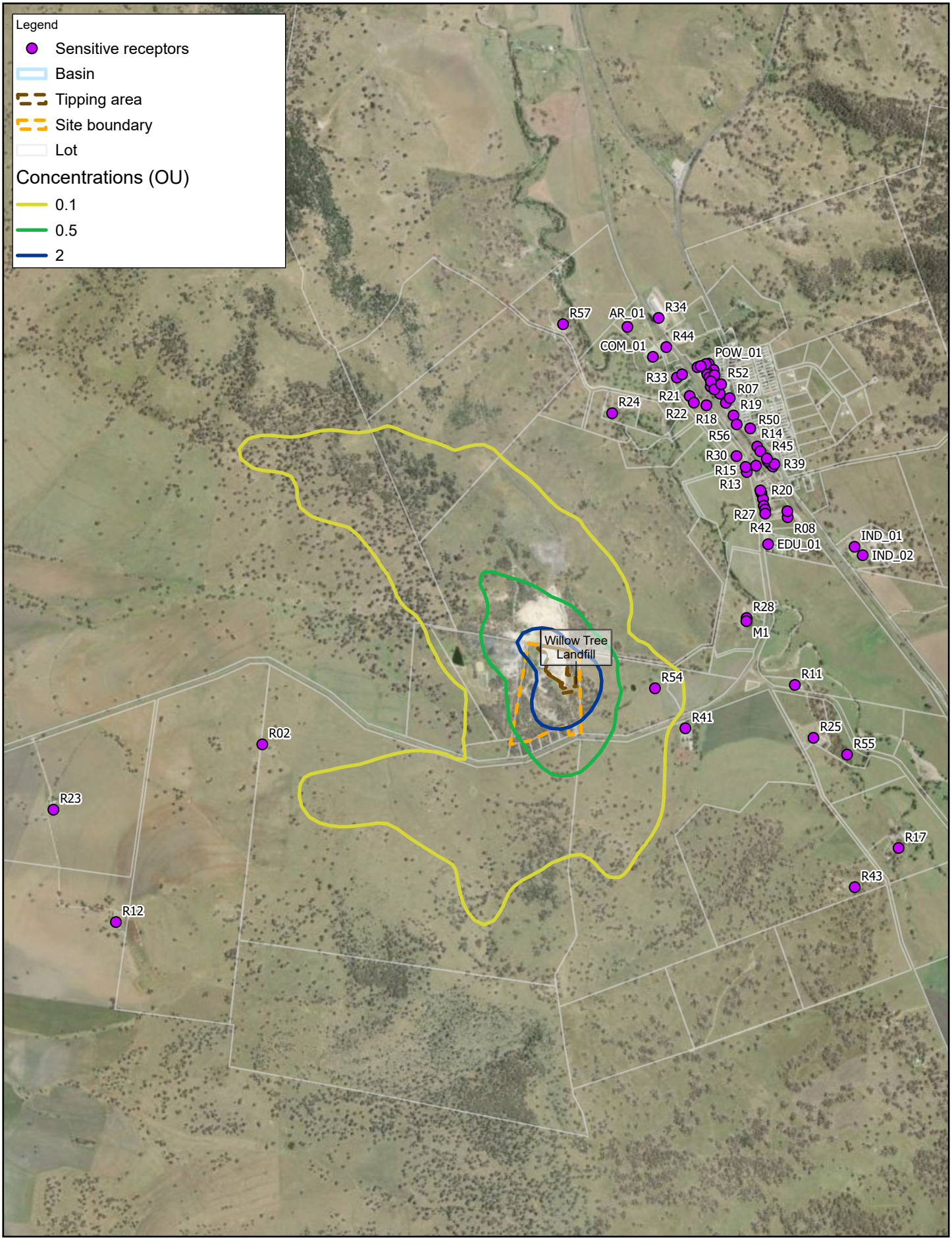

Paper Size ISO A4

0 400 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Liverpool Plains Shire Council
Willow Tree Waste Management Facility Expansion
Environmental Impact Statement

Project No. **12534581**
Revision No. **0**
Date **1/12/2022**

Predicted Air Quality Impacts

FIGURE 6.1

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12534581_EIS013_PredictedAirQualityImpacts_0
Print date: 01 Dec 2022 - 16:37

Data source: NPWS Reserves, Waterways - DFSI, 2022; Crown Land, Roads, Railways - DCS, 2022; NSW_Imagery: © Department of Customer Service 2020
World Imagery: Maxar. Created by: pfernandes

7. Mitigation and management

7.1 Dust mitigation and management

Mitigation measures which would help to minimise dust impacts include:

- Prepare a dust control protocol that forms part of the Construction Environmental Management Plan (CEMP) to detail management measures, a method for recording dust complaints and monitoring requirements.
- On days with forecast and actual high winds (i.e over 10 m/s) reduce work effort accordingly if wind blown dust is observed to be leaving the site boundary.
- Plant and equipment should be maintained in good condition to minimise ignition risk, spills and air emissions that may cause nuisance.
- Dust suppression should be undertaken as required using water sprays, water extension agents, soil stabilising polymers or other media on:
  - Unpaved work areas subject to traffic or wind;
  - During the loading and unloading of dust generating materials.
  - Unpaved access tracks
- If the works are creating levels of dust which may significantly impact on residential amenity, the works should be modified or stopped until the dust hazard is reduced to an acceptable level.
- On days with high background dust levels (due to fire or offsite dust events for example), increase dust mitigation in the form of watering or reduce dusty construction activities.
- Vehicles with potential for loss of loads (such as dust or litter) should be covered when using public roads.

7.2 Odour mitigation and management

Mitigation measures which would help to minimise odour impacts include:

- Establish 24 hour emergency maintenance agreements with equipment manufacturers to limit the impact of equipment failures
- If the works are emitting odour concentrations which may significantly impact the nearby receptors, the works should be modified or stopped until the hazard is reduced to an acceptable level
- Minimise the size of the active landfill face, taking into account the practicalities, safety, access, traffic management, etc
- Cover odorous wastes as soon as possible after delivery
- Train staff (internal and contractors) on odour management strategy and all relevant procedures.

8. Conclusion

The proposed project seeks to increase the allowable processing capacity of the Willow Tree WMF to 4,000 t/yr initially, increasing up to 9,000 t/yr. An air quality assessment, including dust and odour, has been completed to assess the impact of the proposed expansion on the nearby sensitive receptors.

A high level dust assessment has been undertaken which reviewed the potential dust emissions from the project and the recommended separation distances per state guidelines. No significant dust impacts are anticipated.

A Level 3 odour assessment has been undertaken in accordance with the Technical Framework and the Approved Methods. Odour emission rates were estimated based on sampling data obtained from similar facilities. This was used in conjunction with a site-representative meteorological file to complete odour dispersion modelling.

Based on the assessment completed in the report, predicted odour concentrations do not exceed the peak 99th percentile criteria at each of the sensitive receptors. The maximum predicted odour concentration at a residential land use is 0.2 OU.

Based on the findings of this assessment, odour from the Willow Tree WMF is not expected to cause significant odour impacts on the nearby sensitive receptors.

It is expected that dust and odour emissions from the project would be largely unchanged compared to current site operations.

9. References

ACT Government. (2018, November). Separation distance guidelines for air emissions. Canberra.

EML. (2007, March). Odour Analysis Report - 14 and 19 March 2007.

EPA Victoria. (2015, August). Siting, design, operation and rehabilitation of landfills. *Best practice environmental management*.

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MRA Consulting Group. (2018, January 9). Waste Management Strategy - A submission to Liverpool Plains Shire Council.

National Environmental Protection Council. (2021). National Environment Protection (Ambient Air Quality) Measure - Variation .

NSW Department of Environment and Conservation. (2006). Technical framework - Assessment and management of odour from stationary sources in NSW.

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NSW EPA. (2016). Solid waste landfill. *Environmental Guidelines*.

NSW EPA. (2017). Approved methods for the modelling and assessment of air pollutants in New South Wales.

NSW EPA. (2022). Approved methods for the sampling and analysis of air pollutants in New South Wales.

NSW Government. (2021). NSW Protection of the Environment Operations (Clean Air) Regulation.

PAE Holmes. (2010). Air quality assessment - odour and dust: proposed modification to the northern extension landfill at eastern creek.

Appendix A

Meteorological modelling methodology

A-1 Overview

Local meteorology, including long term wind speed and direction as well as atmospheric stability, can influence how pollutants are dispersed into the local environment.

This appendix outlines the methodology used to synthesise site-representative meteorology for the project. The meteorology is used in CALPUFF to drive the dispersion model.

A-2 Methodology

The meteorology modelling methodology is summarised below:

– Selection of a model period.
– Development of coarsely gridded prognostic meteorological data set using The Air Pollution Model (TAPM).
– Development of fine gridded meteorological data set which takes in account local terrain features using the CALMET diagnostic meteorological model.
– Extraction of predicted meteorological parameters from the CALMET model.

A-2-1 Nearby BoM station review

The nearest BoM station is the Murrurundi Gap AWS (ID: 61392). It is located approximately 11.4 km southeast of the site. This station began operation in June 2003 and collects all desired meteorological parameters including cloud data.

A-2-2 Representative year selection

A representative year was chosen for modelling purposes based on review of Southern Oscillation Index (SOI) for the past 10 years and an analysis of BoM data recorded at the Murrurundi Gap AWS for the last five calendar years (01/01/2017 – 31/12/2021). The 2017 calendar year was selected as the representative year based on this review.

The SOI indicates the intensity of El Nino or La Nina events in the Pacific Ocean. A value of less than -7 often indicates El Nino episodes typically accompanied by sustained warming of the central and eastern tropical Pacific Ocean, a decrease in the strength of the Pacific Trade Winds, and a reduction in winter and spring rainfall over much of eastern Australia and the Top End. A value greater than 7 often indicates La Nina episodes, typically associated with stronger Pacific Trade Winds and warmer sea temperatures to the north of Australia. Waters in the central and eastern tropical Pacific Ocean become cooler during this time. Together these give an increased probability that eastern and northern Australia will be wetter than normal.

The SOI for the past 10 years is shown in Figure A.1.

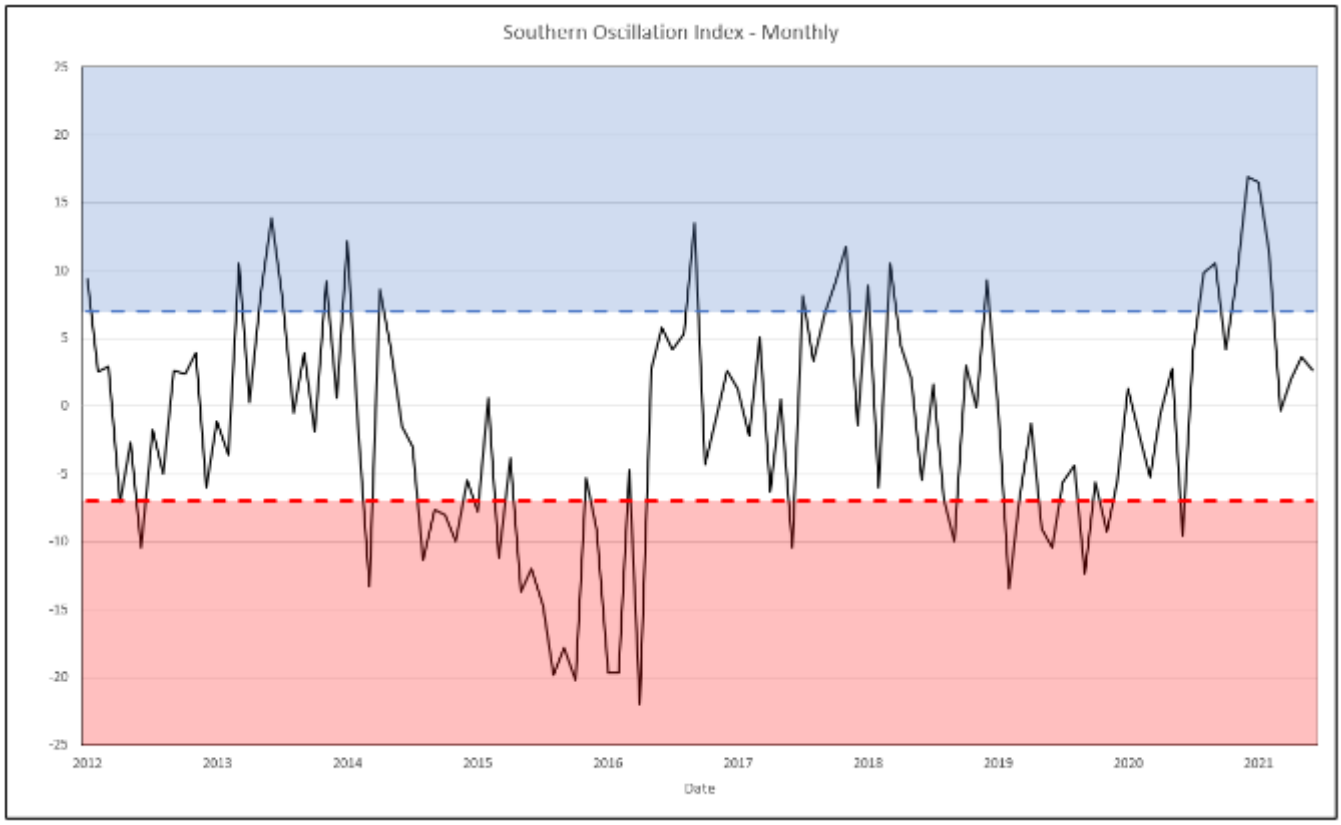

Figure A.1 *Southern Oscillation Index for last 10 years (2012-2021)*

Probability density function plots of Murrurundi Gap AWS data (2017-2021) for temperature, relative humidity, wind direction and wind speed are provided in Figures A.2 to A.5 respectively.

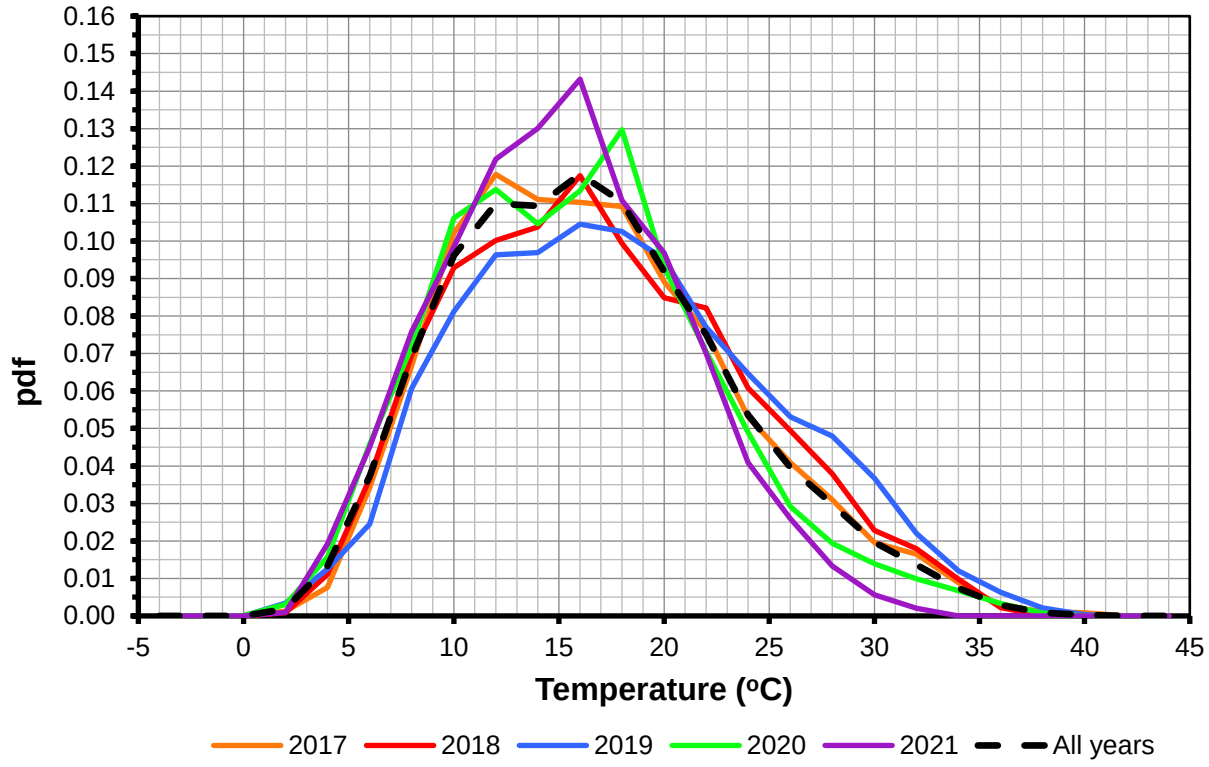

Figure A.2 *Temperature (Murrurundi Gap BoM AWS)*

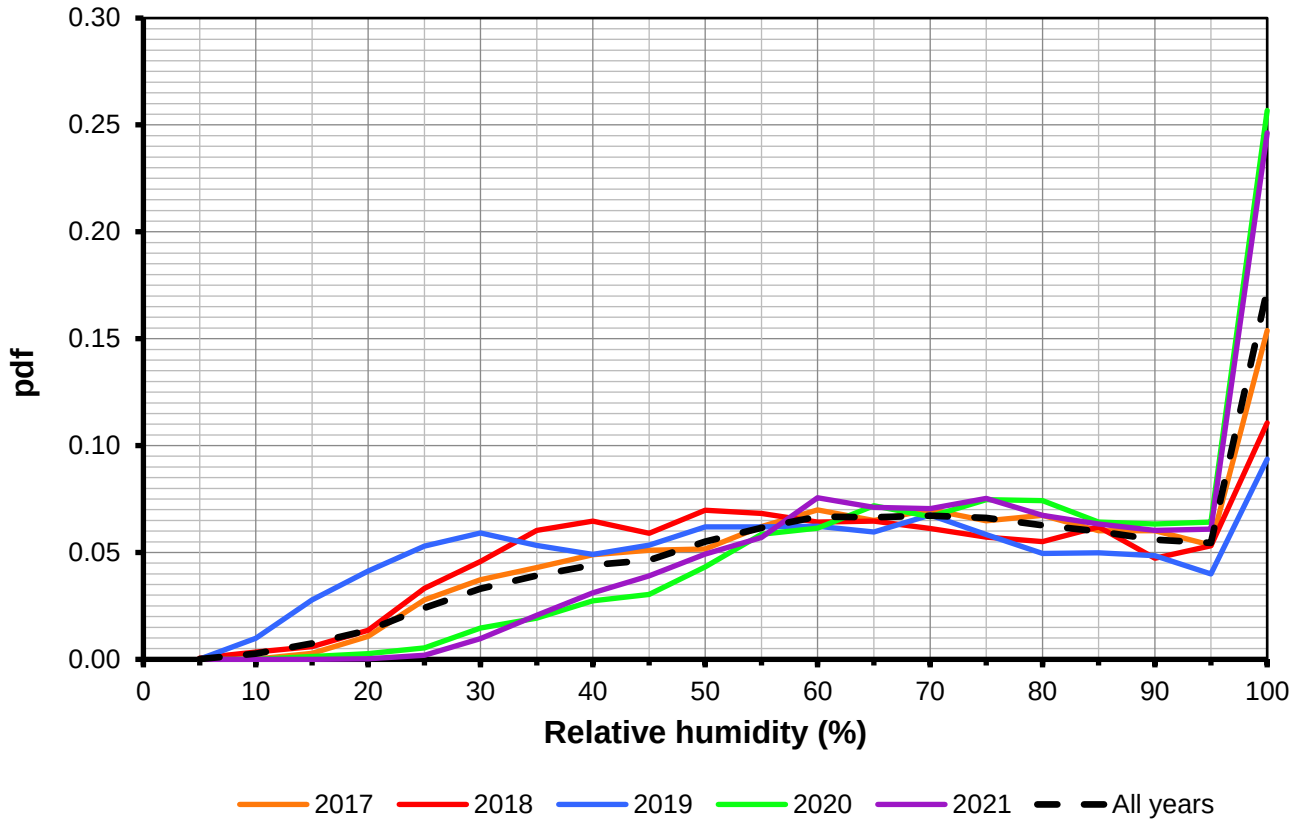

Figure A.3 *Relative humidity (Murrurundi Gap BoM AWS)*

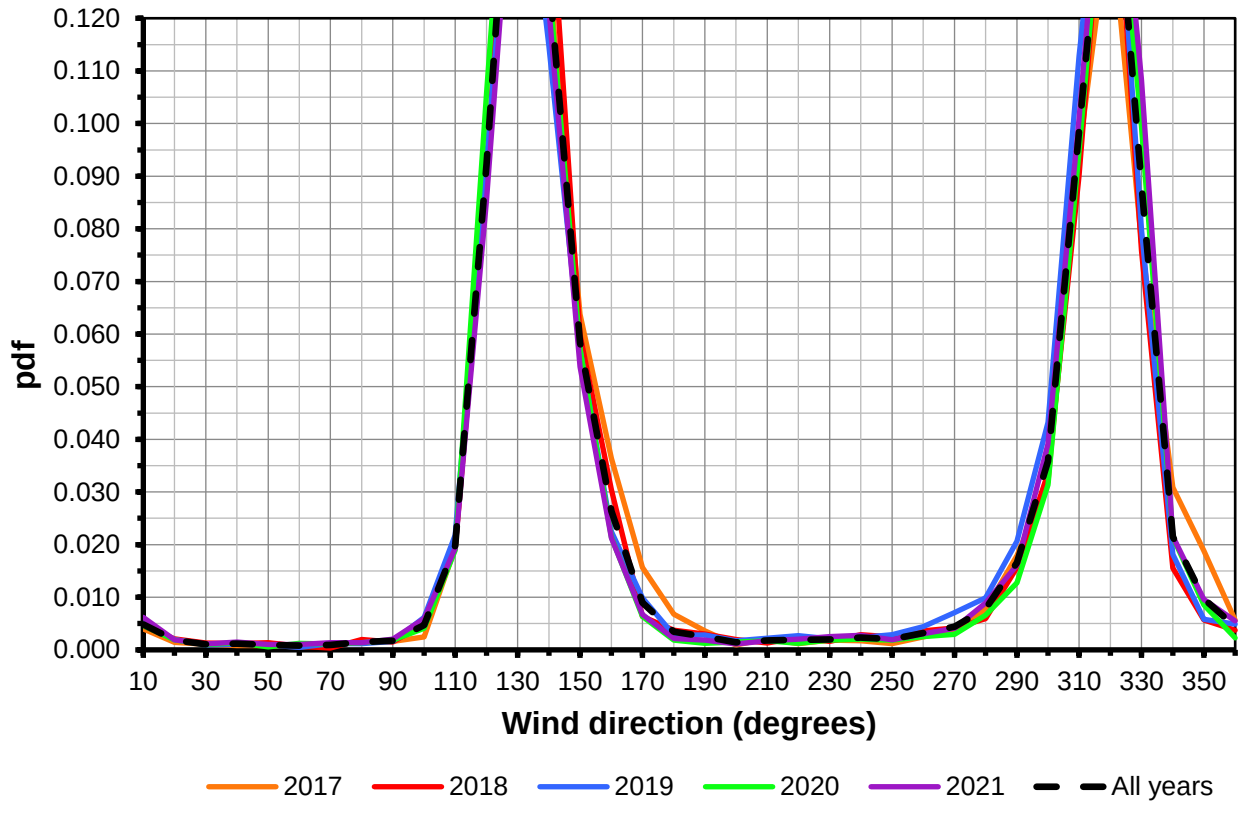

Figure A.4 *Wind direction (Murrurundi Gap BoM AWS)*

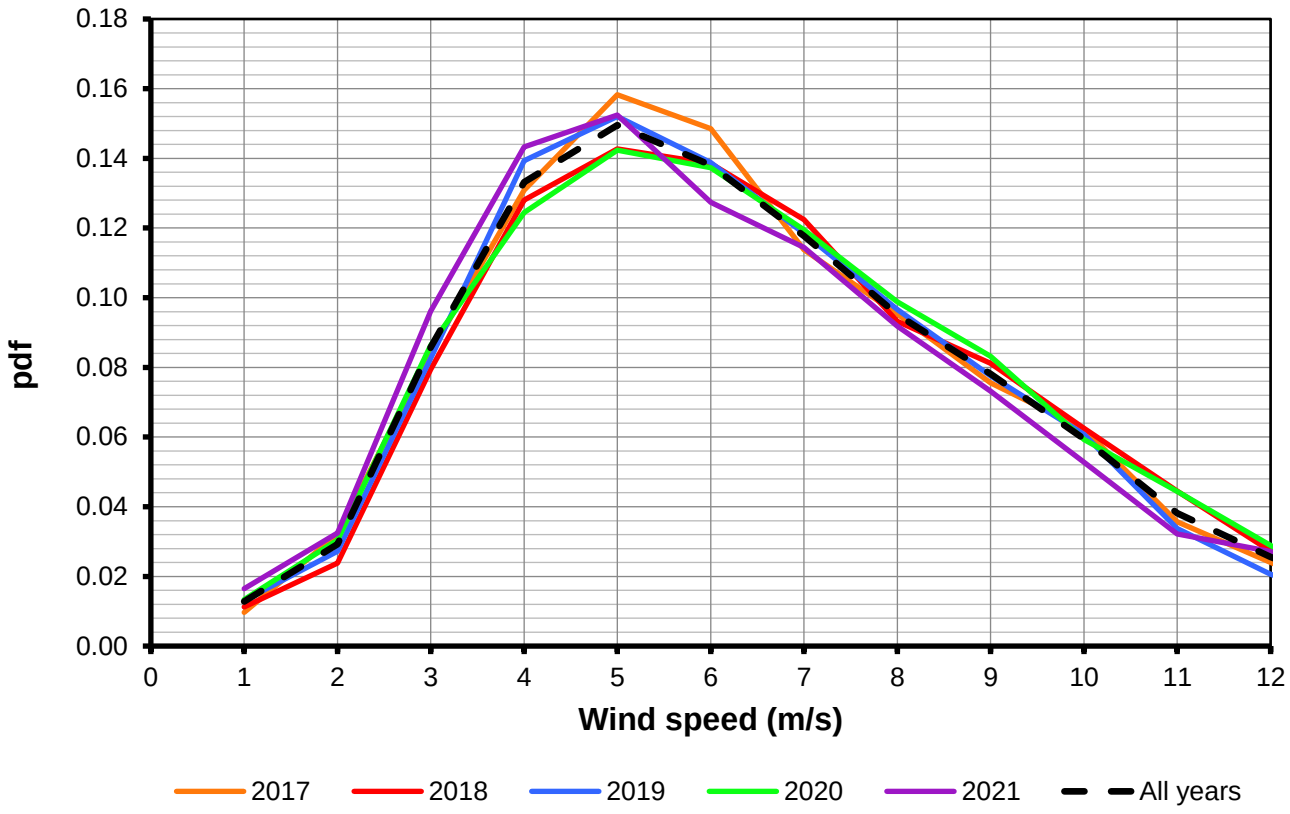

Figure A.5 Wind speed (Murrurundi Gap BoM AWS)

A-2-3 Prognostic meteorology

The parameters for the prognostic TAPM are summarised in Table A.1.

Table A.1 TAPM parameters

Parameter	Value
Modelled period	01 January 2017 to 31 December 2021
Domain centre	UTM zone 56S Easting: 283,524 m Northing: 6,494,245 m
Domain grid spacing	1 x 1 km
Domain size	30 x 30 km
Number of vertical levels	25

A-3 CALMET modelling

CALMET (Version 7) was used to resolve the wind field around the subject site to 200 metres spatial resolution. The application of CALMET for this purpose is an approved modelling approach in NSW as per the Approved Methods with model guidance documentation provided.

Upon completion of the TAPM runs, a CALMET simulation was set up to run for the model period using the three dimensional gridded data output from TAPM as an initial guess field. This approach is consistent with guidance documentation.

CALMET was run using the 'No-Obs' mode (i.e. surface observational data was not included in the model) due to the distance from the nearest meteorological observations and variability in the terrain (at Murrurundi Gap AWS).

Model settings were selected with consideration to the recommendations provided in the Generic 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 (J Barclay and J Scire, Atmospheric Studies Group TRC Environmental Corporation, 2011).

The origin of the CALMET domain was located at UTM Zone 56 coordinates 284 kilometres east and 6494 kilometres north. The CALMET domain extended 22 kilometres to the east and north.

The CALMET domain consisted of 110 grids in both the east and north directions, with a grid resolution of 0.2 kilometre.

The CALMET model parameters are summarised in Table A.2. The TERRAD value was selected based on the 'base to peak' value of the terrain elevations in the immediate vicinity of the subject site.

Wind fields were modelled for two TERRAD values of 3 km and 1.5 km. The wind rose for the 1.5 km option indicated that influence from terrain features were not dominating the wind field on site and therefore this option was selected as the most accurate.

Terrain and land use data used for the CALMET modelling are presented in Figures A.2 and A.3 respectively.

Table A.2 Summary of CALMET model parameters

Parameter	Value
Modelled period	1 January 2018 to 31 December 2018
Mode	No obs (NOOBS = 2)
UTM zone	56
Domain origin	Easting: 284 km Northing: 6494 km
Domain size	110 x 110 at 0.2 km resolution (22.0 km x 22.0 km)
Number of vertical levels	11
Vertical levels (m)	0, 20, 40, 80, 160, 320, 640, 1200, 2000, 3000, 4000,
CALMET settings for hybrid mode Settings selected in accordance with (OEH, 2011)	TERRAD = 1.5 km
Initial guess field	TAPM .m3d file used as an initial guess field for CALMET
Surface data	N/A
Upper air data	No site specific upper air data is used. Upper air data is included within the TAPM .m3d initial guess field.
Land use and terrain data	Land use data was manually developed through assessment of aerial imagery to accurately reflect the land use in the area. High-resolution terrain data was sourced from the STRM 1-second (~30 m) database.

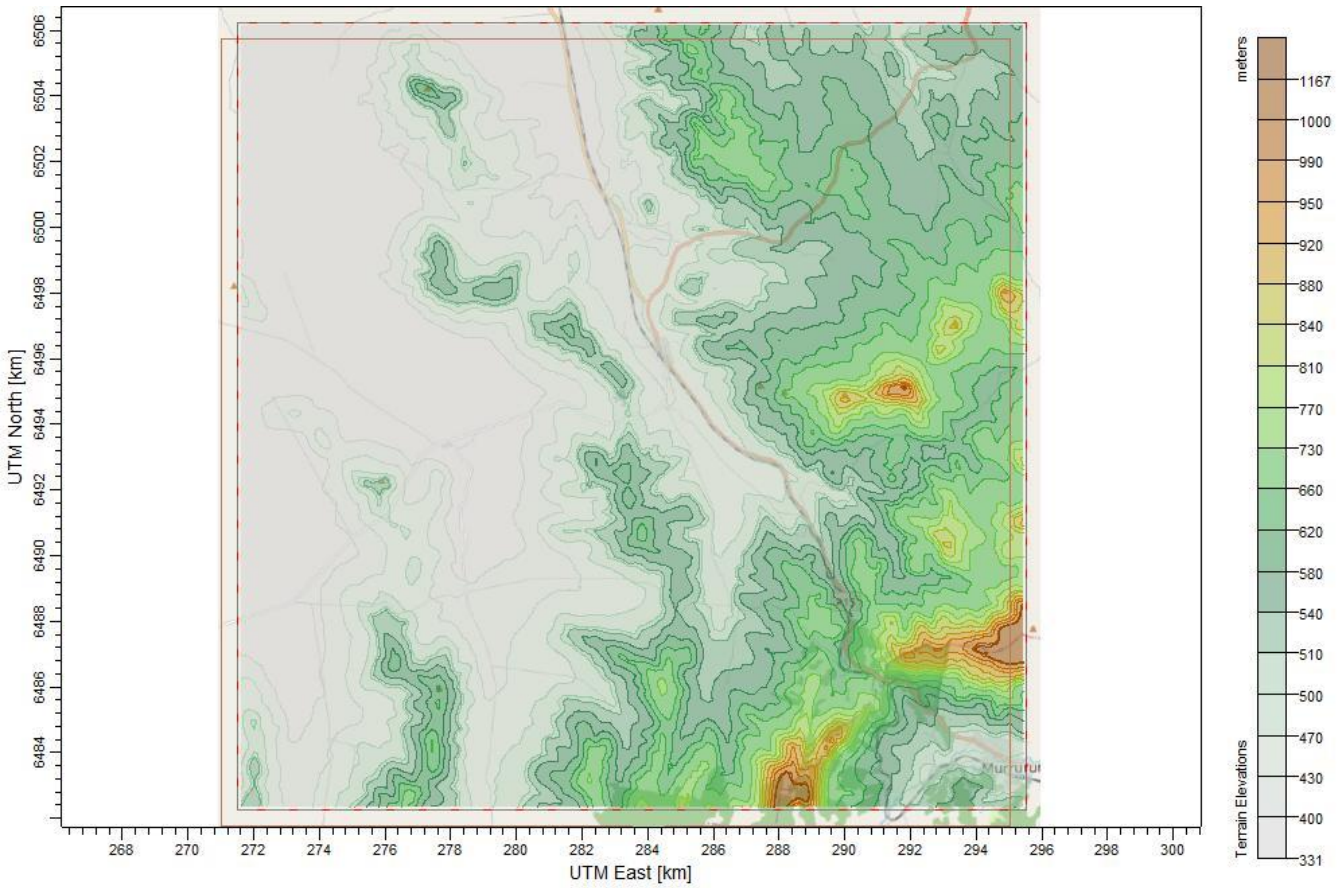

Figure A.6 Terrain data used for CALMET modelling

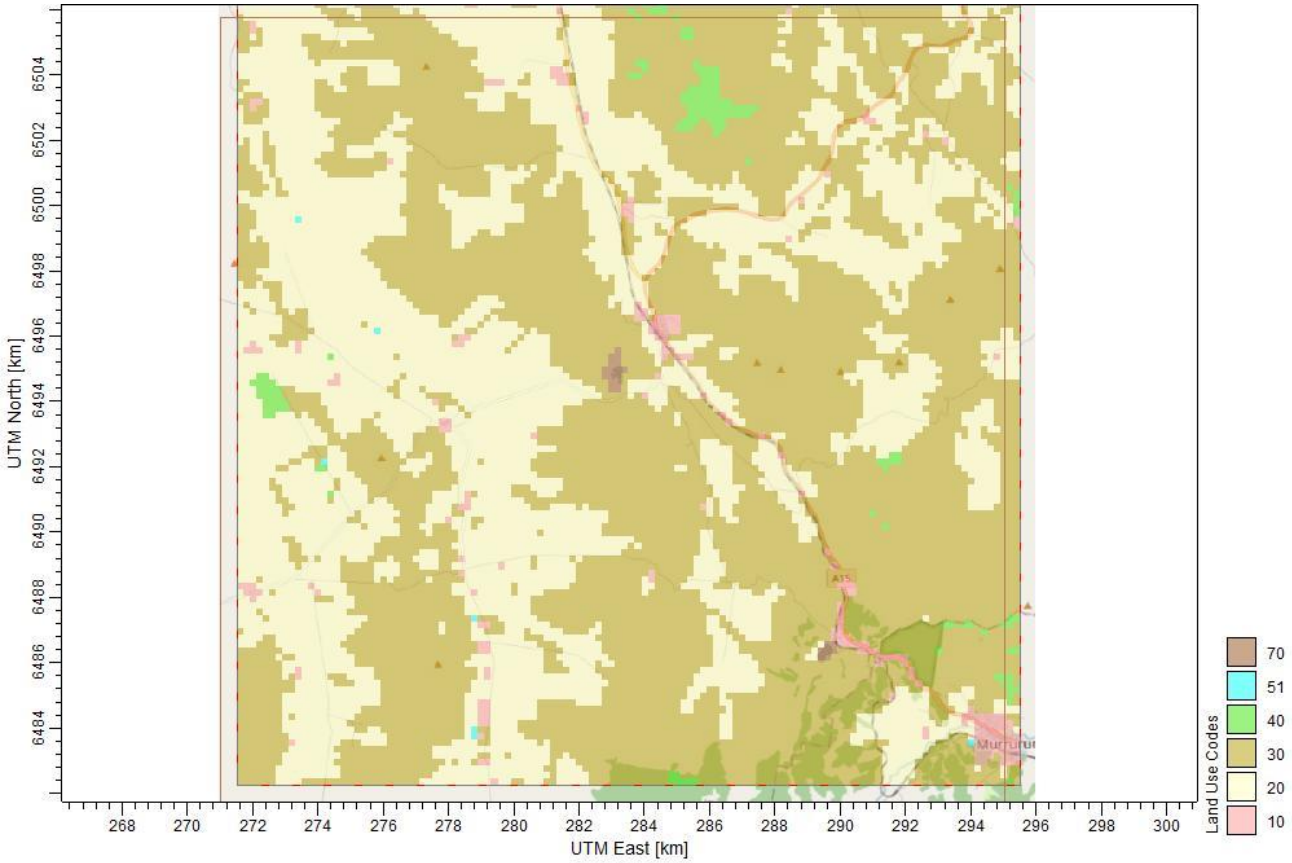

Figure A.7 Land use data used for CALMET modelling

The local meteorology largely determines the pattern of off-site air quality impact on receptors (houses, businesses and industry). The effect of wind on dispersion patterns can be examined using the wind and stability class distributions at the site from the dataset that is produced by CALMET. The winds at the site are most readily displayed by means of wind rose plots, giving the distribution of winds and the wind speeds from these directions.

The features of particular interest in this assessment are (i) the dominant wind directions and (ii) the relative incidence of stable light wind conditions that yield minimal mixing (defines peak impacts from ground-based sources).

A-3-1 Annual wind patterns

The wind rose for the entire data period taken at the project site is shown in Figure A.4 and shows the following features:

– The predominant annual average wind directions are from the east
– The average wind speed predicted was 3.8 metres per second
– Calm conditions (wind speeds less than 0.5 metres per second) occurred 0.6% of the time
– High wind speeds (winds greater than 5 metres per second which are often attributed to dust lift off) mostly occur from the west.

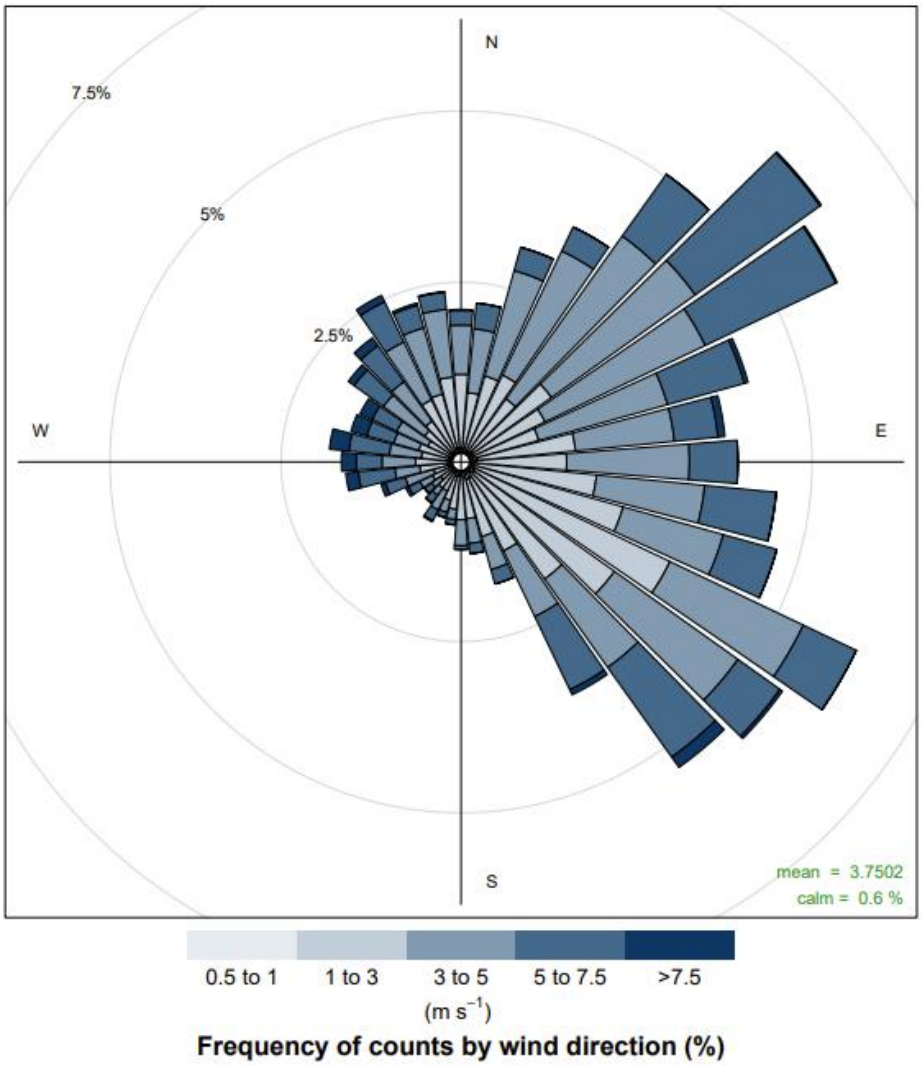

Figure A.8 Wind rose at site from CALMET (2017)

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The Power of Commitment