



WORMTECH YENDA

AIR QUALITY IMPACT ASSESSMENT

REPORT NO. 17202
VERSION 1.0

JANUARY 2024

PREPARED FOR

WORMTECH PTY LTD
224 WOOD ROAD
YENDA NSW 2681

DOCUMENT CONTROL

| Version | Notes | Status | Date | Prepared | Reviewed | Approved |
|---------|-------|--------|------------|----------|----------|----------|
| 0.1 | - | Draft | 28/05/2023 | NH | | NH |
| 1.0 | - | Final | 18/01/2024 | NH | | NH |

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APPENDIX A – CONTOUR PLOTS

1 INTRODUCTION

Wormtech Pty Ltd (Wormtech) operates a vermiculture composting facility at 224 Wood Road, Yenda (the Site). The locality of the Site is shown in **Figure 1-1**.

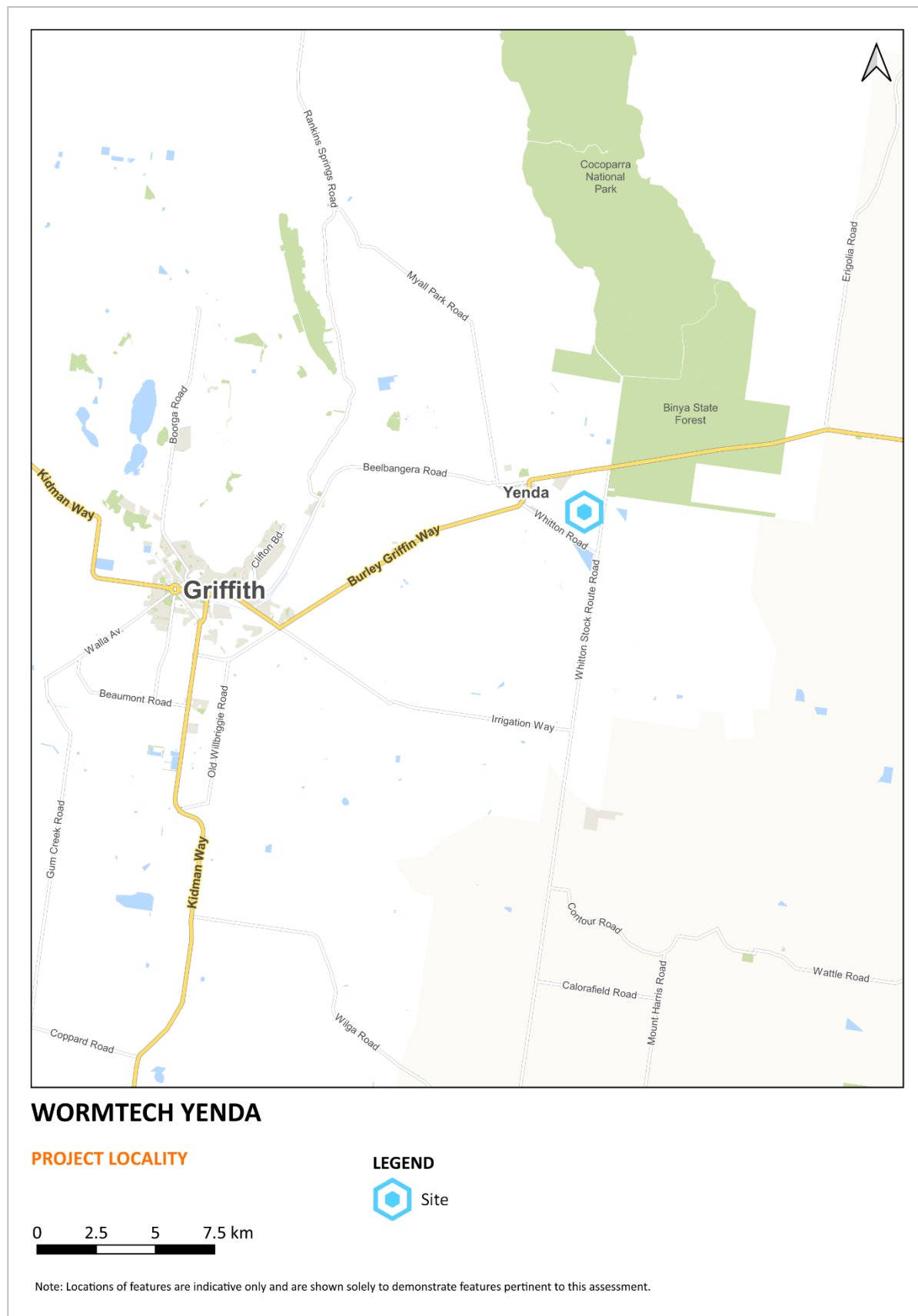
SoundIN Pty Ltd (SoundIN) has been engaged by Wormtech to conduct an air quality impact assessment (AQIA) for the Site.

The assessment has been conducted in general accordance with the NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the "Approved Methods").

Based on observations from a site visit, conducted on 5 April 2023, odours were detected on the Site and are considered to warrant detailed assessment.

Dust emissions from the Site, however, were observed to be relatively small, especially compared to dust from heavy vehicles travelling along Wood Road. Accordingly, potential dust impacts from the Site are considered to be small, subject to appropriate site management practices as outlined in Section 7, and do not warrant detailed assessment.

Figure 1-1 Site locality



2 PROJECT DESCRIPTION

2.1 Overview

The proposal is for the continued use of a vermiculture facility on the site. The primary purpose of the facility is to process non-putrescible wastes combined with pasteurised compost using vermiculture to create worm castings. Wormtech has been operating the site primarily as a research and testing facility since 2015 with the goal of optimising the vermiculture process. No complaints have been made from nearby residents regarding the existing operations and the lined leachate dam has adequately collected water during all rain events.

The layout of the Site is shown in **Figure 2-1**.

Figure 2-1 Site layout



2.2 Process Description

The proposed development involves the continued use of the vermiculture facility which would accept up to 5,000 tonnes of organic material per year under a local (non-designated) development application submitted to Griffith City Council.

Waste streams would consist of a mixture of the following waste types up to a total of 5,000 tonnes per annum (tpa).

- Pasteurised compost – up to 3000 tpa
- Rice – up to 50 tpa
- Mulch – up to 1800 tpa
- De-hydrated food waste – up to 25 tpa
- Fabrics and textiles – up to 100 tpa.

Wormtech are also considering other feed sources to the vermiculture system including filter cake (Paper pulp). This source of organic carbon (non putrescible) will replace some of the compost volume delivered to the Yenda site thus remaining under the 5000 tpa threshold.

2.2.1 Waste Acceptance and Dispatch

Pasteurised compost would be transported to the site via B-double's from Wormtech's site near Carrathool at Conargo Road in the Murrumbidgee Shire LGA. Based on a load of 70 tonnes in a B-double, a total of 42 trucks would deliver compost to the site or less than 1 per week. Other waste streams would be delivered to the site in semi-trailers with up to 40 tonne loads totalling around 50 trucks per year. A total of around 20-125 organics deliveries in trucks would occur throughout the year. It is expected that the same amount of truck movements would be necessary to remove the processed products from the site. As such a total of 250 truck movements (two-way) would be expected per year or around four-five per week.

Trucks would enter the site via the truck entry and proceed to the incoming organics / waste stockpile area. Organics would be separated via stream in bunkers or stockpiles awaiting use in the windrows. Accepted material would be inspected for contaminants. When it is time to 'feed' the worms, the material is loaded into a feed out wagon and run on top of the windrow adding approximately 250mm of fresh material. Immediately after the feeding, the windrows are watered with leachate or raw water. This assists in the vermiculture process and provides dust mitigation.

Feeding occurs every two to three weeks with a minimum of two passes of the watering wheel (which pumps water from the leachate dam and directly applies it to the windrows). After around 9 months the windrows are of a size that mean the worm castings at the bottom of the rows can be picked up and stockpiled for maturation. During maturation, the remaining live forms and eggs of worm's hatch and further refine the material at the same time the piles are allowed to dry out. At this point the

materials are sampled and sent to an external laboratory for testing and analysis.

Matured materials are then collected into 1 tonne bulk produce bins and tipped over a screen to remove any oversized residual organic material and separate any non-organic contaminants (mainly plastics). Screened material is then ready to be sold in bulk or packaged into bags depending on end market requirements.

2.2.2 Vermiculture Pad

The vermiculture pad has been designed to ensure all leachate is collected and slowly worked through the windrow at a grade of 1:1000 prior to entering a drain connected to a 100 mm pipe which discharges directly to the leachate dam. To ensure that leachate does not impact groundwater, the use of an impermeable plastic liner under the worms is proposed. The liner would ensure that leachate does not travel through the subsoils into groundwater. Wormtech wants to ensure that all leachate produced is captured and transferred to the dam for reuse. Leachate is rich in nutrients and its re-application to the windrows improves the finished product. Leachate would drain to the south to existing 100 mm drainage pipes which connect into the leachate dam.

Leachate from the dam is utilised for the watering of the windrows over the 9-month period through the use of a watering cart connected to a moveable pump. The cart works up and down the windrows. The leachate dam has a capacity of 1.5 ML and is plastic lined.

2.2.3 Storage of Finished Product and Incoming Wastes

Incoming wastes would be stored on a clay pad with a maximum storage capacity of around 500 tonnes at any given time. Dehydrated food wastes would be buried on site for storage and utilised only when non-odorous.

Finished product would be stored on clay pads which direct any potential leachate to a second leachate dam. A maximum of 3000 tonnes of harvested worm castings would be stored on site at any given time. In terms of non-conforming wastes, avoidance is first line of defence with samples of feed material sought prior to delivery. If by chance material was delivered and determined to be non-conforming, the load would be isolated and returned to sender. Waste/feed material is only accepted from approved established partners. Wormtech do not operate as a general waste receiver. Potential farm fed inputs are closely controlled and the type of waste accepted at the site must meet the requirements of the vermiculture process.

2.2.4 Office and Amenities

The site presently contains a transportable office building which caters for two staff. A manager's dwelling occupied by two of the owners of the business is used for the amenities for office and outdoor workers. The proposal includes the installation of a amenities block for workers adjacent to the transportable office. The amenities block would be sourced from Coates hire or similar. Plans for the

amenities block can be provided post approval. The use of the dwelling for amenities will cease when the transportable amenities is constructed. A total of 8 staff would occupy the site at any given time and the site would operate between 7am to 5pm – Monday to Friday.

3 AIR QUALITY CRITERIA

3.1 Introduction

The NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the "Approved Methods") (NSW EPA, 2022) sets out applicable impact assessment criteria for a number of air pollutants.

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the pollutants of interest in this study and the application air quality criteria for each pollutant.

3.2 Impact Assessment Criteria

3.2.1 Odour

NSW legislation prohibits emissions that cause offensive odour to occur at any off-site receptor. Offensive odour is evaluated in the field by authorised officers, who are obliged to consider the odour in the context of its receiving environment, frequency, duration, character and so on and to determine whether the odour would unreasonably interfere with the comfort and repose of the normal person. In this context, the concept of offensive odour is applied to operational facilities and relates to actual emissions in the air.

However, in the approval and planning process for proposed new operations or modifications to existing projects, no actual odour exists and it is necessary to consider hypothetical odour. In this context, odour concentrations are used and are defined in odour units. The number of odour units represents the number of times that the odour would need to be diluted to reach a level that is just detectable to the human nose. Thus, by definition, odour less than one odour unit (1 OU), would not be detectable to most people.

The range of a person's ability to detect odour varies greatly in the population, as does their sensitivity to the type of odour. Therefore, there can be a wide range of variability in the way odour response is interpreted.

It should be noted that odour refers to complex mixtures of odours, and not "pure" odour arising from a single chemical. Odour from a single, known chemical very rarely occurs (when it does, it is best to consider that specific chemical in terms of its concentration in the air). In most situations, odour will be comprised of a cocktail of many substances that is referred to as a complex mixture of odorous pollutants, or more simply odour.

For developments with potential for odour it may be necessary to predict the likely odour impact that may arise. This is done by using air dispersion modelling which can calculate the level of dilution of

odours emitted from the source at the point that it reaches surrounding receptors. This approach allows the air dispersion model to produce results in terms of odour units.

The NSW criteria for acceptable levels of odour range from 2 to 7 OU, with the more stringent 2 OU criteria applicable to densely populated urban areas and the 7 OU criteria applicable to sparsely populated rural areas, as outlined below.

Table 3-1 presents the relevant impact assessment criteria for complex mixtures of odorous pollutants.

Table 3-1 Impact assessment criteria – complex mixtures of odorous pollutants

| Population of affected community | Impact assessment criteria (OU) ¹ |
|--|--|
| Urban ($\geq \sim 2,000$) and/or schools and hospitals | 2.0 |
| ~500 | 3.0 |
| ~125 | 4.0 |
| ~30 | 5.0 |
| ~10 | 6.0 |
| Single rural residence ($\leq \sim 2$) | 7.0 |

1. 99th percentile nose-response time.

Potential odours associated with the operation of the Site are anticipated at only 2 nearby isolated rural residences (see **Figure 4-1**). Accordingly, an impact assessment criterion of 7.0 OU has been adopted for this study.

4 EXISTING ENVIRONMENT

4.1 Sensitive Receptors

The nearest and most potentially affected sensitive receptors have been identified for assessment purposes. These receptors are identified in **Table 4-1** and shown in **Figure 4-1**.

Table 4-1 Sensitive receptors

| Receptor ID | Address | Description |
|-------------|--------------------------|-------------|
| R1 | 120 Marin Road, Yenda | Residence |
| R2 | 229 Barracks Road, Yenda | Residence |

The dwelling immediately to the west of the Site is dilapidated and vacant and is therefore not considered in this assessment.

4.2 Local Meteorology

Meteorological conditions strongly influence air quality. Most significantly, wind speed, wind direction, temperature, relative humidity, and rainfall affect the dispersion of air pollutants. The following sub-sections discuss the local meteorology near the site.

4.2.1 Temperature, Humidity and Rainfall

Long term meteorological data for the area surrounding the site is available from the Bureau of Meteorology (BoM) Automatic Weather Station (AWS) at Griffith Airport. The Griffith Airport AWS is located approximately 20 kilometres north-west of the Site and records observations of several meteorological parameters including temperature, humidity, and rainfall.

Long-term climate statistics are presented in **Table 4-2**. Temperature data recorded at the Griffith Airport AWS indicates that January is the hottest month of the year, with a mean daily maximum temperature of 33.2°C. July is the coolest month with a mean daily minimum temperature of 3.5°C. March is the wettest month with an average rainfall of 41 mm falling over 5 days. There are, on average, 49 rain days per year, delivering 407 mm of rain.

Figure 4-1 Sensitive receptors

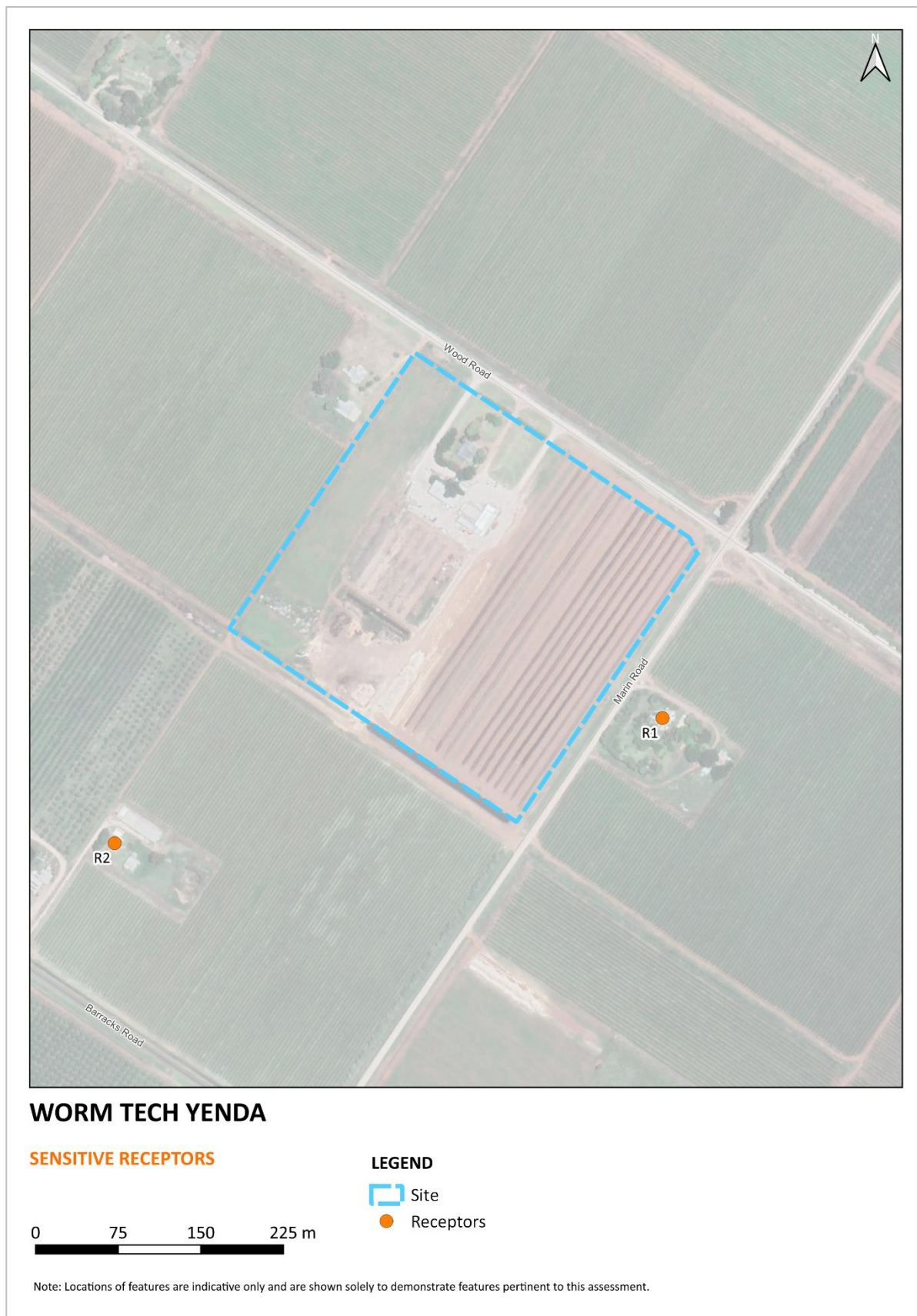


Table 4-2 Climate averages for Griffith Airport AWS

| Obs. | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Year |
|--|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| 9am mean temperature and humidity | | | | | | | | | | | | | |
| Temp(°C) | 23.0 | 21.7 | 18.5 | 15.3 | 10.6 | 7.9 | 6.9 | 9.0 | 12.3 | 16.8 | 18.8 | 21.3 | 15.2 |
| Hum(%) | 49 | 58 | 60 | 66 | 78 | 87 | 88 | 79 | 70 | 56 | 56 | 49 | 66 |
| 3pm mean temperature and humidity | | | | | | | | | | | | | |
| Temp(°C) | 30.6 | 30.2 | 27.0 | 22.8 | 18.2 | 14.3 | 13.3 | 15.5 | 18.9 | 22.8 | 26.0 | 28.6 | 22.4 |
| Hum(%) | 28 | 34 | 37 | 41 | 53 | 63 | 62 | 54 | 47 | 37 | 35 | 31 | 43 |
| Daily minimum and maximum temperatures | | | | | | | | | | | | | |
| Min(°C) | 17.4 | 17.4 | 14.3 | 10.3 | 7.0 | 4.5 | 3.5 | 3.8 | 5.9 | 9.2 | 12.8 | 15.3 | 10.1 |
| Max(°C) | 33.2 | 32.3 | 28.8 | 24.1 | 19.2 | 15.5 | 14.7 | 16.6 | 20.1 | 24.2 | 28.1 | 31.1 | 24.0 |
| Rainfall | | | | | | | | | | | | | |
| Rain(mm) | 36.0 | 28.1 | 36.2 | 29.1 | 35.5 | 35.4 | 32.8 | 35.3 | 33.4 | 40.8 | 35.5 | 32.5 | 406.7 |
| Rain Days | 3.3 | 2.6 | 3.0 | 3.2 | 4.2 | 4.9 | 5.5 | 5.6 | 4.7 | 4.7 | 3.6 | 3.3 | 48.6 |

4.2.2 Wind

As discussed in Section 5.1, a prognostic model has been used to develop site-specific meteorological data for dispersion modelling purposes. This prognostic model uses real observations of wind speed and wind direction to improve model performance. The BoM weather station at Griffith Airport AWS, which is located approximately 14 kilometres west of the Site has been used for this purpose.

Figure 4-2 to Figure 4-7 present annual and seasonal “wind rose” plots for Griffith Airport AWS for the period 2018 to 2022, inclusive. The plots show that easterly and south-easterly winds are prevalent for most of the year, with westerly and north-westerly winds also occurring throughout winter. Wind speed and wind direction during 2021 are considered representative of the five-year period and have therefore been adopted for assessment purposes.

Figure 4-2 Griffith Airport AWS wind roses, 2018

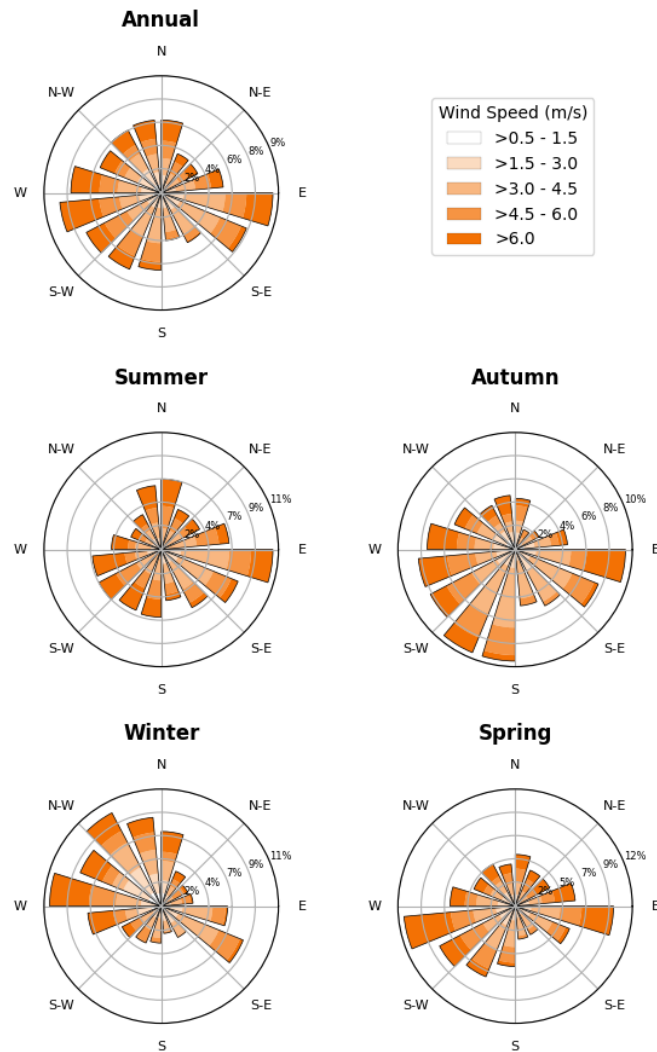


Figure 4-3 Griffith Airport AWS wind roses, 2019

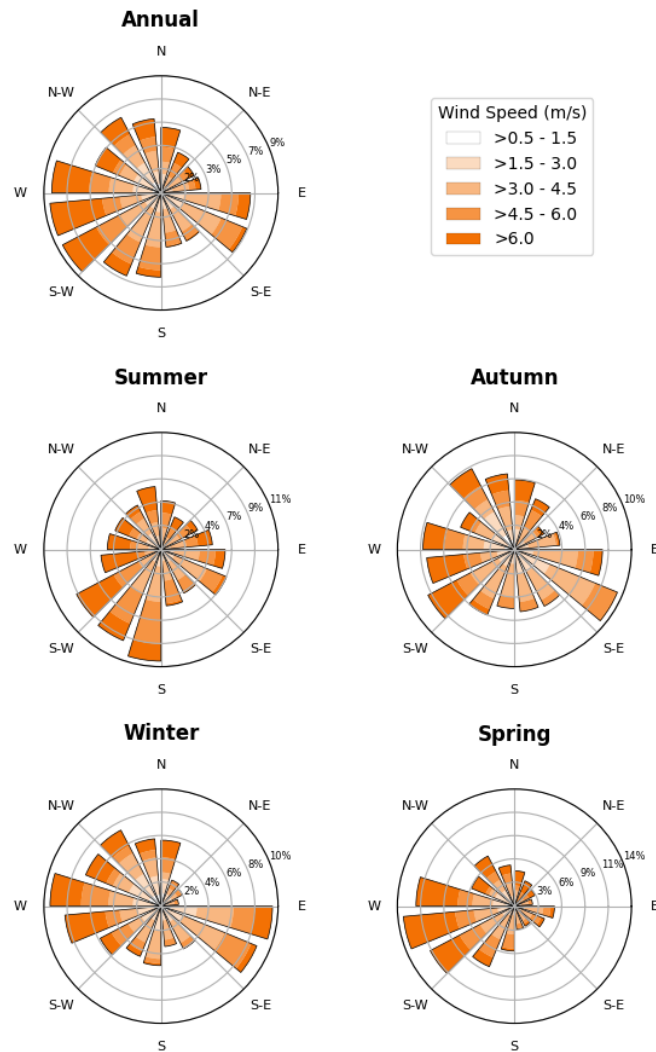


Figure 4-4 Griffith Airport AWS wind roses, 2020

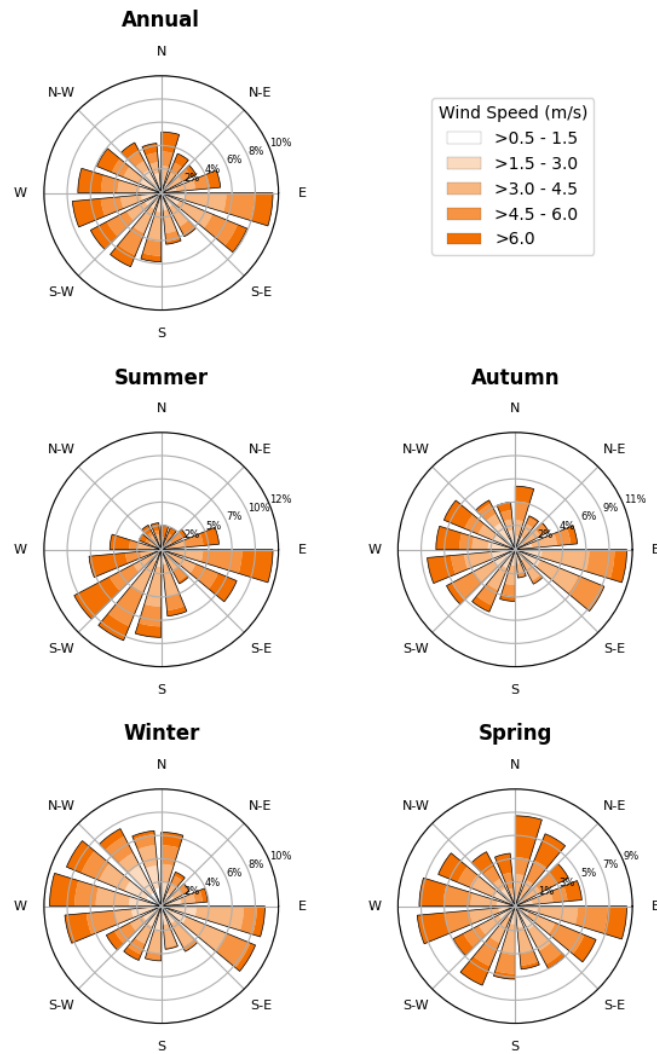


Figure 4-5 Griffith Airport AWS wind roses, 2021

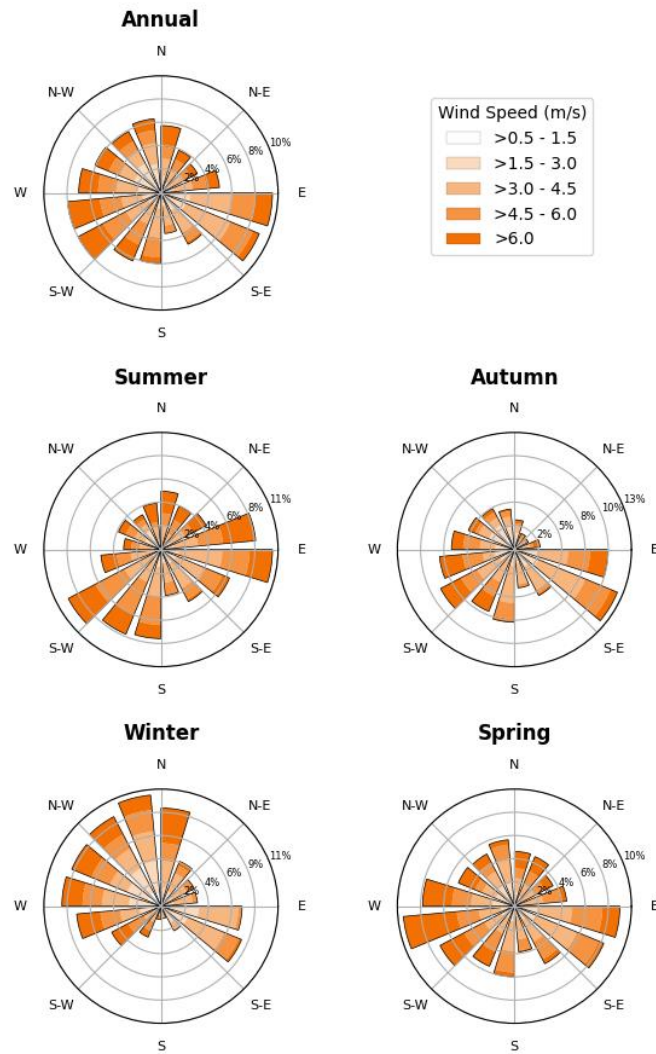


Figure 4-6 Griffith Airport AWS wind roses, 2022

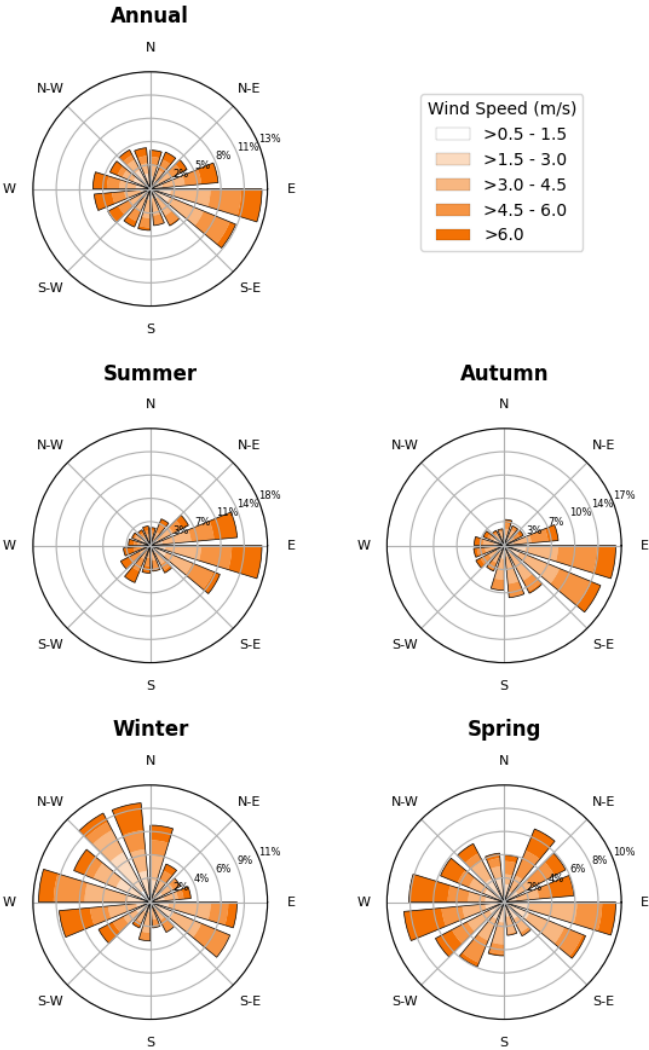
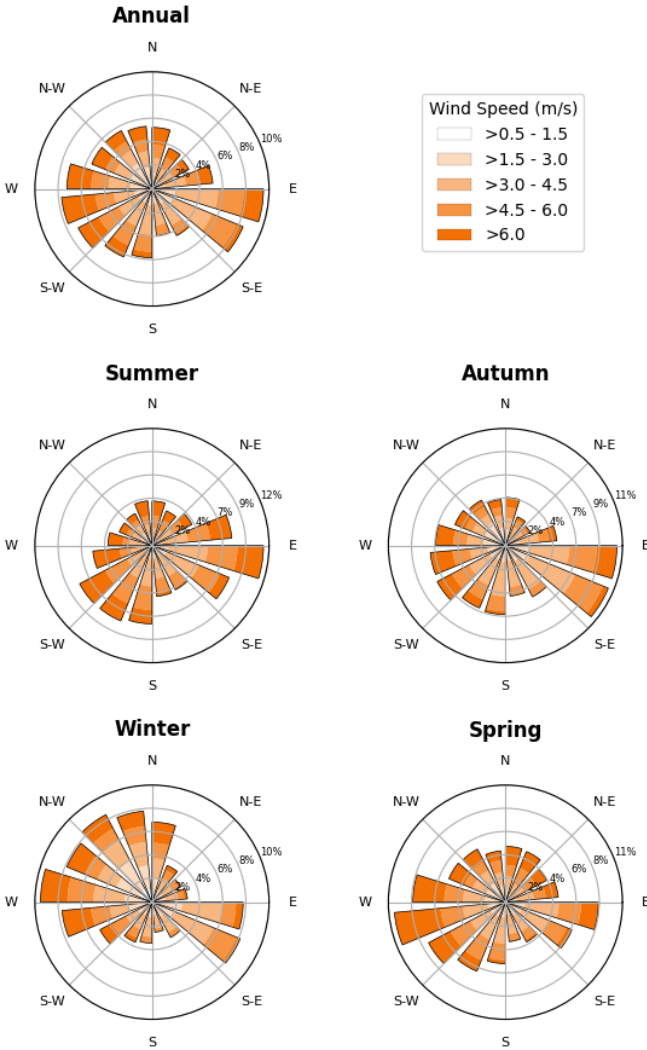


Figure 4-7 Griffith Airport AWS wind roses, 2018-2022



5 MODELLING METHODOLOGY

5.1 Meteorological Modelling

5.1.1 TAPM

No meteorological observation data is available for the area near the Project. Therefore, site-specific meteorological data was generated using a prognostic model. The prognostic model used was The Air Pollution Model (TAPM), developed and distributed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

TAPM is an incompressible, non-hydrostatic, primitive equations prognostic model with a terrain-following vertical coordinate for three-dimensional simulations. It predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of large-scale meteorology provided by synoptic analyses. TAPM benefits from having access to databases of terrain, vegetation and soil type, leaf area index, sea-surface temperature, and synoptic scale meteorological analyses for various regions around the world.

The prognostic modelling domain was centred at 34.258° S, 146.225° E and involved four nesting grids of 30 km, 10 km, 3 km and 1km with 41 grids in the lateral dimensions and 25 vertical levels.

The TAPM model included assimilation of wind data collected at the Griffith Airport AWS BoM Station during 2021.

5.1.2 CALMET

The three dimensional prognostic wind field from the TAPM simulation was incorporated in a CALMET model as the initial guess wind field. CALMET was run using the 'No-Observations Approach' recommended by TRC (2011).

The CALMET domain was 6 x 6 km with a grid resolution of 0.15 km. Local land use and topographical data (SRTM 3) were used to produce realistic fine scale flow fields in the area surrounding the site.

5.2 Dispersion Model

5.2.1 CALPUFF

CALPUFF is a non-steady state Gaussian puff dispersion model, developed for the US EPA and approved for use by the NSW EPA. CALPUFF is considered an advanced dispersion model and is intended for use in situations where less advanced Gaussian plume models are not appropriate. CALPUFF is most often used in areas exhibiting one or more of the following features:

- Complex terrain;
- Recirculating coastal sea breezes;
- High frequency of calm winds; and,
- Buoyant line sources.

CALPUFF is also the preferred dispersion model for odour, and for this reason has been selected for this assessment.

5.2.2 Peak to Mean Ratios

To account for the time-averaging limitations of the dispersion model, peak-to-mean ratios have been incorporated into all odour flux rates in accordance with the Approved Methods. Peak-to-mean ratios for various source types, as prescribed by the Approved Methods, are presented in **Table 5-1**.

Table 5-1 Peak-to-mean ratios

| Source type | Pasquill-Gifford stability class | Peak-to-mean ratio | |
|--------------------------------|----------------------------------|--------------------|-----------|
| | | Near-field | Far-field |
| Area | A, B, C, D | 2.5 | 2.3 |
| | E, F | 2.3 | 1.9 |
| Line | A-F | 6 | 6 |
| Surface wake-free point | A, B, C | 12 | 4 |
| | D, E, F | 25 | 7 |
| Tall wake-free point | A, B, C | 17 | 3 |
| | D, E, F | 35 | 6 |
| Wake-affected point | A-F | 2.3 | 2.3 |
| Volume | A-F | 2.3 | 2.3 |

5.2.3 Building Wake Effects

All odour emissions associated with the Site were modelled using area sources, which are not affected by building wakes.

5.3 Emissions inventory

A site visit was conducted on 5 April to identify potential sources of odour associated with the operation of the Site. Based on the site visit, the following potential odour sources were identified:

- Vermiculture windrows
- Input material stockpiles
- Leachate storage dams.

It was noted during the site visit that odours from the above sources were relatively faint, particularly from the windrows and the leachate storage dams.

During the site visit, a very strong odour was detected in a drain, running along the northern side of Wood Road, near the Corner of Wood Road and Marin Road. This odour was not associated with the Site.

For assessment purposes, specific odour emission rates (SOER) have been adopted from relevant literature, as summarised in **Table 5-2**.

Table 5-2 Specific odour emission rates

| Source | SOER (OU/m ² /s) | Reference |
|------------------|-----------------------------|-----------------|
| Finished compost | 0.15 | Northstar, 2022 |
| Leachate | 0.3 | Northstar, 2022 |

The SOER in **Table 5-2** have been applied to the relevant areas on the site (see **Figure 2-1**) to arrive at the total odour emissions for each source/activity, as summarised in **Table 5-3**.

Table 5-3 Odour sources and emission rates

| Source/Activity | Area (m ²) | SOER (OU/m ² /s) | Odour emission rate (OU/s) |
|-----------------------|------------------------|-----------------------------|----------------------------|
| Vermiculture windrows | 16,704 ¹ | 0.15 | 2,506 |
| Input stockpiles | 5,437 | 0.15 | 816 |
| Windrow leachate | 1,192 | 0.3 | 358 |
| Stockpile leachate | 378 | 0.3 | 113 |

1. Area of 16 windrows, nominally 3 metres wide, 1 metre high, 290 metres long.

6 ASSESSMENT OF IMPACTS

The predicted odour concentrations at sensitive receptors, due to the operation of the Site, are presented in **Table 6-1**.

Table 6-1 Predicted 99th percentile odour concentrations at sensitive receptors

| Receptor | Predicted odour concentration (OU) | Impact assessment criterion | Complies? |
|----------|------------------------------------|-----------------------------|-----------|
| R1 | 7.0 | 7.0 | Yes |
| R2 | 3.0 | 7.0 | Yes |

Review of Table 6-1 indicates that the predicted odour concentrations at sensitive receptors comply with the impact assessment criterion.

A contour plot of the predicted odour concentrations is provided in Appendix A.

7 SITE MANAGEMENT

The following management measures are currently in place to manage potential off-site dust and odour impacts associated with the operation of the Site.

- All organic feed material is either delivered to site pasteurised (compost and mulches) or is put through a thermophilic pasteurisation step prior to use as feed stock to minimise off odours.
- No machinery movement occurs on windy days (gusts of > 20 knots) to reduce dust impacts.
- After putting out fresh feed material in row, water is applied to wet and bed in freshly applied organic material.
- Final screening of worm castings occurs within shed on site with no off odours and minimum dust generated from the material handling processes as the castings are not allowed to completely dry out.
- Equipment that is in contact with odour producing material during the above management practices are washed down immediately after use.

8 CONCLUSION

Wormtech Pty Ltd (Wormtech) operates a vermiculture composting facility at 224 Wood Road, Yenda (the Site).

SoundIN Pty Ltd (SoundIN) has been engaged by Wormtech to conduct an air quality impact assessment (AQIA) for the Site.

The assessment has been conducted in general accordance with the NSW EPA's *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the "Approved Methods").

Based on observations from a site visit, odours were detected on the Site and are considered to warrant detailed assessment whereas dust emissions were observed to be small and can be effectively managed through good housekeeping.

Potential off-site odour impacts associated with the operation of the Site were predicted using the CALPUFF dispersion modelling system.

The modelling results indicate that predicted odour concentrations at sensitive receptors comply with the impact assessment criterion.

9 REFERENCES

Northstar 2022, *Air Quality Impact Assessment, Worm Tech Composting Facility, Carathool NSW*, Northstar Air Quality, March 2022.

NSW EPA 2022, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, New South Wales Government and the Environment Protection Authority, August 2022.

TRC 2011, *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, Australia*, TRC Environmental Corporation, March 2011.

APPENDIX A

CONTOUR PLOTS

Figure A-9-1 Predicted 99th percentile odour concentration

