Shoalhaven Starches Modification 31

Air Quality Impact Assessment

Manildra Group

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→ The Power of Commitment

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Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.7 and the assumptions and qualifications contained throughout the Report.

Assessment overview

GHD was engaged by Manildra to conduct an air quality and odour impact assessment for a proposed modification to the approved SSEP. The modification seeks to deploy a suite of heat recovery updates and enabling infrastructure to capture and transform waste heat into usable energy to drive the ethanol, starch and gluten manufacturing processes. This will ultimately reduce the amount of virgin steam that is required by 75 tph (637,500 tpa) displacing the need to burn natural gas at the plant's onsite co-generation plant and other gas-fired boilers.

The assessment was undertaken in accordance with relevant legislation and government guidance.

Construction assessment findings

Potential impacts associated with dust emissions during construction of the proposed modification were assessed using a risk assessment based on the UK IAQM guidance. Construction activities were identified to primarily consist of installation of prefabricated structures and minor earthworks. The risk identified for all construction activities was low risk for dust soiling, and negligible risk for human health and ecological impacts. Recommendations for dust management during construction were provided to further reduce the risk of dust impacts from construction of the proposed modification.

Operational assessment findings

A quantitative assessment utilising dispersion modelling was adopted to assess odour and air pollutant (including particulates, combustion pollutants and metals) emission during operation of the proposed modification.

An updated odour emissions inventory was prepared based on the findings of the Odour PRS and NSW EPA feedback. Odour emissions inventories were prepared for two scenarios based on average odour sampling data across the last four quarters (last 12 months of data) and worst case (highest) odour sampling data for one quarter.

The odour modelling predicted compliance with the odour criteria for both the average sampling data scenario and the worst case quarter sampling data. Compliance was predicted at all residential receptors.

A source contribution analysis was undertaken and recommendations were provided to investigate potential management and mitigation options to reduce off-site odour impacts.

Review of recent odour complaints concluded that relatively few complaints have been received in recent years. Recent field ambient odour assessments undertaken by Northstar indicate that odour was not often detectable offsite, and on occasions where odour was detectable, it was characterized as either 'Very Weak' or 'Weak'. The odour surveys tend to support model findings of predicted odour concentrations within the NSW EPA criteria range. Odours classified as weak would likely be below 5 OU which is often attributed as an annoyance threshold for odour.

An air pollutant emissions inventory was prepared incorporating the reduced gas consumption from installation of the heat recovery upgrades. Compliance with the assessment criteria was predicted at all receptors for all pollutants.

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1. Introduction

1.1 Overview

GHD was engaged by Shoalhaven Starches Pty Ltd (Manildra) to conduct an air quality impact assessment for a proposed modification to the Shoalhaven Starches Expansion Project (SSEP) (Modification 31 or MOD31).

This report addresses the relevant requirements in the NSW Secretary's Environmental Assessment Requirements (SEARs) for the project issued in March 2025 (as outlined in Section 3.2) and assesses the potential air quality impacts associated with the project. Specifically, this report describes the background and scope of the proposed modifications with respect to potential implications to air quality and includes assessment of construction dust and operational air pollutants (including odour).

1.2 Background

Manildra operates the Shoalhaven Starches factory (the factory) at Bolong Road, Bomaderry, near Nowra, in NSW (the site). At the factory, flour and grains are processed to produce ethanol, starch, gluten, glucose and distiller's dried grain (DDG).

Manildra is the holder of Environment Protection Licence (EPL) number 883 issued by the New South Wales Environmental Protection Authority (NSW EPA).

1.3 General site overview

Wheat flour and grains (wheat) are processed at the Manildra factory to produce ethanol, starch, gluten and glucose. Solid wastes are treated to produce DDG, with liquid wastes being transferred to the environmental farm wastewater treatment plant. Excess treated wastewater is irrigated onto pasture. The main processing and materials treatment areas (plant group areas) at Shoalhaven Starches comprise the:

– Flour mill
  - The flour mill is used to mill wheat grain into flour which is then further processed through the various site processing plants to produce starch, gluten, glucose and ethanol. All remaining mill feed and pollard (flour sieving rejects) is processed through the DDG dryers for sale as stock feed. Flours from the various grinding operations are collected and blended together before passing through final treatment and weighing operations to bulk storage bins. Flour is taken from these bins for use in existing site production processes.
– Starch & Gluten plant
  - Within the starch plant, flour is processed to separate the starch from gluten (the protein component of flour). The starch is graded, dried and packed for shipment. Different grades of starch are manufactured for food and paper making applications. Starch that is not used for these applications is used as a raw material for the ethanol plant. Gluten is dried and sold for use in the food industry.
  - Aqueous (water-based) wastes are reused within the plant or are transferred to the environmental farm wastewater treatment plant.
– Glucose plant
  - The glucose plant (contained within the starch plant area) houses two lines; the 'confectioners' glucose line and the 'brewers' glucose line. Confectioner's glucose is distinguished by having been demineralised to remove latent odours and flavours that might be carried through to the final product by the glucose.
  - Both processes use starch as the raw material. The starch is broken down to its constituent glucose molecules using enzymatic and hydrolytic processes. Water is removed from the resulting solutions using evaporation to produce glucose and brewer's solutions of desired concentration. The glucose product is shipped to customers in bulk containers.
  - The glucose manufacturing process generates aqueous wastes, mostly condensate from the evaporators, which is reused during regeneration of the ion exchangers.

– Ethanol and distillation plants
  - Waste starch from the starch plant is transferred to the ethanol plant and fermented to produce ethanol. Starch, which is in suspension, is heated in jet cookers before being fermented.
  - Fermentation is carried out in fermentation vessels using the treated substrate to which an ethanol-producing yeast inoculum has been added. The yeast inoculum is generated using yeast propagator vessels, these being seeded using commercial strains of yeast.
  - Wastes from the fermenters are transferred to the DDG plant for processing. Fermentation liquor from the ethanol plant is transferred to the distillation plant where water and other impurities are removed to produce various grades of ethanol.
– DDG plant
  - Wastes from the ethanol and distillation plant are dewatered in decanter centrifuges and dried in steam dryers to produce granular DDG. Light phase from the DDG decanters is evaporated to recover soluble protein (syrup) and produce clear condensate (liquid line). The syrup is added to the dryer feed for recovery of the solids (solids line). DDG granular product is transferred to the DDG Pellet Plant for pelletising; the DDG pellets are stored in silos. Some of the granular DDG product is stored in a storage shed until it is loaded into trucks in the DDG load-out area.
– Packing plant
  - Dried gluten/starch will be pneumatically transferred from the existing site to the new packing plant (currently under construction) via underground pipes. This dried material is proposed to be stored in silos.
  - The packing plant will consist of seven silos that will store either gluten or starch product. The medium and large silos are to be filled 24 hours a day, seven days a week, while the small silos can be filled at any time of the day for eight hours.
– Environmental farm
  - A number of wastewater streams are produced at the factory. These consist of five clear condensate streams (distillation plant condensate, evaporator condensate, DDG condensate, a small flow from the carbon dioxide plant and boiler blowdown) and a combined ‘dirty’ stream from the factory processes. The ‘dirty’ wastewater streams are combined in the farm tank (located at the factory) and pumped to the wastewater treatment plant. Treated water is pumped back to the factory for re-use, while excess treated water is stored in dams for irrigation on the farm.
– Co-generators and boilers
  - Steam, which is used in various processes throughout the factory, is generated by using a combination of gas fired boilers (all existing boilers would be converted to operate on gas) and two gas fired co-generation turbine generators.
  - The site intends to rely primarily on the gas-fired co-generation plant to provide the baseload energy and steam production requirements for site operations. Certain boilers would operate at reduced capacity to meet any unexpected peaks in steam demands whilst other boilers would be allocated to standby duty (offline and not operating) for use during maintenance of the co-generation plant.
– Biofilters
  - Exhaust air from odorous sources at the DDG plant is captured and ducted to two existing soil-bed biofilters, each having a surface area of 100 m^2, located at the southwest corner of the factory (on the southern margin of the container storage area). An additional two biofilters are currently undergoing commissioning. The biofilters comprise a bed of organic bark and compost material (the matrix), with distribution of the odorous airstream through the floor of the biofilter via a manifold. Biological oxidation of odorous compounds takes place as the foul air percolates upward through the matrix. The oxidation is achieved by a population of microorganisms in the bed.
  - While the efficiency of biofilters destroying odorous components of the waste air varies according to a range of factors including soil moisture, composition and temperature, it is very high. Any odour in the exhaust air from the biofilter is due to the inherent odour of the matrix materials and typically has an ‘earthy’ characteristic.

1.4 Proposed modification

MOD31 seeks to deploy a suite of heat recovery updates and enabling infrastructure to capture and transform waste heat into usable energy to drive the ethanol, starch and gluten manufacturing processes. This will ultimately reduce the amount of virgin steam that is required by 75 tph (637,500 tpa) displacing the need to burn natural gas at the plant's onsite co-generation plant and other gas-fired boilers.

To facilitate this, MOD31 proposes to:

– Introduce mechanical vapour recovery (MVR) technology stack and enabling infrastructure onto the beverage-grade ethanol distillery.
– Reconfigure and consolidate the distillation column for increased efficiency, including replacing aging infrastructure.
– Install a heat recovery system onto the DDG dryers which will capture hot process gasses and transfer through a heat exchanger to process water that heats the air.

A summary of site changes proposed as part of MOD31 and anticipated changes to emissions to air is provided in Table 1.1.

Table 1.1 Summary of MOD31 works with respect to emissions to air

Factory component	Proposed MOD31 works	Anticipated emissions to air	
		Odour	Particulate matter and gaseous pollutants
Co-generation turbines	Reduction in fuel	Nil	Construction dust Operational emissions from combustion (dust and gaseous emissions)

Note that no changes in emissions of odour are proposed. However, odour modelling has been undertaken to incorporate the most recent odour sampling data.

1.5 Context of modification

It is noted that the New South Wales Environmental Protection Authority (NSW EPA) has issued an Odour Pollution Reduction Study (Odour PRS) as part of an amendment to Manildra's EPL No. 883. GHD has completed all three stages of the Odour PRS.

The Odour PRS relates to odour only from the Shoalhaven Starches site, and no other pollutants such as particulates, combustion pollutants or metals emissions are considered in the Odour PRS.

The Odour PRS aimed to confirm the sources of odour at the site, simplify odour modelling and facilitate greater interrogation of model results to allow identification of key sources and focused mitigation efforts. Based on EPA's review and comments to date, the modelling methodology largely remains the same and additional requirements have been included related to capturing, benchmarking and use of odour sampling data.

The existing modelling methodology (which has undergone refinement based on NSW EPA feedback) was adopted to assess this modification. Further refinement of the modelling methodology may be required for future modifications if significant changes to odour sources are proposed.

The preparation of the odour assessment component of this MOD31 air quality impact assessment gave consideration to the Odour PRS outcomes and sought to address the Odour PRS requirements as much as possible.

1.6 Scope

The scope of the air quality impact assessment (AQIA) included the following tasks:

– Modification details were reviewed including the proposed construction methodology and any changes to site operations due to implementation of the proposed modification.
– A qualitative risk-based assessment was undertaken to assess dust emissions to air during construction of the modification in accordance with Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management (2024).
– An updated odour emissions inventory was prepared for the site including sources identified in the Odour PRS and the latest odour sampling data.
– An updated particulate and gaseous pollutant emissions inventory was prepared for the site including adjustments to sources proposed in the modification.
– A site specific meteorological model was developed which incorporated observational data from Manildra's weather station.
– Air quality including odour dispersion modelling was undertaken to predict odour impacts at nearby sensitive receptors. Results of the dispersion modelling were processed, interpreted and summarised.
– An air quality assessment report (this report) was prepared that outlines the assessment methodology, the outcomes of the dispersion modelling and the findings of the assessment.

1.7 Limitations

This report: has been prepared by GHD for Manildra Group and may only be used and relied on by Manildra Group for the purpose agreed between GHD and Manildra Group as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Manildra Group arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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) 1.8 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared the dispersion model ("Model") for, and for the benefit and sole use of, Manildra Group to support the MOD31 air quality impact assessment and must not be used for any other purpose or by any other person.

The Model is a representation only and does not reflect reality in every aspect. The Model contains simplified assumptions to derive a modelled outcome. The actual variables will inevitably be different to those used to prepare the Model. Accordingly, the outputs of the Model cannot be relied upon to represent actual conditions without due consideration of the inherent and expected inaccuracies. Such considerations are beyond GHD's scope.

The information, data and assumptions ("Inputs") used as inputs into the Model are from publicly available sources or provided by or on behalf of the Manildra Group, (including possibly through stakeholder engagements). GHD has not independently verified or checked Inputs beyond its agreed scope of work. GHD's scope of work does not include review or update of the Model as further Inputs becomes available.

The Model is limited by the mathematical rules and assumptions that are set out in the Report or included in the Model and by the software environment in which the Model is developed.

GHD has prepared this report on the basis of information provided by Manildra Group and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

1.8 Assumptions

The major assumptions used in this assessment are as follows:

- The assessment methodology and key assumptions are outlined in Section 2. It is acknowledged that significant variability in source odour emissions measures exists, however the methodology aimed to model a realistic worst case scenario.
- Construction works were considered relatively minor and therefore a qualitative construction dust assessment was considered appropriate.
- The odour emissions inventory is based on odour sampling data obtained by Stephenson Environmental Management Australia (SEMA) and Ektimo. Where odour sampling had not been undertaken for a particular source or if the source is proposed and is not yet built, an odour emission rate and source discharge parameters were assumed based on data for similar sources on site and/or design specifications.
- The dispersion modelling was undertaken using the NSW EPA and US EPA approved regulatory Gaussian puff dispersion model CALPUFF version 7, which was considered appropriate for the location. Limitations with the predicted concentrations are inherent within the model and in its ability to handle multiple buildings and stacks in a complex setup, with wake effects included. As such, the layout of the plant was simplified in order for the model to handle the setup.
- Meteorological modelling incorporates weather observations and is therefore reliant on the accuracy of weather observations recorded at Manildra's weather station.
- It is understood that increased ethanol production can be primarily facilitated by use of existing equipment however increased turnover of 'batch processes' (i.e. filling of tanks / silos such as the fermenters and grain storage silos) will be required. Dispersion modelling conservatively assumed emissions (both odour and air pollutants) occurred continuously 24 hours per day, 7 days per week. It is acknowledged that some processes (such as batch filling) would results in temporary emissions that occur during 'active phases' only. This is a modelling conservatism and therefore no further consideration with regard to emissions estimation was required to account for increased turnover of batch processes that would occur due to the Modification.

2. Assessment methodology

2.1 General

This AQIA for the construction and operation of the project was completed in accordance with NSW EPA and contemporary guidance to assess air quality impacts from the project. Atmospheric dispersion modelling was undertaken to evaluate the potential worst-case impacts from operation of the project and to inform recommendation of appropriate mitigation measures to minimise any potential impacts.

2.2 Approach

2.2.1 Construction assessment

A review of the proposed construction methodology including identification of potential emissions to air that could occur during construction and proximity to sensitive receptors was undertaken to determine the level of assessment deemed appropriate to assess construction works. It was determined that construction activities would primarily consist of installation of prefabricated structures and minor earthworks. Therefore the magnitude of dust emissions is expected to be low. Review of aerial imagery determined a moderate buffer distance between proposed construction works and sensitive receptors. Therefore the risk of dust impacts was considered to be low.

The review concluded that a qualitative-based approach that focused on management was considered suitable to assess the construction of the proposed modification. A methodology consistent with the Institute of Air Quality Management Guidance on the assessment of dust from demolition and construction (2024) (IAQM guidance) (Institute of Air Quality Management, 2024) was adopted to assess potential particulate matter (dust) impacts during construction of MOD31.

2.2.2 Operational assessment

A quantitative air quality assessment utilising air quality dispersion modelling was undertaken to assess potential worst case air quality impacts from operation of the proposed modification in accordance the NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (2022) (the Approved Methods).

Based on a review of the proposed modification, the pollutants of interest that would be emitted during operation of the proposed modification were identified to include:

- Odour (in the form of complex mixtures of odorous air pollutants)
- Particulate matter (dust):
  - Total suspended particles (TSP)
  - Fine particulate matter less than 10 micron equivalent aerodynamic diameter (PM_{10})
  - Fine particulate matter less than 2.5 micron equivalent aerodynamic diameter ($PM_{2.5}$)
- Gaseous air pollutants:
  - Carbon monoxide (CO)
  - Sulfur dioxide (SO_2)
  - Nitrogen dioxide (NO_2)
  - Polycyclic aromatic hydrocarbon (PAH)
  - Volatile Organic Compounds (VOCs)
- Metals:
  - Type 1 metals: Arsenic, Cadmium, Lead, Mercury
  - Type 2 metals: Beryllium, Chromium, Manganese, Nickel

2.3 Modelling method

2.3.1 Dispersion model selection

A review of the surrounding terrain, air emission sources and distance to nearby receptors was undertaken to inform the choice of dispersion model used for this assessment.

Given the site's location which may be subject to land-sea wind interaction to the east, terrain features to the north and west and importance of modelling of calm conditions which typically result in worst case odour dispersion, GHD found CALPUFF to be the most appropriate dispersion modelling software to use for the project.

CALPUFF is an advanced non-steady-state, Gaussian puff dispersion model that uses a three dimensions spatially varying wind field that is capable of accounting for complex terrain features and varying wind fields.

2.3.2 Emission inventory development

2.3.2.1 Odour emissions inventory

A detailed odour emissions inventory was prepared for the site based on an extensive library of site odour sampling data. The findings of the Odour PRS and NSW EPA recommendations and feedback were included in the odour emissions inventory to the greatest extent possible.

The odour emissions inventory was prepared based on the following methodology:

- **For EPA identified sources** (these are sources where a significant number of odour samples exist and are typically identified as significant (high odour) sources):
  - A review of quarterly odour sampling data was undertaken to understand variability in site-wide odour emissions and identify quarters that exhibited worst case (highest) odour emissions (refer to Section 6.1 for review of quarterly odour sampling data).
  - The review gave consideration to plant design ranges (maximum and minimum design operating rates).
  - Where a source was not sampled on a given quarter (due to inability to access the source or due to safety concerns) an assumed odour emissions rate was adopted based on an average of data collected over previous/future quarters within the last year.
  - The review identified the worst case quarter (over the last one year period) for consideration in dispersion modelling:
    - 2023-2024 Q4
  - To account for 'typical' or average operations, an average scenario was considered whereby an average of odour sampling data collected over the last 12 months (i.e. last 4 quarters being 2023-2024 Q4, 2024-2025 Q1, 2024-2025 Q2, 2024-2025 Q3) was adopted. This scenario provides further context to model predictions.
- **For all remaining sources** (these are sources where fewer odour samples exist (typically 1 – 2 samples):
  - Where a single odour sample exists, this data was adopted.
  - Where multiple samples exist, the most recent odour sampling data was adopted (this approach was assumed appropriate as, in most cases, the second odour sampling event was commissioned because of the age of the original odour sampling (in some cases the original odour sampled dated back to 2007) and therefore the second odour sampling event sought to more accurately characterise the source with reference to current site operations. It is noted that in most cases, the repeat sampling was undertaken recently to inform the Odour PRS.
- **For sources without sampling data** (no odour samples exist):
  - A review of the site odour sampling data database was undertaken, and data from the most similar source was used alongside any design information to estimate source discharge parameters and odour emissions.

Odour emissions inventories were prepared for the following two scenarios:

– A worst case quarter from the last four quarters: 2023-2024 Q4 sampling data
– Average across the last four quarters

This approach was developed to:

– Give consideration to factory complexities and interconnected nature of the odour sources (i.e. significant variability was observed in quarterly odour sampling results, however it appears that worst case (highest) odour emissions do not occur at the same time for different plant areas. Therefore this approach aims to prioritise use of contemporaneously collected sampling data (as far as practical given limitations to odour sampling) so that odour emissions from the site at a single point in time are quantified).
– Acknowledge that maximal odour emissions rates are unlikely to occur at all times by use of data from a single quarter. This is evident in the summary of quarterly odour sampling data review (refer Section 6.1), which shows significantly higher odour emissions in some quarters compared to others.
– Account for potential changes in odour profile over time due to site changes (such as modifications) and process improvements and prioritise use of contemporary data where possible to more accurately characterise current and future odour emissions at the site.
– Give consideration to model sensitivity to odour emissions rate inputs by modelling two scenarios.
– Provide a conservative modelling outcome by use of the highest quarter odour data.

2.3.2.2 Particulate matter, gaseous air pollutants and metals emissions inventory

A detailed particulate matter, gaseous air pollutants and metals emissions inventory (collectively referred to as 'air pollutants') was prepared for the site based on site sampling data, design specifications and documented emissions estimation factors outlined in National Pollutant Inventory Emission estimation technique manuals (NPI factors). It should be noted that where site sampling had been undertaken, use of this data was prioritised in emissions estimation.

Air pollutant emissions inventories were prepared for a typical operating scenario (both gas cogeneration turbines operating a full capacity).

2.3.3 Meteorology

Past odour modification air quality assessments (up until and including MOD23, assessed in *Shoalhaven Starches Modification 23 – gas fired co-generation Air Quality Assessment*, (GHD 2022) (MOD23 Air Quality Assessment) utilised the original meteorological file prepared for the 2008 Air Quality Assessment (*Report on Ethanol Upgrade Air Quality Assessment*, GHD 2008) which was accepted at the time by EPA.

Use of the original meteorological file allowed direct comparison of results between different previous modifications such that any consequences of the proposed modification (changes to emissions to air) would be clearly identifiable in the results and not confused with inherent changes in predictions due to use of a different meteorological file.

An updated site-specific meteorological model spanning October 2022 to October 2023 was used for the latest odour related modification being MOD29, assessed in *Shoalhaven Starches Modification 29 – Expansion Project Air Quality Impact Assessment* (GHD, 2024). This updated model was used for the MOD31 air quality assessment as recommended by the Odour PRS. The new meteorological model was updated to include a more recent time period and incorporated meteorological observations from Manildra's weather station.

The meteorological file was developed in accordance with the methodology outlined in Appendix A.

2.3.4 Dispersion modelling

Predicted air quality impacts were modelled in accordance with the Approved Methods using an approved computer software model CALPUFF.

CALPUFF model settings were generally selected based on 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).

For this assessment, the CALPUFF dispersion model was used to predict ground-level concentrations from the project. The CALPUFF dispersion model utilised a meteorological dataset of one year in duration.

The following settings were used in the simulations:

– Model: CALPUFF Version 7
– Both discrete and gridded and discrete receptors were modelled. Discrete receptors were selected based on a review of aerial imagery (refer Section 4.2 for selection of discrete receptors). The following gridded receptor selection was adopted:
    - For odour, gridded receptors were modelled based on an internally nesting 3 km x 3 km grid with a 50 m grid resolution and an outer grid of 18 km x 10 km, with a 200 m grid resolution. Dual grids were modelled due to software limitations (CALPUFF is only able to process a maximum of 10,000 receptors). Therefore a finer internal grid was chosen to resolve odour predictions in areas of interest (i.e. near the site and sensitive receptor locations), whilst a coarser grid was used to quantify the entire extent of predicted odour impacts within the limitations of the software.
    - For particulate matter, gaseous air pollutants and metals emissions inventory a grid of 18 km x 10 km, with a 200 m grid resolution was adopted.
– Emissions were scaled based on a nose-response time for odour of one second, applying a peak-to-mean ratio to the one hour average concentration of 2.3 for wake affected point sources and volume sources, and variable scaling for area sources
– Building wake effects from existing buildings and large structures on site (including changes to the building layouts proposed in the modification) were modelled to the extent practicable through use of the Building Profile Input Program (BPIP) PRIME algorithm. BPIP PRIME is the preferred building wake algorithm recommended by the Approved Methods. Building footprints and heights were imported into CALPUFF based on inspection of aerial imagery and plant design drawings. The location of all buildings considered in the model is shown on Figure 2.1.
– Horizontal discharge sources were modelled using the rain cap option in CALPUFF (which sets the vertical momentum of the discharge to zero)

A contemporaneous approach was adopted for PM_{10}, $PM_{2.5}$ and NO_x for calculating cumulative concentrations. Predicted incremental concentrations were added to recorded daily and hourly variable background concentrations for the same period to calculate predicted cumulative particulate concentrations.

Chemical transformations were not modelled within CALPUFF, however the ozone limiting method (OLM) which is listed as Method 2 for estimating total NO_2 in the Approved Methods was adopted. Method 1 (Section 8.1.1 of the Approved Methods) in the Approved Methods assumes 100 % of NO will be converted to NO_2. This is considered extremely conservative as in reality, only a fraction of NO will be converted to NO_2. Therefore, a more detailed assessment has been undertaken for all receptors using Method 2 (Section 8.2.2) of the Approved Methods. Method 2 is based on NO reacting with ozone in the atmosphere to form NO_2. Hourly variable background ozone and NO_2 data was sourced from nearby DPIE AQMS (refer Section 4.3.4). The Method 2 equation for estimating NO_2 concentrations is as follows;

$$[NO_2]_{total} = \{0.1 \times [NO_x]_{pred}\} + MIN\left\{(0.9) \times [NO_x]_{pred}\ or\ \left(\frac{46}{48}\right) \times [O_3]_{bkgd}\right\} + [NO_2]_{bkgd}$$

Due to modelling limitations, model predictions are outputted in 1 hourly timesteps. Therefore estimation of shorter time periods, which is required for CO (refer Table 3.4), was undertaken in accordance with guidance contained within Victorian EPA publication 1551 (Guidance notes for using the regulatory air pollution model AERMOD in Victoria, 2013) which recommends use of the following equation:

$$C(t) = C(t_0) \times \left(\frac{t_0}{t}\right)^{0.2}$$

Where; (t) is the averaging time (minutes) of interest (15 minute in this case) and (t_0) is the averaging time consistent with the model outputs (60 minutes in this case).

Figure 2.1 Model building locations

3. Legislative and policy context

3.1 Legislative and policy context to the AQIA

The relevant legislation and guidance for the AQIA of the project are:

– NSW *Protection of the Environment Operations Act 1997* (POEO Act) – 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. For point source emissions where no standard of concentration and/or rate has been set, and for non-point source emissions, 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', subject to limited defences.

– NSW Protection of the Environment Operations (Clean Air) Regulation 2021 (POEO Clean Air Regulation) – The POEO Clean Air Regulation provides regulatory measures to control emissions from motor vehicles, fuels, and industry.

– National Environment Protection Council (NEPC) National Environment Protection (Ambient Air Quality) Measure 2021 (the Air NEPM) – The National Environment Protection Council of Environmental Ministers, now the National Environment Protection Council (NEPC), set uniform national standards for ambient air quality. The document containing these standards is known as the Air NEPM, which also contains goals for the identified relevant pollutants inclusive of particulates and concentration limits, averaging periods, and number of allowed exceedances for each of the identified pollutants.

– Technical framework, Assessment and management of odour from stationary sources in NSW (the Technical Framework), NSW Department of Environment and Conservation (DECC 2006) - The Technical Framework provides a legislative context for the control of odour and presents odour assessment criteria guidelines. It provides a framework for different levels of odour assessment, strategies to mitigate odour, and guidance for performance monitoring, regulation, and enforcement.

– *NSW EPA Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* 2022 (the Approved Methods) - 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.

– Guidance on the assessment of dust from demolition and construction 2024 (IAQM) – The IAQM guidance provides guidance on the assessment of dust from demolition and construction activities. It provides a qualitative step by step process to assess the risk of dust impacts.

3.1.1 Odour assessment criteria

The assessment criteria for odour are applied at the nearest existing or likely future off-site sensitive receptor. The Approved Methods defines odour assessment criteria (measured in odour units (OU))[1] and specifies how they should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are:

– Frequency of the exposure

– Intensity of the odour

– Duration of the odour episodes

– Offensiveness of the odour

[1] The number of odour units is the concentration of a sample divided by the odour threshold or the number of dilutions required for the sample to reach the threshold. This threshold is the numerical value equivalent to when 50 per cent of a testing panel correctly detect an odour

– Location of the source.

These factors are often referred to as the 'FIDOL' factors.

The odour assessment criteria are defined to take account of two of these factors (F is set at 99th percentile; I is set at between 2 to 7 OU). The choice of assessment criteria is also dependent on the population of the affected area, as shown in Table 3.1.

Table 3.1 Odour assessment criteria in the Approved Methods

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

The criteria assume that 7 OU at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases, there is a chance that more sensitive individuals would be encountered. The criterion of 2 OU at the 99th percentile is considered to be acceptable for large populations (more than 2,000 people).

The criteria have also been specified at an averaging time of nominally one second. The choice of the short averaging time recognises that the human nose has a response time of less than one second, so that modelling of odour impact should allow for the short-term concentration fluctuations in an odour plume due to turbulence.

The factory has a site specific odour assessment criteria that is set based on receptor location is an referred to as the '2009 Environmental Assessment (EA) approved 'base case' Odour criterion' which is summarised in Table 3.2.

Table 3.2 2009 EA approved 'base case' Odour criterion'

Receptor	2009 EA approved 'base case' Odour criterion
R1 Bomaderry	6
R2 North Nowra	3
R3 Nowra	5
R4 Terara	5

Additional receptors were included in the AQIA in accordance with NSW EPA recommendations (refer to Section 4.2 for location of additional receptors). Assessment criteria for these additional receptors was based off their location and chosen to be the same as that of the nearest 2009 EA approved 'base case' Odour criterion receptor. An amended odour assessment criterion table presenting the adopted odour criteria for all receptors is provided in Table 3.3.

Table 3.3 2009 EA approved 'base case' Odour criterion'

Receptor	Adopted odour assessment criteria
R01	6
R02	3

[2] This is a prediction of the odour level that may occur 99 per cent of the time, or that is below these criteria for 99 hours in every 100. Odour performance criteria are designed to be precautionary, so that impacts on sensitive receivers can be minimised.

Receptor	Adopted odour assessment criteria
R03	5
R04	5
R05	5
R06	5
R07	5
R08	5
R09	5
R10	5
R11	7
R12	7
C01	N/A
C02	N/A
C03	N/A
C04	N/A
C05	N/A
C06	N/A
C07	N/A
C08	N/A
C09	N/A

3.1.2 Air quality assessment

3.1.2.1 Air quality criteria

Assessment criteria for the project was taken from the Approved Methods and are summarised in Table 3.4. The application of each impact assessment criteria is variable for each pollutant based on the following factors:

– **Averaging period** – the period over which modelled concentrations are averaged.
– **Statistic** – the statistic of the modelled concentrations. As an example for a 1-hour averaging period, the 'maximum statistic' would be the highest predicted value at any receptor for the entire modelling period. The 99.9th percentile statistic would be (approximately) the ninth highest hour in a one year modelling period.
– **Impact location** – the location at which the impacts are to be assessed. For some pollutants, impacts are assessable only at sensitive receptor locations, while some impacts are assessable at and beyond the boundary of the site. The criteria apply at ground level where receptors are likely to be exposed.
– **Impact type** – the type of impact assessed. For some pollutants, the impacts are assessable only for the project's contribution to pollutant concentrations at the relevant impact location (referred to as 'incremental impacts'). For other pollutants, the cumulative impact (which includes both the incremental concentration as well as the background concentration) is assessed.

Table 3.4 Air quality impact assessment criteria – other pollutants

Pollutant	Averaging period	Statistic	Impact location	Impact type	Criterion
Cumulative pollutants					
TSP	Annual	Maximum	Sensitive receptor	Cumulative	90 µg/m^3
PM_{10}	24 hours	Maximum	Sensitive receptor	Cumulative	50 µg/m^3
	Annual	Maximum	Sensitive receptor	Cumulative	25 µg/m^3
$PM_{2.5}$	24 hours	Maximum	Sensitive receptor	Cumulative	25 µg/m^3
	Annual	Maximum	Sensitive receptor	Cumulative	8 µg/m^3
NO_2	1 hour	Maximum	Sensitive receptor	Cumulative	164 µg/m^3
	Annual	Maximum	Sensitive receptor	Cumulative	31 µg/m^3
SO_2	1 hour	Maximum	Sensitive receptor	Cumulative	286 µg/m^3
	24 hour	Maximum	Sensitive receptor	Cumulative	57 µg/m^3
CO	15 minute	Maximum	Sensitive receptor	Cumulative	100 mg/m^3
	1 hour	Maximum	Sensitive receptor	Cumulative	30 mg/m^3
	8 hour	Maximum	Sensitive receptor	Cumulative	10 mg/m^3
Lead	Annual	Maximum	Sensitive receptor	Cumulative	0.5 µg/m^3
Principal toxic air pollutants					
Arsenic (and compounds)	1 hour	99.9th percentile	At and beyond site boundary	Incremental	0.00009 mg/m^3
Beryllium (and beryllium compounds)	1 hour	99.9th percentile	At and beyond site boundary	Incremental	0.000004 mg/m^3
Cadmium (and cadmium compounds)	1 hour	99.9th percentile	At and beyond site boundary	Incremental	0.000018 mg/m^3
Chromium (VI compounds)	1 hour	99.9th percentile	At and beyond site boundary	Incremental	0.00009 mg/m^3
Nickel and nickel compounds	1 hour	99.9th percentile	At and beyond site boundary	Incremental	0.00018 mg/m^3
PAH (as benzo[a]pyrene)	1 hour	99.9th percentile	At and beyond site boundary	Incremental	0.0004 mg/m^3
Individual toxic air pollutants					

Pollutant	Averaging period	Statistic	Impact location	Impact type	Criterion
Manganese (and compounds)	1 hour	99.9th percentile	At and beyond site boundary	Incremental	0.018 mg m^3
Mercury (inorganic)	1 hour	99.9th percentile	At and beyond site boundary	Incremental	0.0018 mg/m^3
Individual odorous air pollutants					
VOC (individual VOCs assessed as Toluene)	1 hour	99.9th percentile	Sensitive receptor	Incremental	0.36 mg/m^3

3.1.2.2 Emission limits

Whilst new emission sources are proposed in this modification (primarily odour sources), no new sources of pollutants with applicable emissions limits are proposed. Regardless, emissions points must comply with the standards of concentration established by the POEO Clean Air regulation and those enforced by Manildra's Environmental Protection Licence conditions.

A summary of relevant maximum discharge concentrations is provided in Sections 0 and 0.

POEO Clean Air Regulation

The POEO Clean Air Regulation outlines air quality standards of concentration that apply to general and specific activities and plant for both scheduled and non-scheduled premises. Standards of concentration relevant to the project have been reproduced in Table 3.5 and were sourced from the Schedule 2 - Standards of Concentrations, Part 2 Scheduled Premises, Division 3 – General Activities and Plant, Group 6 in the Protection of the Environment Operations (Clean Air) Regulation, 2022.

Emissions to air from relevant project operations must comply with these emission limits.

Table 3.5 Relevant standards of concentration

Air impurity	Plant	Standard of concentration (Dry, 273 K, 101.3 kPa)
Division 3 – General activities and plant		
Solid particles (Total)	Any activity or plant	50 mg/m^3
Nitrogen dioxide (NO_2) or nitric oxide (NO) or both, as NO_2 equivalent	A boiler operating on gas	350 mg/m^3
Volatile organic compounds (VOCs), as n-propane equivalent	Any activity or plant using a non-standard fuel	40 mg/m^3 VOCs or 125 mg/m^3 CO
Type 1 substances and Type 2 substances (in aggregate)	Any activity or plant	1 mg/m^3
Cadmium (Cd) or mercury (Hg) individually	Any activity or plant	0.2 mg/m^3

Environmental Protection Licence conditions

The site operates under NSW EPA issued Environmental Protection Licence (EPL) number 883, which establishes conditions and discharge limits that the site must operate in accordance with. The EPL conditions relevant to the project and air quality have been identified in Table 3.6.

Table 3.6 EPL limit conditions

Discharge Point	Pollutant	Unit of Measure	100% Limit	Reference conditions	Oxygen correction	Averaging Period
35 – Boiler 5/6*	TSP	mg/m^3	30	Dry, 273 K, 101.3 kPa	7%	1 hour
	SO_2	mg/m^3	600	Dry, 273 K, 101.3 kPa	7%	1 hour block
	NO_2	mg/m^3	500	Dry, 273 K, 101.3 kPa	7%	1 hour block
	VOC (as n-propane equivalent)	mg/m^3	40	Dry, 273 K, 101.3 kPa	7%	1 hour rolling
	Cadmium	mg/m^3	0.2	Dry, 273 K, 101.3 kPa	7%	1 hour
	Mercury	mg/m^3	0.2	Dry, 273 K, 101.3 kPa	7%	1 hour
* EPL limit is for Boiler 5/6 operating on coal (not gas)						

3.2 Secretary's environmental assessment requirements

The SEARs relevant to air quality, together with a reference to where they are addressed in this report, are outlined in Table 3.7.

Table 3.7 Air quality and odour SEARs

Requirements	Where addressed in this report
Air quality and odour	
A detailed emissions inventory that characterises the emissions from existing and proposed operations, including approved but not yet constructed components of the development used to inform the quantitative assessment	Sections 6.1 and 7.1
A quantitative assessment of the potential air quality, dust and odour impacts of the development in accordance with relevant Environment Protection Authority guidelines, with an assessment that models various emission scenarios, including but not limited to: – the cumulative impacts of the development and all current operations of the site; – the cumulative impacts of the development including all current operations and all approved but not yet constructed components of the site	Sections 6.2 and 7.2
The details of buildings and air handling systems and strong justification for any material handling, processing or stockpiling external to buildings	Section 7.1
Details of proposed mitigation, management and monitoring measures	Section 6.3

4. Existing environment

4.1 Site location

The site is located at 36 Bolong Road, Bomaderry, approximately 2 km northeast of Nowra and 50 km southwest of Wollongong.

Figure 4.1 shows the site context and location of the Manildra plant in Bomaderry, New South Wales. It is located between the Shoalhaven River and township of Bomaderry. The plant comprises a factory, a proposed (currently under construction) packing plant and environmental farm. The packing plant lies immediately to the north of the factory, while the environmental farm is situated approximately 400 metres to the east.

4.2 Nearby sensitive receptors

The Approved Methods define 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”.

The site is proximate to a number of sensitive receptors. The township of Bomaderry lies to the northwest of the factory and west of the packing plant. Nowra is situated south of the plant. Commercial and industrial sensitive receptors are located directly adjacent to the site and across from it along Bolong Road.

The nearest residential sensitive receptors (denoted by a receptor ID beginning with R) and commercial/industrial sensitive receptors (denoted by a receptor ID beginning with C) to the site have been included in the modelling and are listed in Table 4.1 which includes the approximate distances and orientation of each receptor from the site. The commercial/industrial receptors also include the operating times in brackets.

Receptor ID’s are consistent with previous air quality assessments to allow comparison between modification.

Predicted odour concentrations at locations other than the identified receptors can be determined via inspection of the provided contour plots in Sections 6 and 7.

The sensitive receptors are shown in Figure 4.2.

Table 4.1 Location of identified sensitive receptors

Receptor ID	UTM coordinates (m)		Receptor type	Approximate distance and direction from project boundary	Description / additional information
	Easting	Northing			
R01	281,430	6,140,610	Residential	~150 m west from packing plant	Residential dwelling
R02	280,400	6,139,650	Residential	~1300 m southwest from factory	Residential dwelling
R03	281,510	6,139,310	Residential	~700 m south from factory	Residential dwelling
R04	283,000	6,139,450	Residential	~1300 m south from factory	Residential dwelling
R05	281,555	6,140,828	Residential	~100 m northwest from packing plant	Residential dwelling
R06	281,352	6,140,399	Residential	~250 m west from packing plant	Residential dwelling
R07	281,256	6,140,441	Residential	~300 m west from packing plant	Residential dwelling
R08	281,043	6,140,075	Residential	~550 m west from factory	Residential dwelling
R09	281,236	6,139,292	Residential	~850 m southwest from factory	Residential dwelling
R10	281,985	6,139,360	Residential	~750 m south from factory	Residential dwelling
R11	282,699	6,141,227	Residential	on western boundary of environmental farm	Residential dwelling
R12	284,100	6,140,721	Residential	~160 m east from factory	Residential dwelling
C01	281,977	6,140,501	Commercial / industrial	~30 m north from factory	Boc Gases (7am to 5pm, weekdays)

Receptor ID	UTM coordinates (m)		Receptor type	Approximate distance and direction from project boundary	Description / additional information
	Easting	Northing			
C02	281,685	6,140,373	Commercial / industrial	~20 m north from factory	Trackside Takeaway (8am to 5pm, weekdays)
C03	281,663	6,140,373	Commercial / industrial	~20 m north from factory	Jim Freeman Plumbing & Southern Industrial Plumbing Group (8am to 5pm, weekdays)
C04	281,615	6,140,371	Commercial / industrial	~60 m northwest from factory	C & S Frew Fabrications (7am to 4pm, weekdays)
C05	281,563	6,140,372	Commercial / industrial	~120 m northwest from factory	Mobil (24 hours)
C06	281,655	6,140,320	Commercial / industrial	~20 m west from factory	Cleary Bros Bomaderry (Weekdays: 7am to 5pm, Saturday: 7am to 12pm)
C07	281,597	6,140,289	Commercial / industrial	~50 m northwest from factory	Poolside Shoalhaven (Weekdays: 8am to 5pm, Saturday: 8am to 12pm)
C08	281,181	6,139,982	Commercial / industrial	~450 m west from factory	Bomaderry Mitre 10 (Weekdays: 7am to 5pm, Saturday: 8am to 4pm, Sunday: 8am to 2pm)
C09	281,600	6,140,601	Commercial / industrial	on western boundary of packing plant	Kiteleys roofing contractor (Weekdays: 7:30am to 4:30pm, Saturday: 8am to 4pm, Sunday: 8am to 2pm)

LEGEND

- APM boundary
- Environmental farm boundary
- Packing plant (proposed) boundary
- Shoalhaven Starches factory boundary
- Nature reserve
- Regional park
- Aboriginal area

Paper Size ISO A4

0 0.5 1 1.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Manildra Group
Shoalhaven Starches Modification 31
Air Quality Impact Assessment

Project No. **12655910**
Revision No. **0**
Date **11/06/2025**

Site location and context

FIGURE 4.1

N:\AU\Sydney\Projects\21\12655910\GIS\Maps\Deliverables\12655910_AQIA.aprx
Print date: 11 Jun 2025 - 09:12

Data source: DCS: Roads, Railways, Waterways, 2025. DFSI: NPWS: 2025. Nearmap WMS Server: – Imagery (Date extracted: 11/06/2025).
Created by: tmorton

LEGEND

- APM boundary
- Environmental farm boundary
- Packing plant (proposed) boundary
- Shoalhaven Starches factory boundary
- Sensitive receptors

Paper Size ISO A4

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Manildra Group
Shoalhaven Starches Modification 31
Air Quality Impact Assessment

Project No. **12655910**
Revision No. **0**
Date **11/06/2025**

Sensitive receptor locations

FIGURE 4.2

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Print date: 11 Jun 2025 - 09:12

Data source: DCS: Roads, Railways, Waterways, 2025. DFSI: NPWS: 2025. Nearmap WMS Server: – Imagery (Date extracted: 11/06/2025).
Created by: tmorton

4.3 Background air quality

4.3.1 Background odour

A review of the National Pollutant Inventory (NPI) database and aerial imagery was undertaken to identify any nearby facilities that emit odorous emissions with potential to cause cumulative impacts with the site and modification.

The following facilities were identified:

– The Bomaderry Wastewater Treatment Plant (located on the northwestern boundary of the site)
– The Nowra Sewage Treatment Plant (located approximately 2 km south of the site)

Significant odour emissions are not expected from either wastewater or sewage treatment plants under routine operations. Upset conditions (such as dewatering of sludge ponds at the treatment plants) may result in higher odour emissions. However, it is expected that upset periods of high odour emissions would be infrequent and short in duration (typically hours).

It is anticipated that investigation of odour complaints would be able to distinguish between odour from the treatment plants and that from Site operations based on reported odour character of complaint, a ‘drive by’ visual investigation of wastewater or sewage treatment plants activities and the location and prevailing meteorology during complaint.

Consequently it was concluded that there is a low risk of cumulative odour impacts occurring with nearby facilities. No further consideration to potential cumulative odour impacts was included in this assessment.

4.3.2 Odour complaints

A summary of the number of odour complaints received on an annual basis is provided in Figure 4.3, noting that partial calendar year records are provided for 2025 as the year was not complete at the time this report was prepared.

Figure 4.3 shows the total number of complaints received. Investigation of some of these complaints was inconclusive if Manildra was responsible for odour complaint, however all complaints have been shown for completeness.

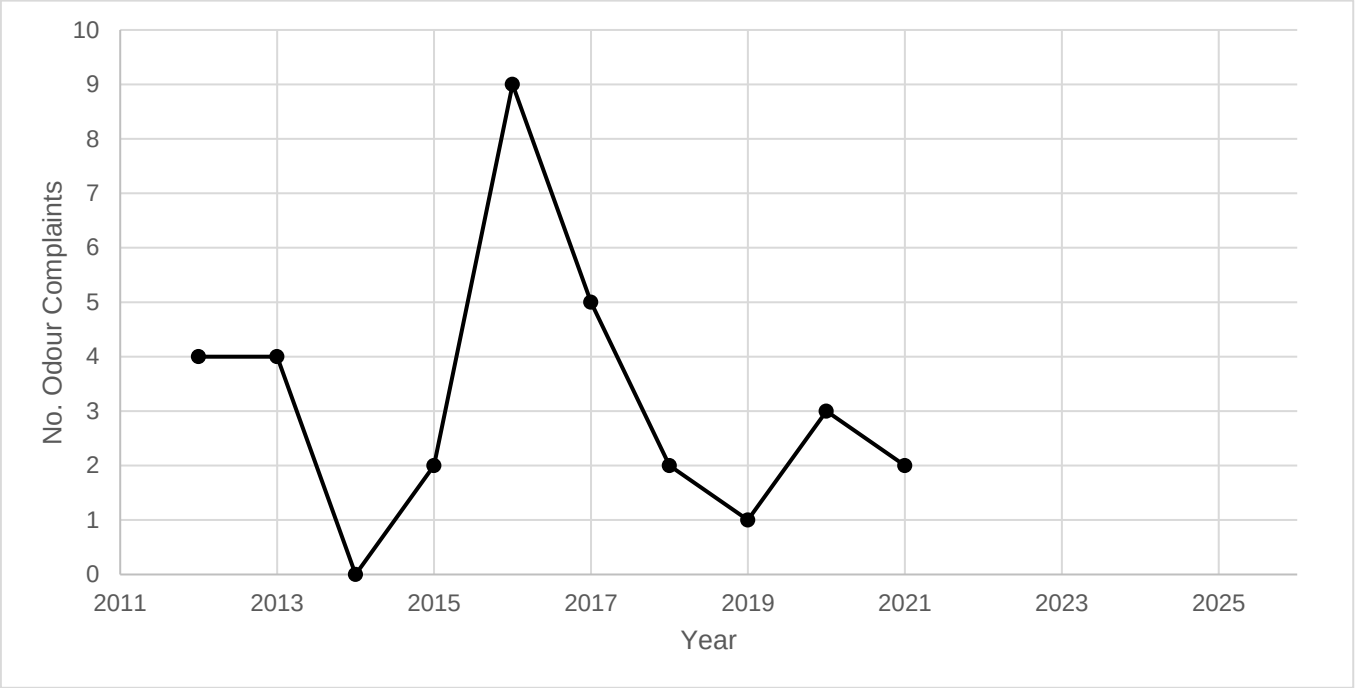


Figure 4.3 Shoalhaven Starches odour complaint history

A summary and analysis of recent odour complaints and the findings of the subsequent investigations is provided in Appendix B. The investigations aim to attribute Manildra or others for the source of odour, and if it was concluded that Manildra is responsible, then the onsite activities causing the odour were identified.

4.3.3 Odour surveys

Northstar Air Quality Pty Ltd (Northstar) perform regular field ambient odour assessments (FAOA) to assess the potential presence and characterisation of odour at sensitive receptors surrounding the site. A summary of recent FAOA findings is provided below:

– *Shoalhaven Starches Field Ambient Odour Assessment 24.1133.FR2V1* (07/11/2024)
  - FAOA performed on 04/11/2024 and 05/11/2024
  - A total of 222 discrete odour observations were undertaken across 14 locations. The maximum observed odour intensity was:
    – Obvious at 3 of the 14 locations (21%)
    – No odour at 11 of the 14 locations (79%)

– *Shoalhaven Starches Field Ambient Odour Assessment 24.1018.RF2V1* (04/10/2023)
  - FAOA performed on 26/09/2023
  - A total of 96 discrete odour observations were undertaken. All observations resulted in an odour intensity of I = 0 (odour not detected) indicating that no odour was detected at all observation points during FAOA period.

– *Shoalhaven Starches Field Ambient Odour Assessment 22.1126.RF3V1* (03/03/2023)
  - FAOA performed on 02/03/2023
  - A total of 108 discrete odour observations were undertaken. All observations resulted in an odour intensity of I = 0 (odour not detected)

– *Shoalhaven Starches Field Ambient Odour Assessment 22.1126.RF2V1* (03/11/2022)
  - FAOA's were performed across four occasions on 01/08/2022, 08/08/2022, 15/08/2022 and 10/10/2022
  - A total of 552 discrete odour observations were undertaken:

– 420 (76% of total) resulted in an odour intensity of I = 0 (odour not detected)
– 99 (18% of total) resulted in an odour intensity of I = 1 (very weak odour detected)
– 33 (6% of total) resulted in an odour intensity of I = 2 (weak odour detected)

The findings of the FAOA indicate that odour was not often detectable offsite, and on occasions where odour was detectable, it was characterized as either 'Very Weak' or 'Weak'.

4.3.4 Background particulate matter, gaseous air pollutants and metals

4.3.4.1 Data overview

In order to assess the total impact of a given project by comparing model predictions against the assessment criteria prescribed in the Approved Methods (refer Section 3.1.2), suitable background concentrations need to be incorporated in the assessment.

The Department of Climate Change, Energy, the Environment and Water (DCCEEW) operates air quality monitoring stations (AQMS) in many locations across NSW. A summary of data available from the nearest DCCEEW AQMS is provided in Table 4.2.

Table 4.2 Summary of data reviewed as part of the assessment

Station name	Distance from the site boundary	Pollutants of interest that are measured
Albion Park South	~34 km northeast	PM_{10}, $PM_{2.5}$, SO_2, NO_2 and Ozone
Kembla Grange	~46 km northeast	PM_{10}, $PM_{2.5}$, NO_2 and Ozone
Wollongong	~54 km northeast	PM_{10}, $PM_{2.5}$, SO_2, NO_2, Ozone and CO

A summary of the ambient air quality data recorded at each AQMS over the last 5 complete calendar years is provided in Table 4.3. A summary of 24 hour timeseries ambient PM_{10} and $PM_{2.5}$ concentrations recorded at Albion Park South (the nearest AQMS) shown relative the assessment criteria (refer Section 3.1.2.1 for further details regarding assessment criteria) is provided in Figure 4.4.

The data peaks in Figure 4.4 that occurred late 2019 and early 2020 are attributed to regional bushfires events.

Table 4.3 5 year summary of available background particulate matter data recorded by DCCEEW

Pollutant	Statistic	Recorded background concentration by calendar year (µg/m^3)				
		2020	2021	2022	2023	2024
Albion Park South						
PM_{10}	24 hour maximum	153.3	39.4	38.2	36.7	41.8
	24 hour maximum less than assessment criteria (50 µg/m^3)	45.4	39.4	38.2	36.7	41.8
	70th percentile	18.0	15.1	12.3	14.9	17.8
	Annual average	17.1	13.1	11.0	13.4	14.8
$PM_{2.5}$	24 hour maximum	96.3	23.3	15.8	22.0	15.4
	24 hour maximum less than assessment criteria (25 µg/m^3)	21.4	23.3	15.8	22.0	15.4
	70th percentile	6.6	5.6	4.5	5.5	7.0
	Annual average	6.8	4.8	3.9	4.9	5.4
SO_2	1 hour maximum	61.5	56.4	47.0	57.4	57.2
	24 hour maximum	15.5	17.5	22.6	16.2	16.8

Pollutant	Statistic	Recorded background concentration by calendar year (µg/m^3)				
		2020	2021	2022	2023	2024
NO_2	1 hour maximum	79.0	65.8	62.5	76.4	88.3
	Annual average	6.0	5.0	6.4	8.6	8.1
CO	1 hour maximum	N/A	N/A	N/A	N/A	N/A
Wollongong						
PM_{10}	24 hour maximum	121.6	43.2	46.9	50.8	54.3
	24 hour maximum less than assessment criteria (50 µg/m^3)	48.1	43.2	46.9	47.6	49.7
	70th percentile	20.5	17.4	17.2	18.7	22.3
	Annual average	18.7	15.2	14.3	16.4	18.2
$PM_{2.5}$	24 hour maximum	100.9	23.4	13.2	25.4	17.5
	24 hour maximum less than assessment criteria (25 µg/m^3)	23.1	23.4	13.2	20.5	17.5
	70th percentile	7.4	6.7	5.6	6.3	7.9
	Annual average	7.8	5.7	4.7	5.5	6.0
SO_2	1 hour maximum	58.5	84.5	49.7	74.1	85.7
	24 hour maximum	10.8	17.8	10.5	15.8	20.0
NO_2	1 hour maximum	83.9	86.7	60.1	113.4	86.2
	Annual average	13.2	9.9	8.4	13.6	14.1
CO	1 hour maximum	4,944	2,654	1,771	2,286	3,999
Kembla Grange						
PM_{10}	24 hour maximum	187.7	62.3	43.8	74.1	75.6
	24 hour maximum less than assessment criteria (50 µg/m^3)	48.3	49.9	43.8	49.7	48.9
	70th percentile	22.5	20.7	16.9	24.7	24.3
	Annual average	21.4	17.6	14.5	21.3	21.4
$PM_{2.5}$	24 hour maximum	100.4	23.5	12.2	21.1	16.2
	24 hour maximum less than assessment criteria (25 µg/m^3)	25.0	23.5	12.2	21.1	16.2
	70th percentile	6.6	6.0	4.7	6.6	7.9
	Annual average	7.1	5.1	3.9	5.9	5.7
SO_2	1 hour maximum	N/A	N/A	N/A	N/A	N/A
	24 hour maximum	N/A	N/A	N/A	N/A	N/A
NO_2	1 hour maximum	8.2	5.6	4.2	9.3	73.9
	Annual average	78.2	57.9	54.6	107.4	10.2
CO	1 hour maximum	N/A	N/A	N/A	N/A	N/A

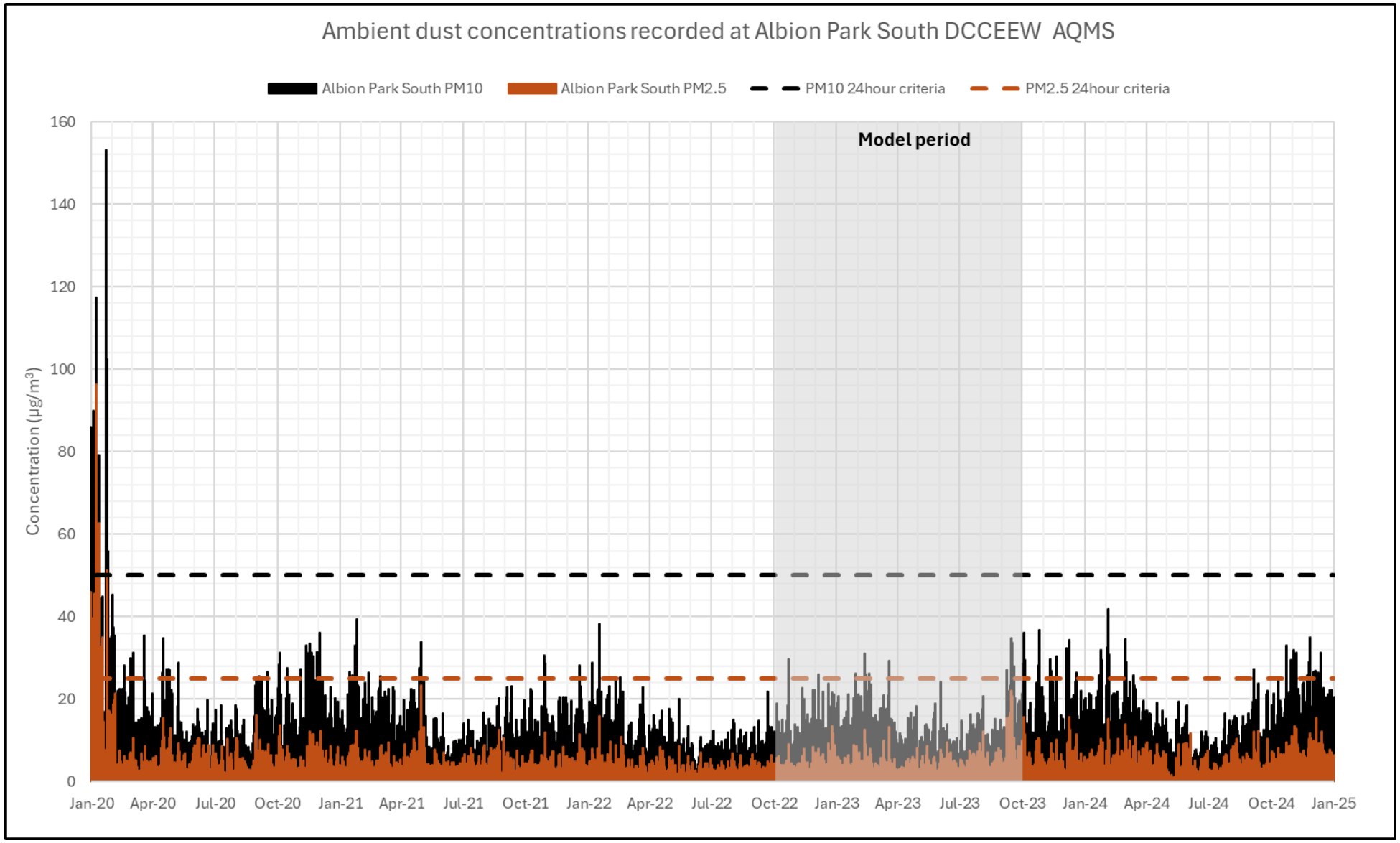


Figure 4.4 Background PM_{10} and $PM_{2.5}$ concentrations recorded at Albion Park South AQMS (01/01/2020 – 31/12/2024)

4.3.4.2 Adopted background data

The background air quality data adopted in this assessment is contemporaneous with the meteorological data used in the dispersion modelling which allows addition of predicted incremental impacts to recorded background concentrations of the same time period to calculate cumulative impacts.

In the absence of site specific background data, data from the nearest DCCEEW AQMS to the site was prioritised where sufficient data was available. Therefore data was predominately sourced from the Albion Park South DCCEEW AQMS.

It is noted that the Illawarra region (where the DCCEEW AQMS are located) is characterised by higher levels of urbanisation and contains some significant sources of air pollutants emissions such as the Tallawarra Power Station and various industry located at Port Kembla. It is therefore anticipated that background air quality concentrations recorded at Albion Park South, Kembla Grange and Wollongong DCCEEW AQMS would be greater than those experienced at the site (i.e. background concentrations at the site would be lower than those recorded at DCCEEW AQMS).

Use of background concentration recorded at DCCEEW AQMS in this assessment allows for additional conservatism.

A summary of the background air quality data adopted in this assessment is provided in Table 4.4.

Table 4.4 Adopted background air quality data

Pollutant	Averaging period	Adopted background value
TSP	Annual	25.0 µg/m^3, equal to twice the annual PM_{10} concentration recorded at Albion Park South AQMS for the modelling period
PM_{10}	24 hour	Daily variable from Albion Park South AQMS (i.e. a different value was used for each 24 hour period over the model period (01/10/2022 – 30/09/2023). Indicative values can be inferred via inspection of the shaded region labelled “Model period” in Figure 4.4..
$PM_{2.5}$	24 hour	Daily variable from Albion Park South AQMS (i.e. a different value was used for each 24 hour period over the model period (01/10/2022 – 30/09/2023). Indicative values can be inferred via inspection of the shaded region labelled “Model period” in Figure 4.4.
NO_2	1 hour	Hourly variable from Albion Park South AQMS (i.e. a different value was used for each hour over the model period (01/10/2022 – 30/09/2023).
O_3	1 hour	Hourly variable from Albion Park South AQMS (i.e. a different value was used for each hour over the model period (01/10/2022 – 30/09/2023).
SO_2	1 hour	Hourly variable from Albion Park South AQMS (i.e. a different value was used for each hour over the model period (01/10/2022 – 30/09/2023).
	24 hour	Daily variable from Albion Park South AQMS (i.e. a different value was used for each 24 hour period over the model period (01/10/2022 – 30/09/2023).
CO	1 hour	2.3 mg/m^3, maximum recorded 1 hour value at Wollongong AQMS during the model period
	8 hour	1.5 mg/m^3, maximum recorded 8 hour value at Wollongong AQMS during the model period
Lead	Annual	Nil (0 µg/m^3)

5. Construction air quality assessment

5.1 Construction overview

It is understood that the proposed construction of the modification would involve the following activities:

– Installation of heat exchangers at the DDG Dryers
– Construction of the heat recovery building
– Construction of the gantry over Bolong Road from the heat recovery building
– Relocation of 78 parking spaces and road works associated with moving the entry and exit of the parking lot

The location of the proposed MOD31 features are shown in Figure 5.1 and the indicative construction footprint with a 250 metre buffer zone (refer to section 5.3 for further explanation regarding selection of buffer zone) is shown in Figure 5.2.

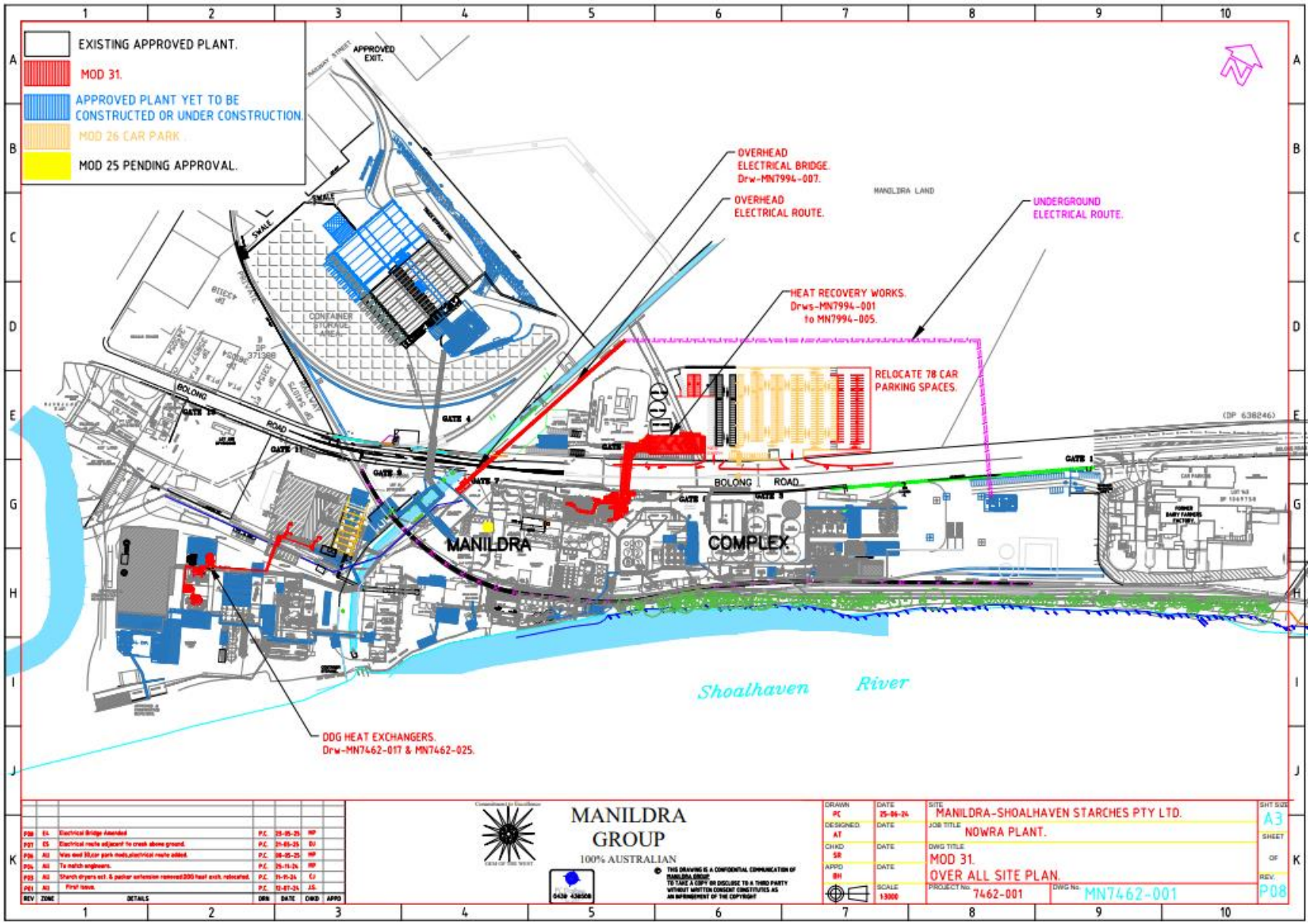
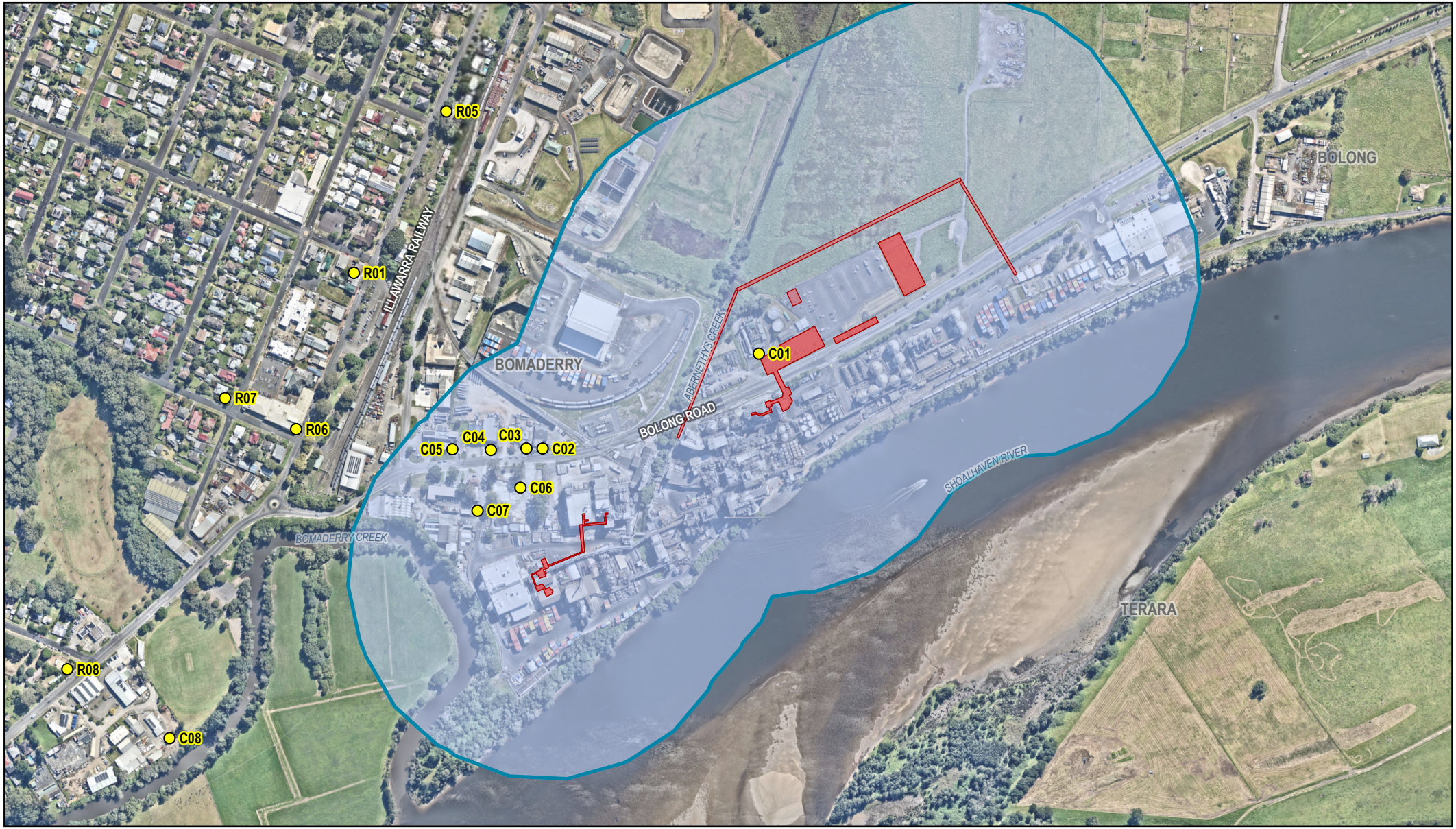


Figure 5.1 Proposed MOD31 plant and equipment locations (provided by Manildra, 2025)



LEGEND

- MOD31 construction buffer
- MOD31 indicative construction area
- Sensitive receptors

Paper Size ISO A4

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Manildra Group
Shoalhaven Starches Modification 31
Air Quality Impact Assessment

Indicative location of proposed construction works with buffer distance

Project No. **12655910**
Revision No. **0**
Date **10/06/2025**

FIGURE 5.2

N:\AU\Sydney\Projects\21\12655910\GIS\Maps\Deliverables\12655910_AQIA.aprx
Print date: 11 Jun 2025 - 09:12

Data source: DCS: Roads, Railways, Waterways, 2025. DFSI: NPWS: 2025. Nearmap WMS Server: – Imagery (Date extracted: 11/06/2025).
Created by: tmorton

5.2 Construction emissions

The key emissions to air from the construction of the proposed modification were identified upon review of the construction methodology. Low levels of dust emissions (TSP and PM_{10}) are expected during construction efforts, primarily from:

– Earthworks – dust emissions from clearing of land for the heat recovery works and the relocated parking spaces.
– Construction – dust emissions from installation of prefabricated structures including the heat recovery works and DDG heat exchangers
– Track-out – Wheel generated dust from truck delivery supplies to the construction area.

Minor vehicle exhaust emissions are expected throughout the construction period; however, sources will be discontinuous, transient, and mobile, and therefore the air quality risk associated with vehicle emissions during construction is low.

No significant demolition works are proposed.

5.3 Assessment approach

A risk-based approach in accordance with IAQM guidance was adopted to assess potential particulate matter impacts during the construction of the proposed modification.

The IAQM guidance recommends that a detailed risk assessment be undertaken where there is a human receptor within 250 m or an ecological receptor within 50 m of the construction footprint, or where there is a human or ecological receptor within 50 m of any haulage routes up to 250 m from the site entrance.

Given there are human receptors within 250 m of the construction footprint (refer to Figure 5.2), a detailed risk assessment has been undertaken.

5.4 Risks identified

The construction program has been divided into three activity groups that have potential to cause dust emissions. These activities are earthworks, construction and track-out. To identify the risk of dust impact from each activity group, the size and scale of each activity must be determined as well as the sensitivity of the surrounding environment.

Size and scale

The size and scale of the activities are determined by not only the physical size of the project but other factors that are likely to increase or decrease the amount of dust created during each construction activity. Table 5.1 outlines these factors for each activity and the resulting size and scale descriptor as defined by the IAQM Guidance.

Table 5.1 Size and scale of construction activities

Activity	Description	Size and scale descriptor of dust emission magnitude
Earthworks	– Earthworks and material handling associated with clearing of land for the heat recovery works and the relocated parking spaces. – Total earth working area is ~7,000 m^2 (which falls between the IAQM descriptor of <18,000 m^2 for small) – < 5 heavy earth moving vehicles active at any one time	Small
Construction	– Installation of prefabricated structures including the heat recovery works and DDG heat exchangers. – Construction material used has a low potential for dust release	Small
Track-out	– Estimated that there will be < 10 vehicle movements per day delivering	Small

Activity	Description	Size and scale descriptor of dust emission magnitude
	– Vehicle movements may occur on a short length of unpaved road	

Sensitivity

The sensitivity of the surrounding environment is determined by the number of high risk, medium risk and low risk receptors within a certain proximity of the construction footprint. High sensitivity receptors include dwellings, educational institutions, and medical facilities. Medium sensitivity receptors include commercial, and industrial premises. Low sensitivity receptors include farmland, recreational parklands, and other public spaces. The sensitivity is determined for three areas of concern, these are:

– Sensitivities of people to dust soiling effects
– Sensitivities of people to the health effects of PM_{10}
– Sensitivities of receptors to ecological effects.

The sensitivities for each area for all construction activities are outlined in Table 5.2.

Table 5.2 Sensitivity of areas of concern for all construction activities

Activity	Description	Sensitivity of surrounding area
Sensitivities of people to dust soiling effects	– Seven medium sensitivity receptors (commercial premises at C01, C02, C03, C04, C05, C06 and C07) are located within 250 m from any construction activity, with one receptor (C01) located less than 10 m from the heat recovery works	Medium
Sensitivities of people to the health effects of PM_{10}\	– The annual average PM_{10} concentrations[3] from the closest three DCCEEW ambient air monitoring stations is < 24 µg/m^3 – Seven medium sensitivity receptors (commercial premises) are located within 250 m from any construction activity, with one receptor (C01) located less than 10 m from the heat recovery works	Low
Sensitivities of receptors to ecological effects.	– No high or medium sensitive ecological features within 50 m of the construction activity	Low

Risk summary

The risk matrix uses the sensitivity and scale to determine the risk of dust impacts on the surrounding receptors. Table 5.3 outlines the risk matrix determined for the construction of the rail extension. The risk identified for all construction activities was **low risk** for dust soiling, and **negligible risk** for human health and ecological impacts.

Proposed specific mitigation measures to further minimise the risk of dust impacts at receptor locations during construction works include:

– Prepare a construction dust management plan for the works
– Inform construction staff of activities likely to cause high dust emissions (as part of site inductions) and appropriate methods to mitigate dust emissions.
– Use dust suppression watering via water truck or cart during high dust generating activities
– Reducing or stopping construction works if dust plumes are observed travelling off site beyond the site boundary.
– Covering of loads during transport to prevent loss of material during haulage.

[3] Data obtained from NSW Government Air Quality database on 26/03/2024 available online: https://www.airquality.nsw.gov.au/air-quality-data-services/data-download-facility

Table 5.3 Risk matrix for dust impacts during construction

Impact	Risk		
	Earthworks	**Construction**	**Track-out**
Dust soiling	Low	Low	Low
Human health	Negligible	Negligible	Negligible
Ecological	Negligible	Negligible	Negligible

6. Operational odour assessment

6.1 Odour emissions inventory

6.1.1 Source identification

Odour is created from various processes and activities associated with the production of ethanol, starch, gluten, glucose and DDG at the site. At the factory, odour emissions are primarily emitted via stacks or tank vents (point sources) while at the environmental farm, odour is primarily released from pond surfaces (area sources).

A significant number of potential odour sources have been mitigated since the 2007 odour audit, whereby mitigation has been achieved by capping of the source vents and ducting odorous air to the scrubbers and biofilters or boilers for treatment. Where multiple sources have been mitigated, the individual odour 'origin' sources are not considered in the emissions inventory as emissions do not occur from these locations, instead only the final 'receiving' source (biofilter or boiler) was included in the emissions inventory as this is the location where the odour is discharged to the surrounding environment.

Identification of potential individual odour sources was informed by previous air quality assessments (including the 2007 odour audit) and a site inspection undertaken as part of Odour PRS stage 1 works.

The MOD31 emissions inventory included the key odour sources only. An odour source inclusion assessment ('inclusion assessment') (refer Odour PRS stage 2 GHD 2023) was undertaken on an individual source by source basis to determine which sources should be included in the emissions inventory (and therefore site odour model). The inclusion assessment aimed to identify sources with potential to contribute to off-site odour impacts and concluded that these sources should be included in the dispersion model. The inclusion assessment governing logic, which was developed based on the Odour PRS stage 2 findings and NSW EPA feedback, generally determined a source should be included in the model if it met the following criteria:

– The source has an elevated Odour Concentration (> 500 OU) and or an Odour Emission Rate (OER) (> 1,000 OUm^3/s – OUm^2/s)
– The source has an unpleasant odour character or a character that is similar to odours detected off-site
– The source emits odours continuously (as opposed to intermittent sources such as batch operations e.g. during tank filling)

6.1.2 Availability of odour sampling data

Numerous odour emissions sampling campaigns have been undertaken at the site including:

– The original odour survey undertaken in 2007 (Odour Survey Manildra Group, Emission Testing Consultants, 2007)
– Various ad-hoc sampling
– Quarterly sampling of EPA identified points in accordance with EPL requirements

6.1.3 Quarterly odour sampling review

A review of quarterly odour sampling data is shown in Figure 6.1 which displays the cumulative odour emissions from all EPA identified sources for each quarter.

It is noted that not all EPA sources are sampled each quarter (this was limited to some of the effluent storage dams (source ID: PO1, PO2 and PO3) due to insufficient water volume to sample and was deemed unsafe to access for odour sampling and the DDG Pellet Plant Stack (source ID: PPES) due to high winds and not having access to the required elevated work platform and No. 2 Gluten Dryer and No. 3 Starch Dryer which were not operational during the sampling period or there was safe concerns for accessing the sampling ports). In these instances, assumed odour emissions rates were adopted for the missing odour source based on averaging the data of previous/future quarters within the last year.

Biofilter C (source ID: BIO3) was first sampled in 2024-25 Q2. This source is presented using a different colour in Figure 6.1 to indicate the relative increase in comparison with previous quarters.

The quarters with highest cumulative odour emissions in the last year were identified to be:

– 2023-2024 Q4
– 2024-2025 Q2

Odour emissions varied significantly each quarter, with the highest quarter being significantly (~100,000 OUm^3/s) higher than the other quarters.

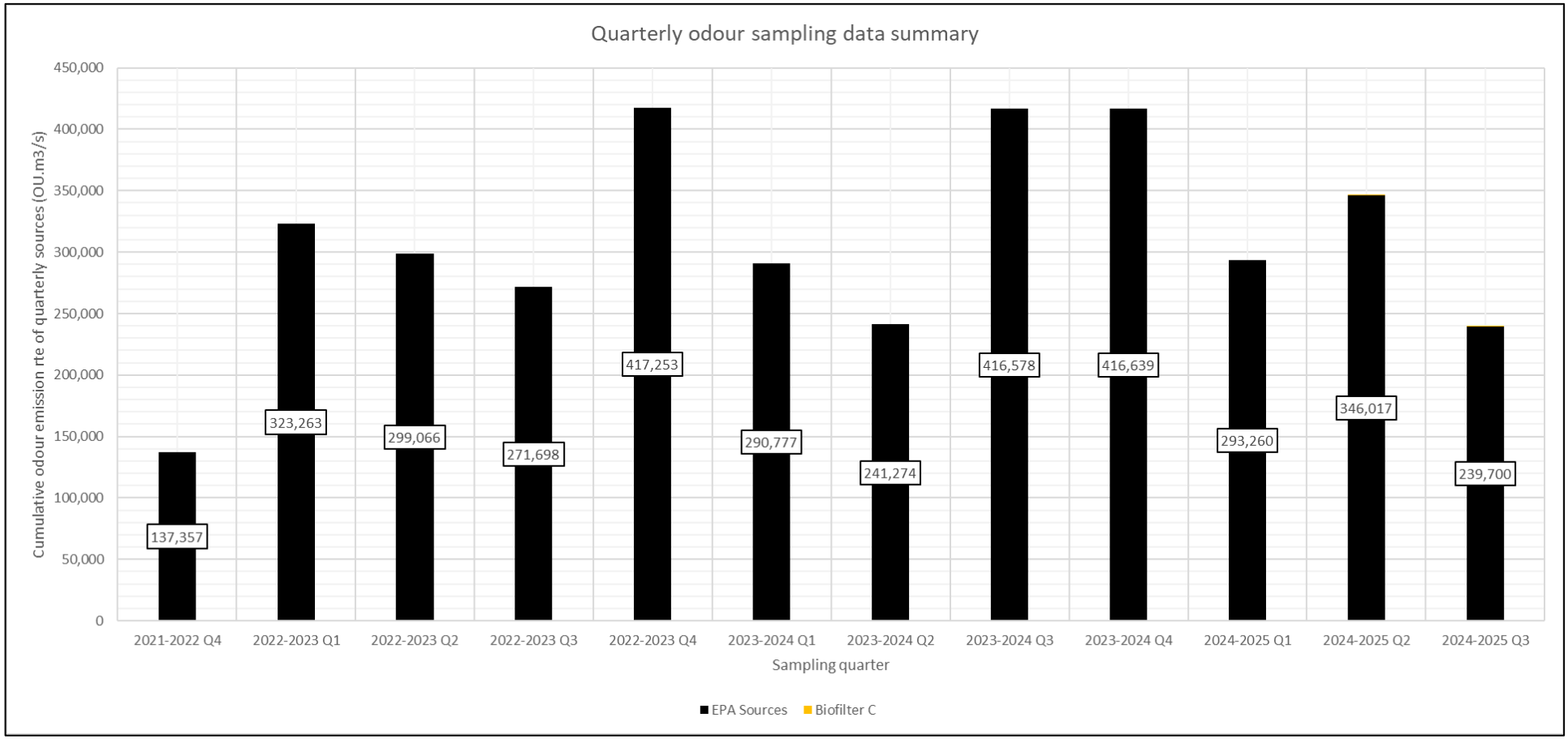


Figure 6.1 Summary of quarterly odour sampling data

6.1.4 Changes due to the proposed modification

No changes to the sources of odour are anticipated due to the proposed modification.

Odour assessment has been undertaken to incorporate the latest sampling data for each source, however there are no changes in sources or source characteristics.

6.1.5 Odour emissions assumptions

Due to the extensive library of odour sampling data, source specific sampling data is available for majority of the sources on site and therefore the source specific sampling data was adopted in the emissions inventory.

In the instance where odour sampling had not been undertaken for a particular source or if the source is proposed and is not yet built, an odour emission rate and source discharge parameters were assumed based on data for similar sources on site and/or design specifications.

A summary of odour modelling source assumptions for existing sources without sampling data is provided in Table 6.1.

Table 6.1 Existing odour modelling source assumptions

Source	Model ID	Odour data adopted and justification
Beverage Ethanol D500 Vent	CWV2	Odour data adopted from existing source: Column washing vent (Model ID: CWV) which is a similar source and is considered representative of CWV2.
Silo 801, 704 and 705	DDGSILO	Odour concentration and vent discharge properties were assumed based on data from existing starch and gluten silos which are expected to be similar. An outlet odour concentration of 1,000 OU and a constant flowrate of 0.5 m^3/s was assumed equating to an OER of 500 OU.m^3/s. These assumptions are considered conservative as the maximum recorded odour concentration of a similar source was 160 OU at Gluten 1A silo and silo flowrates ranged from 0.18 – 0.3 m^3/s. Based on the resultant odour emission rate calculated for the source, adoption of these assumptions is considered conservative and low risk. Odour sampling report reference: *Air Quality Impact Assessment Proposed Modifications to Approved Packing Plant* (SEMA, 2015) *Emissions Test Report No 5600*
Gluten dryer 8	GD8	GD8 is a proposed source that has been constructed and is undergoing final stages of commissioning. Therefore, odour sampling has not yet been undertaken on this source. Odour data adopted from existing source: Gluten dryer 6 (Model ID: GD6) which is a similar source and is considered representative of GD8.
No. 5 Starch Dryer: – No. 5 Starch Dryer (Current) – No. 5 Starch Dryer (New)	– SD5C – SD5N	It is understood that No. 5 Starch Dryer exhaust stack (SD5, EPA ID: 47) is to be split into two separate stacks (named SD5C and SD5N). The design flowrate split is as follows: – SD5C to receive 44,800 m^3/h (of 274,380 m^3/h) – SD5N to receive 229,580 m^3/h (of 274,380 m^3/h) Source parameters including discharge velocity and odour emission rate was scaled based on the design flowrate splits based on odour sampling data of SD5 (currently active as a single stack).
DDG plant area cooling towers: – Additional cooling towers to the west (proposed) – Cooling tower – Cooling towers (DDG dryer area)	– CTP – DDG38 – DDG46 – DDG47	Cooling towers were not considered a source of odour in the inclusion assessment as odour is not created at these sources, rather ambient odorous air in the immediate vicinity of the cooling towers is entrained (i.e. 'pulled' into and joins) into the cooling tower exhaust flow due to its high flowrate and it emitted along with it. Historic odour sampling at cooling towers has recorded odour which is anticipated from entrainment of odour from nearby localised sources (the 2007 odour audit indicated that nearby spills could be contributing to ambient odour around the cooling towers, which has subsequently been cleaned). Feedback from NSW EPA indicated that the cooling tower should be included in the dispersion modelling. There is a risk of 'double counting' odour

Source	Model ID	Odour data adopted and justification
– Cooling Towers (DDG Evaporator area)		emissions by including cooling towers in the model as odour emissions are included once at the source of origin, then twice as ambient odorous air is entrained and redispersed via the cooling tower exhaust, however this results in a conservative outcome. Cooling tower odour emissions data was adopted from most recent sampling of DDG plant area Cooling tower 1B (historically EPA ID 18, until it was removed as an odour source). Odour sampling report reference: *EPL Odour Emission Survey Quarter 2, 2013-2014* (SEMA, 2014)
Retention tanks: – Westside retention tank (2 tanks) – Southside retention tank (2 tanks)	– WRT – SRT	It is understood that all retention tanks operate in same manner and for same purpose. Therefore odour concentration and vent discharge properties were assumed based on data from a similar source: Eastside retention tank (4 tanks) (Model ID: ERT). Worst case (highest OER) sampling data of ERT was adopted for WRT and SRT retention tanks.
MVR evaporator plant sources: – Feed tank (TK921) and Product tanks (TK922) – Distribution tank (TK912)	– FPTANK – DISTTANK	It is understood that MVR evaporator plant sources would have similar odour emissions profiles. Odour concentration and vent discharge properties were assumed based on data from a similar source: MVR Vacuum Pump (Model ID: MVRVPUMP) which is understood to be a similar source. These sources are unable to be sampled due to physical constraints. The tanks are auto level control, therefore flow discharge would be rare and minimal.

6.1.6 Odour source summary

Odour emissions inventories were prepared for the following scenarios:

– Average operations (average of odour sampling data over the last four quarterly sampling events)
– 2023-2024 Q4 sampling data (highest quarter)

The individual quarter selected has the highest sampled odour emissions over the last 12 months and was found to be significantly higher than other quarters and therefore represents a reasonable worst case. Modelling the worst quarter occurring 24 hours per day over the entire year is a highly conservative approach.

The odour emissions inventories are presented in:

– Table 6.2 – Complete odour emissions inventory for the average sampling data (average across last four quarters) scenario
– Table 6.3 – Partial odour emissions inventory for the 2023-2024 Q4 sampling data (highest quarter) for EPA identified sources (i.e. this table only shows values for EPA identified sources, all other sources are consistent with the parameters shown in Table 6.2).

Table 6.2 Odour emissions inventory (average across last four quarters)

Plant group area	Source	Model Reference	EPA ID	Source type	Wake Affected (Y / N)	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	Area (m^2) (if applicable)	Odour concentration (OU)	Adopted OER (OUm^3/s)	PtM ratio	Modelled OER (OUm^3/s) or ($OUm^3/s/m^2$)	Justification of parameters
Glucose Plant - Brewers glucose line	Enzyme tanks (17 & 18)	B7		Point	Y	1	2.5	0.44	2.00	336		1700	333	2.3	767	Most recent sampling data adopted
Biofilter	Biofilter A	BIO1	40	Area	Y		2				100	1000	1000	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	10	A biofilter outlet odour concentration of 1,000 OU was assumed for all biofilters. Standard biofilter performance is expected to achieve 500 OU based on manufacturer design specifications. Construction of additional biofilter C is expected to alleviate overloading currently experienced by biofilters A & B which is anticipated to improve performance of existing biofilters.
Biofilter	Biofilter B	BIO2	41	Area	Y		2				100	1000	1000	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	10	A biofilter outlet odour concentration of 1,000 OU was assumed for all biofilters. Standard biofilter performance is expected to achieve 500 OU based on manufacturer design specifications. Construction of additional biofilter C is expected to alleviate overloading currently experienced by biofilters A & B which is anticipated to improve performance of existing biofilters.
Biofilter	Biofilter C	BIO3		Area	Y		2				200	1000	2000	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	10	A biofilter outlet odour concentration of 1,000 OU was assumed for all biofilters. Standard biofilter performance is expected to achieve 500 OU based on manufacturer design specifications. Construction of additional biofilter C is expected to alleviate overloading currently experienced by biofilters A & B which is anticipated to improve performance of existing biofilters.
Boiler house	Combined Boiler Stack for No. 5 & 6 Boilers	BOILR5	35	Point	Y	1	54	2.02	10.00	374		3150	59750	2.3	137425	Average data over last four quarterly sampling events
Glucose Plant - Confectioners glucose line	Flash chamber	C1		Point	Y	1	21	0.44	2.00	362		8800	1667	2.3	3833	Most recent sampling data adopted
Glucose Plant - Confectioners glucose line	Saccharification tanks (19 units)	C2		Point	Y	0	21	0.44	2.00	332		12000	3333	2.3	7667	Most recent sampling data adopted.
Glucose Plant - Confectioners glucose line	Filtration drum vacuum receiver	C4		Point	Y	1	21	0.20	11.00	320		4800	1400	2.3	3220	Most recent sampling data adopted
DDG plants - Liquids line	Additional cooling towers to the west (proposed)	CTP		Point	Y	0	10	2.50	6.00	305		36	916	2.3	2107	Cooling tower odour emissions data was adopted from most recent sampling of DDG plant area Cooling tower 1B (historically EPA ID 18)
Ethanol Plant - Beverage	Column washing vent	CWV		Point	Y	1	48	0.07	8.80	312		26600	850	2.3	1955	Most recent sampling data adopted

Plant group area	Source	Model Reference	EPA ID	Source type	Wake Affected (Y / N)	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	Area (m^2) (if applicable)	Odour concentration (OU)	Adopted OER (OUm^3/s)	PtM ratio	Modelled OER (OUm^3/s) or ($OUm^3/s/m^2$)	Justification of parameters
grade ethanol distillery																
Ethanol Plant - Beverage grade ethanol distillery	Beverage Ethanol D500 Vent	CWV2		Point	Y	1	55	0.07	8.80	312		26600	850	2.3	1955	Properties of CWV adopted. Design height provided by Manildra.
Ethanol Plant - Distillation plant	Molecular Sieve - Vacuum drum (Stage 2 vacuum drum flame arrester (D697))	D2		Point	Y	1	10	0.08	13.00	337		26000	1350	2.3	3105	Most recent sampling data adopted
Ethanol Plant - Distillation plant	Stage 3 incondensable gases vent (E538)	D6		Point	Y	1	13	0.18	0.85	309		21000	400	2.3	920	Most recent sampling data adopted
DDG plants - Liquids line	Cooling tower	DDG38		Point	Y	1	10	2.50	6.00	305		36	916	2.3	2107	Cooling tower odour emissions data was adopted from most recent sampling of DDG plant area Cooling tower 1B (historically EPA ID 18)
DDG plants - Liquids line	Dryer building	DDG39		Volume	N		8					1200	3000	2.3	6900	Most recent sampling data adopted. It is noted that there is no specific odour source related to this source. The dryers/equipment within the building are fitted with odour recovery pipework, however some odorous air leaks, contributing to odour within the building. Ambient winds push the odour around/out of the building. No specific discharge/outlet - model as volume source. Under certain conditions, potential for odorous air movement from building. Sampling was undertaken across 2 faces of the building, the face with the lower sampled odour concentration was assumed to be the inlet, while the face with the higher odour concentration was assumed to be the outlet. Building outlet face area estimated based on photography, ambient wind at outlet assumed to be 0.1m/s at all times.
DDG plants - Liquids line	Cooling towers (DDG dryer area)	DDG46		Point	Y	1	10	2.50	6.00	305		36	916	2.3	2107	Cooling tower odour emissions data was adopted from most recent sampling of DDG plant area Cooling tower 1B (historically EPA ID 18)
DDG plants - Liquids line	Cooling Towers (DDG Evaporator area)	DDG47		Point	Y	1	10	2.50	6.00	305		36	916	2.3	2107	Cooling tower odour emissions data was adopted from most recent sampling of DDG plant area Cooling tower 1B (historically EPA ID 18)
DDG plants - DDG pellet plant	Silo 801, 704 and 705	DDGSILO		Point	Y	0	10	0.30	7.07	303		1000	500	2.3	1150	Assumed odour concentration of 1,000 OU and flowrate of 0.5 m3/s

Plant group area	Source	Model Reference	EPA ID	Source type	Wake Affected (Y / N)	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	Area (m^2) (if applicable)	Odour concentration (OU)	Adopted OER (OUm^3/s)	PtM ratio	Modelled OER (OUm^3/s) or ($OUm^3/s/m^2$)	Justification of parameters
DDG plants - Liquids line	Stillage Evaporator Slab Main Sump	DDGSUMP		Point	N	0	0.1	1.00	1.10	323		21000	47	2.3	107	Most recent sampling data adopted Discharge parameters estimated based on visual observation.
DDG plants - Liquids line	Turbo fans (6 in total, each evaporator has a turbo fan)	DDGTF		Volume	N		1	0.07	34.00	360		2987	2070	2.3	4761	Average of most recent sampling data adopted. 6 turbo fans total. Average OER multiplied by 6
Ethanol Plant - MVR evaporator plant	Distribution tank (TK912)	DISTTANK		Point	Y	0	17	0.25	0.63	295		4600	132	2.3	303	Odour concentration would be similar to MVR Vacuum Pump. Unable to sample due to physical constraints. Tanks are auto level control, therefore flow discharge would be rare and minimal.
Ethanol Plant - Starch line	Fermenter No. 2	E17		Point	Y	0	35	0.40	3.00	315		3900	1267	2.3	2913	Most recent sampling data adopted. Used as a back-up storage tank for stillage from Ethanol Plant. Emission occur intermittently based on use. A representative filling exercise was undertaken in mid 2023 where manildra diverted to this tank for 30 mins, so that odour samples could be taken from the exhaust to gauge MOER.
Ethanol Plant - Starch line	Beer Wells Tanks #5 & #6 (formerly known as Feed transfer to distillery)	E22		Point	Y	0	2.5	0.33	0.37	300		6100	167	2.3	383	Most recent sampling data adopted
Ethanol Plant - Starch line	Cooling towers	E23		Point	Y	1	10	3.41	7.50	301		12000	6667	2.3	15333	Not considered a source of odour. The cooling towers entrain fugitive odour and redisperse it. Including cooling towers has potential to 'double count' odour emissions (odour is counted once at source of origin, then again at cooling tower which 'collects and disperses' ambient odour). Cooling tower may improve / reduce fugitive odour emission impacts as odorous air is 'collected' and undergoing significantly more mixing with ambient air prior to reaching receptors. EPA requested source in model. 90% odour reduction assumed based on improvements to site wide odour fugitive odour emissions and implementation of other 2007 audit recommendations.
Ethanol Plant - Starch line	Ethanol Recovery Scrubber Discharge	ERESC	16	Point	Y	1	50	0.44	9.5	294		25102	44726	2.3	102871	Average data over last four quarterly sampling events. Sampling data collected during the selected quarter were not considered representative due to anomalies between this quarters' results and the previous and following quarters' results. Representative data for the quarter was estimated using an average of the three prior quarters.
Ethanol Plant - Starch line	Eastside retention	ERT		Point	Y	1	15	0.26	3.20	355		9600	1283	2.3	2952	Most recent sampling data adopted

Plant group area	Source	Model Reference	EPA ID	Source type	Wake Affected (Y / N)	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	Area (m^2) (if applicable)	Odour concentration (OU)	Adopted OER (OUm^3/s)	PtM ratio	Modelled OER (OUm^3/s) or ($OUm^3/s/m^2$)	Justification of parameters
	tank (4 tanks)															
Environmental farm	Farm tank (located at factory)	F18		Point	Y	0	1.5	0.33	3.30	301		4200	1073	2.3	2469	Most recent odour sampling data used for odour concentration. Historic flowrate sampling data used to calculate OER. High tank contents transfer rate. Level controlled tank with negligible exhaust air flowrate.
Ethanol Plant - Starch line	Fermenters (F10 – F17)	FERM	44	Point	Y	1	21	0.30	3.60	305		43250	10000	2.3	23000	Average data over last four quarterly sampling events
Ethanol Plant - MVR evaporator plant	Feed tank (TK921) and Product tanks (TK922)	FPTANK		Point	Y	0	14	0.30	0.44	295		4600	132	2.3	303	Odour concentration would be similar to MVR Vacuum Pump. Unable to sample due to physical constraints. Tanks are auto level control, therefore flow discharge would be rare and minimal. Not considered a significant source of odour. Assumed same OER as MVRVPUMP (same product, therefore similar OU and similar flowrate).
Starch plant	No. 6 Gluten Dryer	GD6		Point	Y	1	35	2.13	20.00	342		540	31667	2.3	72833	Most recent sampling data adopted
Starch plant	No. 7 Gluten Dryer	GD7		Point	Y	1	29	1.80	18.00	330		450	16000	2.3	36800	Most recent sampling data adopted
Starch plant	Gluten dryer 8	GD8		Point	Y	1	29	2.13	20.00	342		540	31667	2.3	72833	Proposed source, not constructed. Assumed same properties as Gluten Dryer 6.
Ethanol Plant - Starch line	Indirect tank	INDTANK		Point	Y	1	18	0.06	2.00	332		33000	167	2.3	383	Most recent sampling data adopted
Environmental farm	Membrane bio-reactor	MBR		Area	N		2				800	130	54	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.068	Most recent sampling data adopted
Ethanol Plant - MVR evaporator plant	MVR vacuum pumps	MVRVPUMP		Volume	N		1			295		4600	132	2.3	303	Most recent sampling data adopted
Starch plant	Product dryer 9	PD9		Point	Y	1	35.6	1.66	17.00	331		470	14333	2.3	32967	Most recent sampling data adopted
Environmental farm	Pond 1 / Treated effluent storage dam 1	PO1	19	Area	N		2				3080	89	167	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.054	Average data over last four quarterly sampling events. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
Environmental farm	Pond 2 / Treated effluent storage dam 2	PO2	20	Area	N		2				2500	510	973	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.389	Average data over last four quarterly sampling events. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
Environmental farm	Pond 3 / Treated	PO3	21	Area	N		2				6000	34	153	Based on stability	0.026	Average data over last four quarterly sampling events.

Plant group area	Source	Model Reference	EPA ID	Source type	Wake Affected (Y / N)	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	Area (m^2) (if applicable)	Odour concentration (OU)	Adopted OER (OUm^3/s)	PtM ratio	Modelled OER (OUm^3/s) or ($OUm^3/s/m^2$)	Justification of parameters
	effluent storage dam 3													class: 2.3 for A, B, C & D, 1.9 for E & F		Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
Environmental farm	Pond 5 / Treated effluent storage dam 5	PO5	23	Area	N		2				35170	660	9333	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.27	Average data over last four quarterly sampling events. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
Environmental farm	Pond 6 / Treated effluent storage dam 6	PO6	24	Area	N		2				60030	100	3333	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.056	Average data over last four quarterly sampling events. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
DDG plants - DDG pellet plant	Pellet Plant exhaust stack	PPES	46	Point	Y	1	49.2	1.49	20.80	323		-	61150	2.3	140645	Average data over last four quarterly sampling events.
Starch plant	No. 1 Starch dryer scrubber tower	S01	12	Point	Y	1	26	1.71	10.00	312		665	13000	2.3	29900	Average data over last four quarterly sampling events.
Starch plant	No. 1 Gluten dryer baghouse	S02	8	Point	Y	0	25.5	1.35	13.91	344		398	6328	2.3	14553	Average data over last four quarterly sampling events. Note that no temperature or flow rate readings could be taken due to access issues. Therefore an average of historic flowrate and temperatures were used. Velocity calculated based on average flowrate from sampling data.
Starch plant	No. 3 Gluten dryer baghouse	S03	10	Point	Y	1	21	2.54	14.00	346		749	41125	2.3	94588	Average data over last four quarterly sampling events.
Starch plant	No. 2 Gluten dryer baghouse	S04	9	Point	Y	0	27	1.19	17.00	339		549	7425	2.3	17078	Average data over last four quarterly sampling events.
Starch plant	No. 4 Gluten dryer baghouse	S05	11	Point	Y	0	30	1.73	17.00	345		803	27750	2.3	63825	Average data over last four quarterly sampling events.
Starch plant	No. 3 Starch dryer scrubber tower	S18	13	Point	Y	1	20	1.15	21.00	316		48	917	2.3	2108	Most recent sampling data adopted
Starch plant	No. 4 Starch dryer scrubber tower	S19	14	Point	Y	1	20	1.15	22.00	313		130	2833	2.3	6517	Most recent sampling data adopted
Starch plant	No. 5 Starch Dryer (existing)	SD5C	47	Point	Y	1	33.5	2.40	2.75	331		348	3135	2.3	7210	Average data over last four quarterly sampling events. Velocity and OER calculated based on design flowrate split 44,800m3/h (of 274,380m3/h). NOTE: above calculations assume that SD5N has been constructed

Plant group area	Source	Model Reference	EPA ID	Source type	Wake Affected (Y / N)	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	Area (m^2) (if applicable)	Odour concentration (OU)	Adopted OER (OUm^3/s)	PtM ratio	Modelled OER (OUm^3/s) or ($OUm^3/s/m^2$)	Justification of parameters
Starch plant	No. 5 Starch Dryer Cooler Exhaust (new)	SD5N		Point	Y	1	30	2.40	14.07	331		348	16065	2.3	36950	Average data over last four quarterly sampling events. Velocity and OER calculated based on design flowrate split 229580m3/h (of 274,380m3/h).
Starch plant	No. 5 Ring Dryer Starch	SDR5		Point	Y	0	25	1.56	12.00	348		800	14500	2.3	33350	Most recent sampling data adopted
Environmental farm	Sulphur Oxidisation (SO) Basin	SOBAS	25	Area	N		2				14030	73	727	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.052	Average data over last four quarterly sampling events. Source was not sampled during this monitoring round, therefore data from the previous monitoring round was adopted.
Environmental farm	Sludge pit (effluent pit)	SP		Area	N		1			291	160	1500	145	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.91	Most recent sampling data adopted
Ethanol Plant - Starch line	Southside retention tank (2 tanks)	SRT		Point	Y	1	20	0.26	3.20	355		8800	1283	2.3	2952	Data from worst case retention tanks adopted (Westside retention tanks). It is understood that the southside retention tank operate in the same manner as the eastise and westside retention tanks.
Ethanol Plant - Distillation plant	Stillage flash vessel	SST		Point	Y	1	2	0.14	3.30	360		3117	138	2.3	317	Most recent sampling data adopted
Ethanol Plant - Starch line	Westside retention tank (2 tanks)	WRT		Point	Y	1	16	0.26	3.20	355		9600	1283	2.3	2952	Operates in same manner and for same purpose as other retention tanks, Worst case (highest OER) sampling data adopted from other retention tanks.
Ethanol Plant - Starch line	Yeast tank Y4 (repurposed from Fermenter No. 4) and yeast tank Y6 (repurposed from Fermenter No. 6) (formerly YP45)	YP46		Point	Y	1	17	0.17	2.70	304		12999	667	2.3	1533	Most recent sampling data adopted

Table 6.3 Odour emissions inventory (2023-2024 Q4 sampling data – highest quarter) (partial table showing only quarterly sampled sources)

Plant group area	Source	Model Reference	EPA ID	Source type	Wake Affected (Y / N)	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	Area (m^2) (if applicable)	Odour concentration (OU)	Adopted OER (OUm^3/s)	PtM ratio	Modelled OER (OUm^3/s) or ($OUm^3/s/m^2$)	Justification of parameters
Boiler house	Combined Boiler Stack for No. 5 & 6 Boilers	BOILR5	35	Point	Y	1	54	2.02	10.00	374		3200	74000	2.3	170200	Quarterly data adopted based on selected quarter
Ethanol Plant - Starch line	Ethanol Recovery Scrubber Discharge	ERESC	16	Point	Y	1	50	0.44	9.5	294		39333	70556	2.3	162278	Quarterly data adopted based on selected quarter. Sampling data collected during the selected quarter were not considered representative due to anomalies between this quarters' results and the previous and following quarters' results. Representative data for the quarter was estimated using an average of the three prior quarters.
Ethanol Plant - Starch line	Fermenters (F10 – F17)	FERM	44	Point	Y	1	21	0.30	3.60	305		80000	18000	2.3	41400	Quarterly data adopted based on selected quarter
Environmental farm	Pond 1 / Treated effluent storage dam 1	PO1	19	Area	N		2				3080	89	167	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.054	Quarterly data adopted based on selected quarter. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
Environmental farm	Pond 2 / Treated effluent storage dam 2	PO2	20	Area	N		2				2500	510	973	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.389	Quarterly data adopted based on selected quarter. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
Environmental farm	Pond 3 / Treated effluent storage dam 3	PO3	21	Area	N		2				6000	34	153	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.026	Quarterly data adopted based on selected quarter. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
Environmental farm	Pond 5 / Treated effluent storage dam 5	PO5	23	Area	N		2				35170	660	9333	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.27	Quarterly data adopted based on selected quarter. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
Environmental farm	Pond 6 / Treated effluent storage dam 6	PO6	24	Area	N		2				60030	100	3333	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.056	Quarterly data adopted based on selected quarter. Where source was not sampled due to low water level or safety concerns, data from previous monitoring rounds was adopted
DDG plants - DDG pellet plant	Pellet Plant exhaust stack	PPES	46	Point	Y	1	49.2	1.49	20.80	323		-	43600	2.3	100280	Quarterly data adopted based on selected quarter
Starch plant	No. 1 Starch dryer scrubber tower	S01	12	Point	Y	1	26	1.71	10.00	312		500	10000	2.3	23000	Quarterly data adopted based on selected quarter
Starch plant	No. 1 Gluten dryer baghouse	S02	8	Point	Y	0	25.5	1.35	13.91	344		490	7800	2.3	17940	Quarterly data adopted based on selected quarter. Note that no temperature or flow rate readings could be taken due to access issues. Therefore an

Plant group area	Source	Model Reference	EPA ID	Source type	Wake Affected (Y / N)	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	Area (m^2) (if applicable)	Odour concentration (OU)	Adopted OER (OUm^3/s)	PtM ratio	Modelled OER (OUm^3/s) or ($OUm^3/s/m^2$)	Justification of parameters
																average of historic flowrate and temperatures were used. Velocity calculated based on average flowrate from sampling data.
Starch plant	No. 3 Gluten dryer baghouse	S03	10	Point	Y	1	21	2.54	14.00	346		1000	58000	2.3	133400	Quarterly data adopted based on selected quarter
Starch plant	No. 2 Gluten dryer baghouse	S04	9	Point	Y	0	27	1.19	17.00	339		95	1400	2.3	3220	Quarterly data adopted based on selected quarter
Starch plant	No. 4 Gluten dryer baghouse	S05	11	Point	Y	0	30	1.73	17.00	345		1100	36000	2.3	82800	Quarterly data adopted based on selected quarter
Starch plant	No. 5 Starch Dryer (existing)	SD5C	47	Point	Y	1	33.5	2.40	2.75	331		440	4082	2.3	9388	Quarterly data adopted based on selected quarter. Velocity and OER calculated based on design flowrate split 44,800m3/h (of 274,380m3/h). NOTE: above calculations assume that SD5N has been constructed
Starch plant	No. 5 Starch Dryer Cooler Exhaust (new)	SD5N		Point	Y	1	30	2.40	14.07	331		440	20918	2.3	48112	Quarterly data adopted based on selected quarter. Velocity and OER calculated based on design flowrate split 229580m3/h (of 274,380m3/h).
Environmental farm	Sulphur Oxidisation (SO) Basin	SOBAS	25	Area	N		2				14030	73	533	Based on stability class: 2.3 for A, B, C & D, 1.9 for E & F	0.038	Quarterly data adopted based on selected quarter. Source was not sampled during this monitoring round, therefore data from the previous monitoring round was adopted.

6.2 Predicted odour impacts

The odour model predictions are presented as tabulated results providing ground level concentrations at each sensitive receptor and as contour plots to illustrate the predicted pattern of dispersion and allow interpretation of the model predictions at any point of the sampling grid. The model results were presented as peak 1 second averaged 99th percentile odour concentration in accordance with the Approved Methods. The predicted model results were compared against the adopted odour assessment criteria to determine regulatory compliance.

The predicted odour concentrations during operation of MOD31 for both odour emissions scenarios are presented in Table 6.4.

Predicted odour contour dispersion plots are provided in:

– Figure 6.2 – Average sampling data over last four quarters scenario
– Figure 6.3 – 2023-2024 Q4 sampling data (highest quarter) scenario

The results of the MOD31 odour modelling predicted compliance with the odour criteria for both the worst case quarter (2023-2024 Q4) and the average sampling data scenario.

Nine commercial/industrial receptors are included in the assessment. These are all located within approximately 125 m of the site. One second, 99th percentile odour impacts have been predicted based on the site operating 24 hours per day, 7 days per week. It is unlikely that these commercial/industrial receptors would be occupied at all times and therefore may not be subject to worst case meteorological dispersion conditions (and likely worst case odour impacts) that typically occur during calms at night and early morning periods.

Commercial receptors C1 and C6 are located approximately 45 and 80 metres from the site.

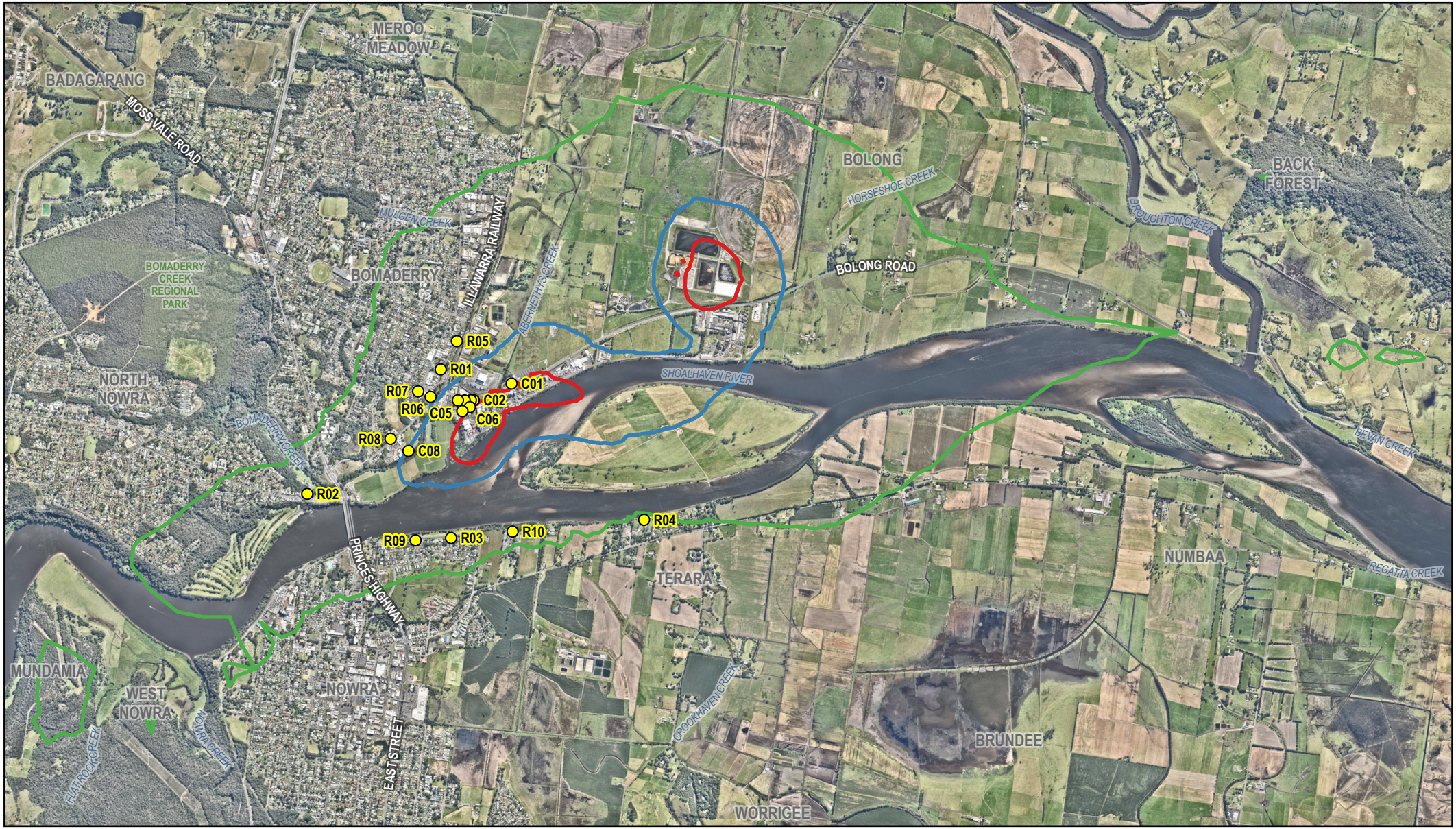
Given the industrial nature of these receptors, and its existing proximity to the site no significant odour impacts are anticipated from the proposal.

The odour surveys tend to support model findings of predicted odour concentrations within the NSW EPA criteria range. Odours classified as weak would likely be below 5 OU which is often attributed as an annoyance threshold for odour (Guideline Odour Impact Assessment from Developments, Queensland Government Department of Environment and Heritage Protection, 2018).

Table 6.4 Predicted peak (99th percentile, short term averaged) odour impact at nearby receptors

Receptor	Adopted odour assessment criteria (OU)	Predicted odour concentration (OU)	
		Average across last 4 quarters	2023-2024 Q4
R01	6	4	5
R02	3	3	3
R03	5	3	3
R04	5	2	2
R05	5	4	4
R06	5	5	5
R07	5	4	4
R08	5	4	4
R09	5	3	3
R10	5	2	2
R11	7	3	4
R12	7	4	5
C01	N/A	9	9
C02	N/A	8	9

Receptor	Adopted odour assessment criteria (OU)	Predicted odour concentration (OU)	
		Average across last 4 quarters	2023-2024 Q4
C03	N/A	8	9
C04	N/A	8	8
C05	N/A	7	7
C06	N/A	10	10
C07	N/A	9	10
C08	N/A	5	6
C09	N/A	5	5



LEGEND

Predicted odour impact – average scenario (OU):

- 2
- 5
- 10
- Sensitive receptors

Paper Size ISO A4

0 0.5 1

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Manildra Group
Shoalhaven Starches Modification 31
Air Quality Impact Assessment

Predicted odour impact for MOD31 – average scenario (99th percentile, short term averaged OU)

Project No. **12655910**
Revision No. **0**
Date **11/06/2025**

FIGURE 6.2

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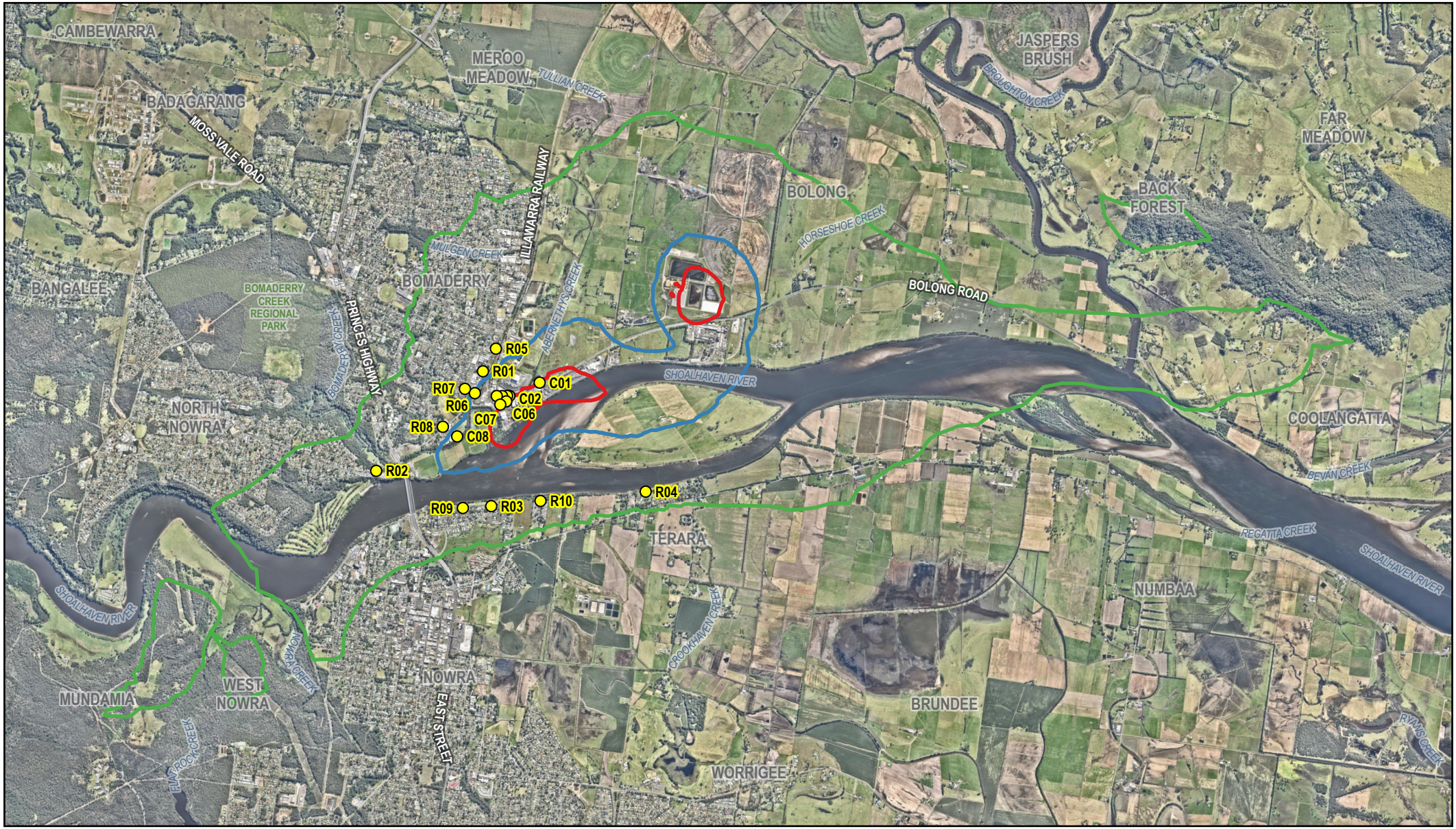
Print date: 11 Jun 2025 - 09:12

Data source: DCS: Roads, Railways, Waterways, 2025. DFSI: NPWS: 2025. Nearmap WMS Server: – Imagery (Date extracted: 11/06/2025).
Created by: tmorton



LEGEND

Predicted odour impact – 2023-2024 Q4 (OU):

- 2
- 5
- 10
- Sensitive receptors

Paper Size ISO A4

0 0.5 1 1.5

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

Manildra Group
Shoalhaven Starches Modification 31
Air Quality Impact Assessment

Predicted odour impact for MOD31 – 2023-2024 Q4 scenario (99th percentile, short term averaged OU)

Project No. **12655910**
Revision No. **0**
Date **11/06/2025**

FIGURE 6.3

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Print date: 11 Jun 2025 - 09:12

Data source: DCS: Roads, Railways, Waterways, 2025. DFSI: NPWS: 2025. Nearmap WMS Server: – Imagery (Date extracted: 11/06/2025).
Created by: tmorton

6.3 Recommended odour management and mitigation

To inform odour management and mitigation, a source contribution analysis was undertaken at each of the twelve residential receptors. The analysis identified the following sources where mitigation efforts would be most effectively focused to minimise off site odour impacts:

– Ethanol Recovery Scrubber Discharge (ERESC)
– No. 3 Gluten dryer baghouse (S03)
– No. 5 Gluten dryer baghouse (S05)
– Pellet Plant exhaust stack (PPES)
– Combined Boiler Stack for No. 5 & 6 Boilers (BOILR5)

It is recommended that further investigation is undertaken into the above identified sources to determine potential odour management and mitigation options.

The findings of the odour sampling should be compared against the odour emission rate assumptions adopted in this report (refer Section 6.1.5.2). Should significant discrepancies (differences) between the model assumptions and sampled results be identified, it is recommended that Manildra conduct an internal investigation to determine likely reasons/causes for the differences. Implementation of additional odour mitigation and management measures should be considered if odour emissions are higher than assumed in this assessment.

7. Operational air pollutant assessment

7.1 Pollutant emissions inventory

7.1.1 Source identification

In addition to odour emissions, the operation of the Shoalhaven Starches plant also has the potential to generate emissions of particulate matter, products of combustion and metals.

These emissions occur from a variety of mechanisms including:

– Combustion of gas for energy (stream) production in gas cogeneration turbines and boilers
– From drying of gluten and starch via the exhaust baghouses on gluten and starch dryers
– Processing and milling of flour
– Handling and transfer (including conveying) of raw material and finished product
– Loading and unloading silos

The emissions inventory for MOD31 includes all existing air emissions sources at the site and those proposed in previous Modifications, except for MOD26 and MOD22 (up to and including Modification 29).

7.1.2 Changes due to the proposed modification

No new emissions sources are proposed in this modification, however changes (decreases) to fuel consumption in the gas turbines, boilers and dryers are proposed due to reduced heat generation requirements. Therefore, reduced emissions of particulate matter, combustion pollutants and metals is anticipated due to reduced fuel consumption.

7.1.3 Air pollutant emissions assumptions

Generally the air pollutant emissions estimation methodology adopted for this Modification was consistent with that of previous modifications. Emission rates for this modification were updated based on most recent sampling data to reflect the site's current operations where new data was available.

Pollutant sampling data was available for:

– Boilers 4 and 8
– Particulate emissions for Gluten dryers 1, 2, 3, and 4 and starch dryers 1, 3 and 4 and NO_x emissions for Gluten dryers 1 – 7 and starch dryers 1, 3 and 4
– Particulate emissions from select vents at flour mills A and B
– Particulate emissions from select vents at the existing packing plant
– Cogeneration plant

A summary of air pollutant emissions modelling assumptions for existing sources is provided in Table 7.1.

Table 7.1 Existing source modelling assumptions

Source	Model ID	Modelled species	Pollutant data adopted and justification
Gas turbines	turb1 turb2	TSP, PM_{10}, $PM_{2.5}$, CO, SO_2, NO_2, VOC	Gas turbine emissions were estimated based on source specific sampling data. Sampling data were obtained from *Emissions Testing Report – Cogeneration Plant* (Ektimo, 2024). Exhaust flow rate from the turbines was calculated based on the MOD31 natural gas consumption.
Boilers	BOILR1 BOILR5 BOILR8	TSP, PM_{10}, $PM_{2.5}$, CO, SO_2, NO_2,	Boiler emissions were estimated based on review of recent boiler sampling data including:

Source	Model ID	Modelled species	Pollutant data adopted and justification
		VOC, Metals and PAH	– Sampling of boiler 4 which was operating on natural gas refer to Manildra Group, Shoalhaven Starches Pty Ltd, Bomaderry Emission Testing Report EPA ID 42 – Boiler 4 Report Number R013746 (Ektimo, 2023) – Sampling of boiler 8 which was operating on a mixture of natural gas and biogas refer to Manildra Group, Shoalhaven Starches Pty Ltd, Bomaderry Emission Testing Report Boiler 8 Report Number R013746-1 (Ektimo, 2023) It was found that sampling of boiler 8 was generally higher and therefore future boiler emissions were conservatively scaled off boiler 8 sampling data based on gas consumption. Emissions were scaled from boiler 8 sampling data based on the energy consumption at the time of sampling compared to the proposed MOD31 energy consumption.
Gluten and starch dryers	S02 S04 S03 S05 SDR5 GD6 GD7 GD8 S01 S18 S19 SD5C SD5N S20 PD9	TSP, PM_{10}, $PM_{2.5}$, CO, SO_2, NO_2, VOC	Gluten and starch dryer emissions were estimated as follows: – Particulate matter emissions were based off source specific sampling data. If an individual dryer hasn't been tested, data was assumed from the dryer considered most similar was adopted. Sampling data was obtained from: • *Stack Emissions Survey - Particles, Odour Metals and Gases* (SEMA, 2008) • *Stack Emission Survey - TSP Emissions - Gluten Dryers 6&7 - Report No. 5379* (SEMA, 2014) • *Stack Emission Survey - Particulate Matter - Starch Dryer 1, 4 and Spray Dryer - Report No. 7071* (SEMA, 2020) – NO_x emissions were based off source specific sampling data: • *Starch and Gluten Dryers NO_x Emission Test Report No. 7093* (SEMA, 2020) – CO, SO_2 and VOC emissions were estimated based on gas consumption rates and emission factors from *National Pollutant Inventory Emission estimation technique manual for Combustion in boilers Version 3.6* (December 2011) Table 20: Emission factors for natural gas (tangential fired). Gas consumption recorded in FY 2024 of 436,298 GJ was split evenly across the dryers.
Flour mill	FMP1, FMP2 FMBA-FMBF FMC1-FMC3	TSP, PM_{10} and $PM_{2.5}$	Flour mill particulate matter emissions were based off source specific sampling data. If an individual four mill outlet hasn't been tested, data was assumed from the most representative sampling data. Sampling data was obtained from *Stack Emissions Survey Flour Mill Project No. 4916* (SEMA, 2011)
Packing plant	PPL1-2, PPM1-3, PPS1-2	TSP, PM_{10} and $PM_{2.5}$	Flour mill particulate matter emissions were based off source specific sampling data. If an individual four mill outlet hasn't been tested, data was assumed from the most representative sampling data. Sampling data was obtained from *Packing Plant Emissions Survey Emission Test Repot No. 5600* (SEMA, 2015)
Bag house emissions (from silos, bulk bag aspiration fan and Product dryer 3 & 4 starch grinding bag house)	SILO1 SILO2 SILO3 SILO4 SILO5 A04 B46 SD3SGBH SD4SGBH	TSP, PM_{10} and $PM_{2.5}$	Bag house particulate matter emissions were estimated based on an assumed baghouse (fabric filter) maximum TSP concentration of 5 mg/m^3 and design stack flowrate.

For all sources listed in Table 7.1, where particulate matter faction size data was not available, fractions of PM_{10} and $PM_{2.5}$ were calculated using a PM_{10}/TSP ratio of 0.61 and a $PM_{2.5}/PM_{10}$ ratio of 0.23 based on particle size distribution data provide for Grain processing in *Appendix B.1 Particle Size Distribution Data and Sized Emission Factors for Selected Sources* of *United States Environmental Protection Agency Air Emissions Factors and Quantification AP-42: Compilation of Air Emissions Factors* (US EPA guidance).

7.1.4 Pollutant source summary

Air pollutant emissions inventories were prepared for a typical operating scenario (both gas cogeneration turbines operating a full capacity).

Preparation of the air pollutant emissions inventory relied upon the sampling data and assumptions outlined in Section 7.1.3.

The air pollutant emissions inventories are provided in the following tables:

– Table 7.2 – Discharge parameters and particulates
– Table 7.3 – Combustion pollutants, Metals and PAH

Table 7.2 Air pollutant emissions inventory – Discharge parameters and particulates

Source details		Discharge parameters						Particulate emission rate (g/s)		
Equipment	Model ID	Source type	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	TSP	PM_{10}	$PM_{2.5}$
Boiler No. 1	BOILR1	POINT	1	25	0.9	-	-	-	-	-
Boiler No. 5/6	BOILR5	POINT	1	54	2.1	2.2	376	0.039	0.039	0.026
Boiler No. 8	BOILR8	POINT	1	24	1.7	-	-	-	-	-
Gluten dryer No. 1	S02	POINT	0	26	3.2	14.0	344	0.015	0.0003	0.000069
Gluten dryer No. 2	S04	POINT	0	27	3.2	17.0	337	0.015	0.0010	0.00023
Gluten dryer No. 3	S03	POINT	1	21	2.5	11.0	347	0.020	0.012	0.0028
Gluten dryer No. 4	S05	POINT	0	30	2.7	21.0	345	0.020	0.012	0.0028
Ring Dryer No.5	SDR5	POINT	0	25	1.2	10.0	320	0.012	0.0072	0.0017
Gluten dryer No. 6	GD6	POINT	1	35	1.7	20.0	346	0.020	0.012	0.0028
Gluten Dryer No.7	GD7	POINT	1	29	1.8	19.0	341	0.035	0.021	0.0049
Gluten Dryer No.8	GD8	POINT	1	29	1.9	20.0	346	0.020	0.012	0.0028
Starch dryer No. 1	S01	POINT	1	26	1.3	6.0	311	0.044	0.033	0.0076
Starch dryer No. 3	S18	POINT	1	20	1.2	23.0	309	0.040	0.013	0.0030
Starch dryer No. 4	S19	POINT	1	20	1.2	22.0	312	0.057	0.029	0.0066
Starch dryer No. 5 (Existing)	SD5C	POINT	1	34	2.4	2.9	341	0.062	0.038	0.0087
No. 5 Starch Dryer (new - SD5 was split into 2 stacks)	SD5N	POINT	1	30	2.4	14.7	341	0.32	0.19	0.045
Spray dryer 5	S20	POINT	0	19	1.4	8.0	344	0.0028	0.0019	0.00043
Flour Mill A - Point 1	FMP1	POINT	1	33	0.9	4.2	300	0.00030	0.00018	4.2E-05
Flour Mill A Point 2	FMP2	POINT	1	32	0.7	4.4	320	0.00020	0.00012	2.8E-05
Flour Mill B - Point A	FMBA	POINT	1	40	0.7	12.2	322	0.00049	0.00030	6.9E-05
Flour Mill B - Point B	FMBB	POINT	1	40	1.0	2.8	294	0.00023	0.00014	3.2E-05
Flour Mill B - Point C	FMBC	POINT	1	40	1.0	4.9	322	0.00041	0.00025	5.8E-05
Flour Mill B - Point D	FMBD	POINT	1	40	0.7	29.1	300	0.0012	0.00071	0.00016
Flour Mill B - Point E	FMBE	POINT	1	40	1.1	10.2	300	0.0010	0.00064	0.00015
Flour Mill B - Point F	FMBF	POINT	1	40	1.1	3.5	322	0.00036	0.00022	5.1E-05
Flour Mill C - Point 1	FMC1	POINT	1	38	0.7	12.2	322	0.00049	0.00030	6.9E-05
Flour Mill C - Point 2	FMC2	POINT	1	38	0.7	6.5	294	0.00030	0.00018	4.2E-05
Flour Mill C - Point 3	FMC3	POINT	1	38	0.7	11.7	322	0.00047	0.00029	6.60402E-05
Packing Plant - Small Gluten Silo	PPS1	POINT	1	34	0.2	18.6	320	0.0050	0.0031	0.00070
Packing Plant - Small Starch Silo	PPS2	POINT	1	34	0.2	18.6	320	0.0050	0.0031	0.00070
Packing Plant - Medium Gluten Silo 1	PPM1	POINT	1	21	0.2	6.8	320	0.0010	0.00061	0.00014
Packing Plant - Medium Gluten Silo 2	PPM2	POINT	1	21	0.2	6.8	320	0.0010	0.00061	0.00014
Packing Plant - Medium Gluten Silo 3	PPM3	POINT	1	21	0.2	6.8	320	0.0010	0.00061	0.00014
Packing Plant - Large Starch Silo 1	PPL1	POINT	1	27	0.2	6.8	320	0.0010	0.00061	0.00014
Packing Plant - Large Starch Silo 2	PPL2	POINT	1	27	0.2	6.8	320	0.0020	0.0012	0.00028
Co-generator turbine No. 1 (proposed)	turb1	POINT	1	45	2.7	9.1	374	0.16	0.16	0.10
Co-generator turbine No. 2 (proposed)	turb2	POINT	1	45	2.7	9.1	374	0.16	0.16	0.10
Silo source 1 (combined stack for 3 silos)	SILO1	POINT	1	34	0.3	15.0	323	0.0042	0.0025	0.00058

Source details		Discharge parameters						Particulate emission rate (g/s)		
Equipment	Model ID	Source type	Horizontal release (Vertical = 1 or horizontal release = 0)	Stack height (m)	Diameter (m)	Velocity (m/s)	Temperature (k)	TSP	PM_{10}	$PM_{2.5}$
Silo source 2 (combined stack for 6 silos)	SILO2	POINT	1	34	0.3	15.0	323	0.0042	0.0025	0.00058
Silo source 3 (combined stack for 2 silos)	SILO3	POINT	1	34	0.5	15.0	323	0.017	0.010	0.0023
Silo source 4 (combined stack for 6 silos)	SILO4	POINT	1	34	0.3	15.0	323	0.0042	0.0025	0.00058
Silo source 5 (combined stack for 3 silos)	SILO5	POINT	1	34	0.5	15.0	323	0.013	0.0076	0.0018
Product dryer 9	PD9	POINT	1	36	0.9	15.3	346	0.015	0.00030	0.000069
Wheat silos	A04	POINT	1	30	0.3	13.9	323	0.0034	0.0021	0.00048
Bulk bag aspiration fan	B46	VOLUME	1	15	0.0	0.0	0	0.0027	0.0016	0.00037
Product dryer 3 starch grinding bag house	SD3SGBH	POINT	1	29	0.5	7.6	316	0.0075	0.0046	0.0011
Product dryer 4 starch grinding bag house	SD4SGBH	POINT	1	29	0.5	7.6	316	0.0075	0.0046	0.0011

Table 7.3 Air pollutant emissions inventory – Combustion pollutants, Metals and PAH

Source details		Combustion pollutants emission rates (g/s)				Metals and PAH emission rate (g/s)											
Equipment	Model ID	CO	SO_2	NO_2	VOC	Sb	As	Cd	Pb	Hg	Be	Cr	Co	Mn	Ni	Se	PAH
Boiler No. 1	BOILR1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boiler No. 5/6	BOILR5	0.05	6.1	1.6	0.06	4.5E-05	1.9E-05	4.5E-06	1.3E-05	4.5E-06	5.8E-06	9.7E-06	7.1E-06	1.9E-05	6.6E-05	4.5E-05	1.9E-05
Boiler No. 8	BOILR8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gluten dryer No. 1	S02	0.012	0.0006	0.12	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Gluten dryer No. 2	S04	0.012	0.0006	0.024	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Gluten dryer No. 3	S03	0.012	0.0006	0.43	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Gluten dryer No. 4	S05	0.012	0.0006	0.060	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Ring Dryer No.5	SDR5	0.012	0.0006	0.075	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Gluten dryer No. 6	GD6	0.012	0.0006	0.099	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Gluten Dryer No.7	GD7	0.012	0.0006	0.062	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Gluten Dryer No.8	GD8	0.012	0.0006	0.23	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Starch dryer No. 1	S01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Starch dryer No. 3	S18	0.012	0.0006	0.038	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Starch dryer No. 4	S19	0.012	0.0006	0.036	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Starch dryer No. 5 (Existing)	SD5C	0.0020	0.00009	0.016	0.00047	-	-	-	-	-	-	-	-	-	-	-	-
No. 5 Starch Dryer (new - SD5 was split into 2 stacks)	SD5N	0.010	0.00048	0.082	0.0024	-	-	-	-	-	-	-	-	-	-	-	-
Spray dryer 5	S20	0.012	0.0006	0.048	0.0029	-	-	-	-	-	-	-	-	-	-	-	-
Co-generator turbine No. 1 (proposed)	turb1	0.4	0.31	1.3	0.01	-	-	-	-	-	-	-	-	-	-	-	-
Co-generator turbine No. 2 (proposed)	turb2	0.1	0.31	2.2	0.04	-	-	-	-	-	-	-	-	-	-	-	-
Product dryer 9	PD9	0.012	0.0006	0.035	0.0029	-	-	-	-	-	-	-	-	-	-	-	-

7.2 Predicted pollutant impacts

The air pollutant model predictions are presented as tabulated results providing ground level concentrations at each sensitive receptor and as contour plots to illustrate the predicted pattern of dispersion and allow interpretation of the model predictions at any point of the sampling grid. The model results for each species were presented as appropriate averaging periods and percentiles to align with their respective assessment criteria. The predicted model results were compared against the adopted assessment criteria to determine regulatory compliance.

7.2.1 Particulates

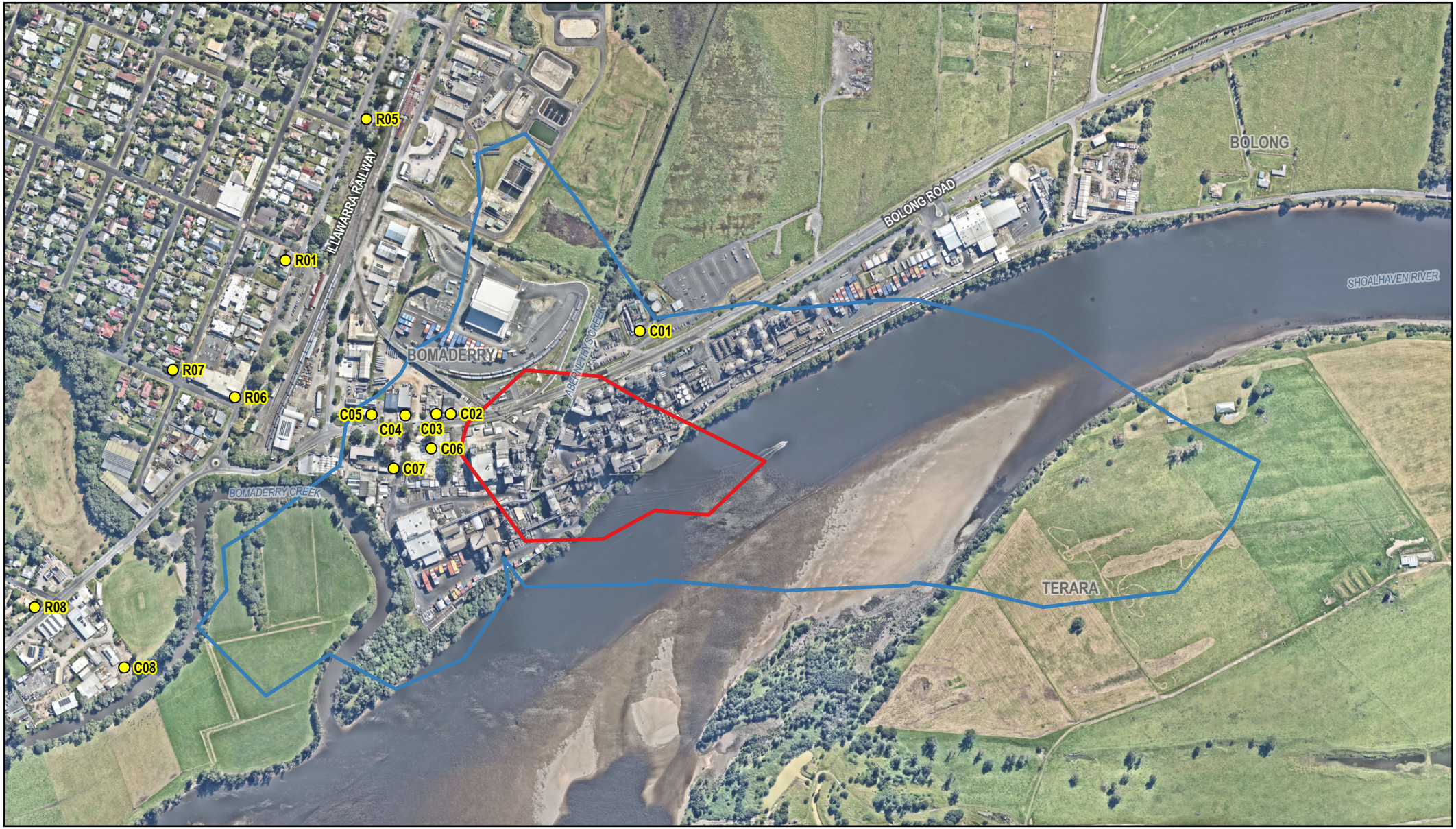
Predicted incremental and cumulative particulate matter concentrations are provided in Table 7.4.

Compliance with the assessment criteria is predicted at all receptors for all particulate matter fractions across all scenarios.

A contour plot displaying the pattern of dispersion for 24 hour PM_{10} is provided in Figure 7.1.

Table 7.4 Maximum predicted TSP, PM_{10} and $PM_{2.5}$ concentrations (µg/m^3)

Receptor	Predicted particulate matter concentrations (µg/m^3)									
	Incremental					Cumulative				
	TSP	PM_{10}		$PM_{2.5}$		TSP	PM_{10}		$PM_{2.5}$	
Averaging period	Annual	24 hour	Annual	24 hour	Annual	Annual	24 hour	Annual	24 hour	Annual
Criteria µg/m^3	90	50	25	25	8	90	50	25	25	8
R01	0.4	1.5	0.3	0.4	0.1	25.4	35.0	12.7	22.1	4.8
R02	0.2	0.9	0.1	0.3	0.1	25.2	35.0	12.5	22.2	4.7
R03	0.1	0.8	0.1	0.3	0.0	25.1	35.0	12.5	22.1	4.7
R04	0.1	1.0	0.1	0.4	0.0	25.2	35.1	12.5	22.1	4.7
R05	0.4	1.4	0.3	0.6	0.1	25.4	34.9	12.7	22.1	4.8
R06	0.5	1.7	0.3	0.5	0.1	25.5	35.3	12.7	22.2	4.8
R07	0.4	1.4	0.2	0.4	0.1	25.4	35.2	12.6	22.2	4.8
R08	0.4	1.3	0.3	0.5	0.1	25.4	35.3	12.7	22.3	4.8
R09	0.2	0.7	0.1	0.2	0.0	25.2	35.0	12.5	22.1	4.7
R10	0.1	0.7	0.1	0.2	0.0	25.1	34.9	12.5	22.1	4.7
R11	0.3	0.8	0.2	0.2	0.0	25.3	34.8	12.6	22.1	4.7
R12	0.4	0.9	0.3	0.3	0.1	25.5	34.9	12.7	22.1	4.7
C01	1.5	2.7	0.9	0.7	0.2	26.5	35.0	13.3	22.1	4.9
C02	1.4	3.8	0.9	0.9	0.2	26.4	35.9	13.3	22.3	4.9
C03	1.3	3.4	0.8	0.9	0.2	26.3	35.9	13.2	22.3	4.9
C04	1.1	2.9	0.7	0.7	0.2	26.1	35.9	13.1	22.3	4.9
C05	0.9	2.6	0.6	0.7	0.2	26.0	35.7	13.0	22.3	4.9
C06	1.5	3.1	0.9	0.8	0.2	26.5	36.6	13.3	22.5	4.9
C07	1.3	2.8	0.8	0.7	0.2	26.3	36.2	13.2	22.4	4.9
C08	0.6	2.0	0.4	0.7	0.1	25.6	35.3	12.8	22.3	4.8
C09	0.6	1.8	0.4	0.5	0.1	25.6	35.0	12.8	22.1	4.8



LEGEND

Predicted PM_{10} 24 hour concentration (µg/m³):

- 2.5
- 5
- Sensitive receptors

Paper Size ISO A4

0 100 200 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Manildra Group
Shoalhaven Starches Modification 31
Air Quality Impact Assessment

Maximum predicted incremental 24 hour PM_{10} concentrations (100th percentile, µg/m³)

Project No. **12655910**
Revision No. **0**
Date **11/06/2025**

FIGURE 7.1

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Print date: 11 Jun 2025 - 09:12

Data source: DCS: Roads, Railways, Waterways, 2025. DFSI: NPWS: 2025. Nearmap WMS Server: – Imagery (Date extracted: 11/06/2025).
Created by: tmorton

7.2.2 Products of combustion

Predicted incremental and cumulative combustion pollutant concentrations are provided in Table 7.5.

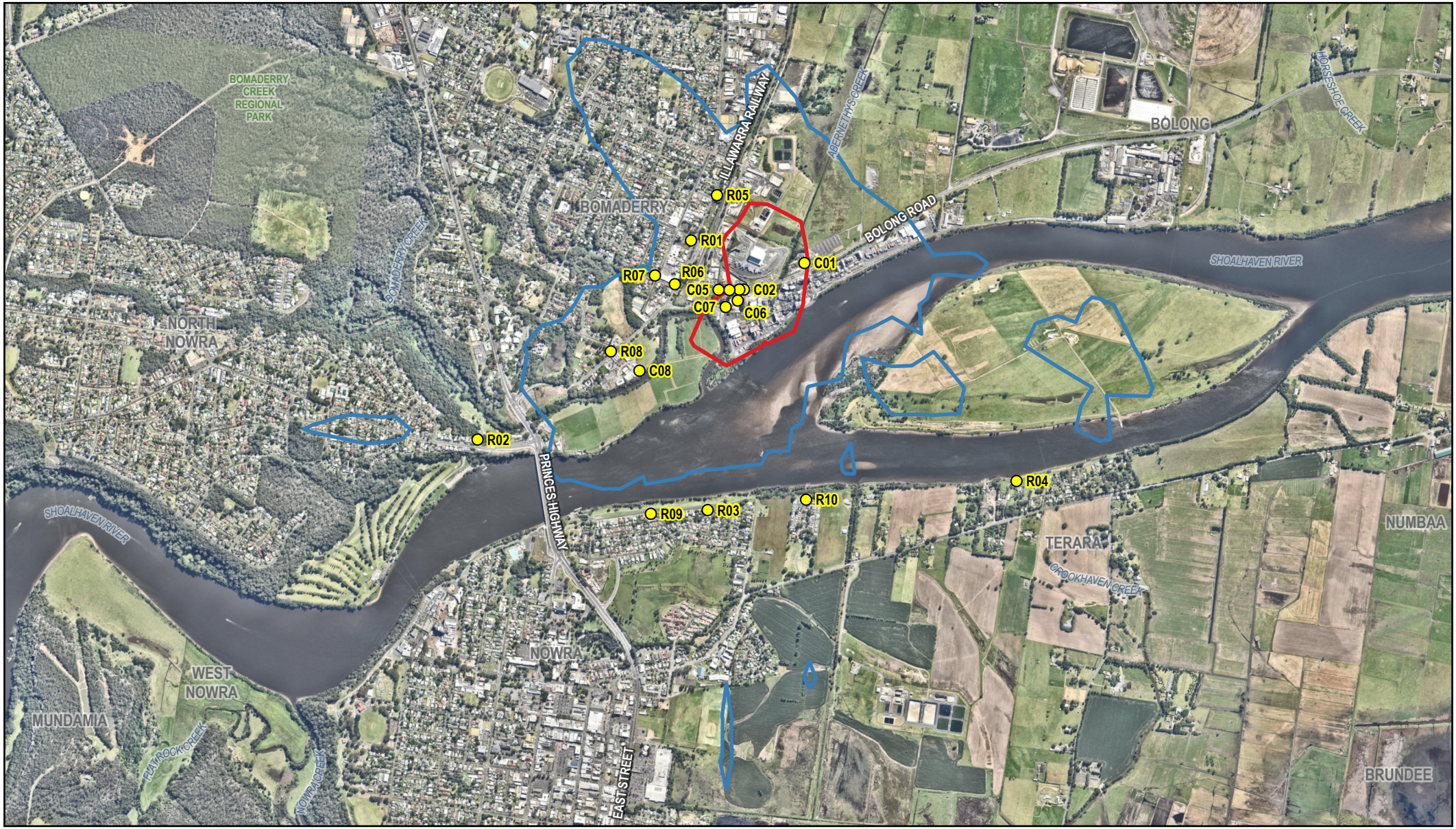
Compliance with the assessment criteria is predicted at all receptors for all combustion pollutants.

A contour plot displaying the pattern of dispersion for combustion pollutants is provided in:

– Figure 7.2 for 1 hour NO_2 (noting that the figure shows 100% conversion of NOx into NO_2 opposed to the OLM adopted for the results in Table 7.5. Figure 7.2 was provided to show the pattern of dispersion of the pollutant, compliance with the assessment criteria should be determined based on Table 7.5.)
– Figure 7.3 for 1 hour SO_2

Table 7.5 Predicted concentrations of products of combustion (µg/m^3)

Receptor	Predicted NO_2 concentrations (µg/m^3)				Predicted SO_2 concentrations (µg/m^3)				Predicted CO concentrations (mg/m^3)					
	Incremental		Cumulative		Incremental		Cumulative		Incremental			Cumulative		
Averaging period	1 hour	Annual	1 hour	Annual	1 hour	24 hour	1 hour	24 hour	15 min	1 hour	8 hour	15 min	1 hour	8 hour
Criteria	164	31	164	31	286	57	286	57	100	30	10	100	30	10
Bomaderry (R1)	40.7	1.5	76.4	9.5	89.5	12.5	91.1	20.0	0.01	0.01	0.002	3.0	2.3	1.5
North Nowra (R2)	25.0	0.9	90.1	8.8	57.4	8.5	74.7	18.4	0.01	0.004	0.001	3.0	2.3	1.5
Nowra (R3)	23.8	0.4	76.4	8.3	63.8	5.0	70.1	16.8	0.01	0.00	0.001	3.0	2.3	1.5
Terara (R4)	34.6	0.4	76.4	8.4	93.4	6.1	96.3	15.4	0.01	0.00	0.001	3.0	2.3	1.5
R05	32.9	1.4	76.4	9.4	140.5	17.1	140.6	23.8	0.01	0.01	0.002	3.0	2.3	1.5
R06	39.3	1.7	76.4	9.7	165.8	13.6	167.2	20.7	0.01	0.01	0.002	3.0	2.3	1.5
R07	38.7	1.4	76.4	9.3	149.2	12.6	150.6	19.5	0.01	0.01	0.002	3.0	2.3	1.5
R08	33.5	1.6	79.1	9.5	115.9	13.1	116.0	21.1	0.01	0.01	0.002	3.0	2.3	1.5
R09	44.6	0.4	76.4	8.4	84.5	6.8	85.3	17.8	0.01	0.00	0.001	3.0	2.3	1.5
R10	25.2	0.3	76.4	8.3	75.2	6.0	96.0	16.3	0.00	0.00	0.001	3.0	2.3	1.5
R11	24.6	0.7	76.4	8.7	81.9	9.7	83.4	16.2	0.00	0.00	0.001	3.0	2.3	1.5
R12	22.7	1.1	78.1	9.1	59.1	9.5	59.9	15.6	0.00	0.00	0.001	3.0	2.3	1.5
C01	46.3	2.6	76.4	10.5	187.2	15.0	188.1	21.2	0.01	0.01	0.003	3.0	2.3	1.5
C02	45.1	3.3	86.3	11.3	236.8	23.1	237.6	26.4	0.02	0.02	0.002	3.1	2.3	1.5
C03	45.2	3.2	85.2	11.2	221.6	23.8	222.4	26.5	0.02	0.01	0.002	3.1	2.3	1.5
C04	46.3	3.0	81.8	11.0	184.4	22.9	185.2	25.8	0.02	0.01	0.003	3.1	2.3	1.5
C05	47.1	2.7	78.4	10.7	146.3	20.6	147.1	24.5	0.02	0.01	0.002	3.1	2.3	1.5
C06	39.8	3.6	87.6	11.5	192.6	24.9	193.4	27.6	0.02	0.02	0.003	3.1	2.3	1.5
C07	39.5	3.3	80.3	11.3	134.2	21.8	135.0	26.3	0.02	0.01	0.002	3.1	2.3	1.5
C08	34.2	2.1	80.2	10.1	101.2	17.0	103.2	22.8	0.01	0.01	0.002	3.0	2.3	1.5
C09	44.7	1.9	76.4	9.9	150.1	17.6	150.9	23.1	0.02	0.01	0.002	3.1	2.3	1.5



LEGEND

Predicted NO_2 1 hour concentration (µg/m³):

- 50
- 100
- Sensitive receptors

Paper Size ISO A4

0 200 400 600 800

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

N

GHD

Manildra Group
Shoalhaven Starches Modification 31
Air Quality Impact Assessment

Maximum predicted incremental 1 hour NO_2 concentrations (100th percentile, µg/m³)

Project No. **12655910**
Revision No. **0**
Date **11/06/2025**

FIGURE 7.2

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Print date: 11 Jun 2025 - 09:12

Data source: DCS: Roads, Railways, Waterways, 2025. DFSI: NPWS: 2025. Nearmap WMS Server: – Imagery (Date extracted: 11/06/2025).
Created by: tmorton

LEGEND

Predicted SO_2 1 hour concentration (µg/m³):

- 60
- 100
- 200
- Sensitive receptors

Paper Size ISO A4

0 0.5 1 1.5

Kilometres

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

GHD

Manildra Group
Shoalhaven Starches Modification 31
Air Quality Impact Assessment

Maximum predicted incremental 1 hour SO_2 concentrations (100th percentile, µg/m³)

Project No. **12655910**
Revision No. **0**
Date **11/06/2025**

FIGURE 7.3

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Print date: 11 Jun 2025 - 09:12

Data source: DCS: Roads, Railways, Waterways, 2025. DFSI: NPWS: 2025. Nearmap WMS Server: – Imagery (Date extracted: 11/06/2025).
Created by: tmorton

7.2.3 PAH, VOCs and metals

Predicted incremental PAH, VOC and metal concentrations are provided in Table 7.6.

Compliance with the assessment criteria is predicted at all receptors for all pollutants across all scenarios.

Table 7.6 Maximum predicted ground level PAH, VOC and metals concentrations

Receptor	Predicted incremental PAH, VOC and metal concentrations (mg/m^3)									
Pollutant	**PAH**	**VOC**	**Arsenic**	**Cadmium**	**Mercury**	**Beryllium**	**Chromium**	**Manganese**	**Nickel**	**Lead**
Criteria	**0.0004 mg/m^3 (1 hour)**	**Individual VOCs (Toluene 0.36 mg/m^3) (1 hour)**	**9.00E-05 mg/m^3 (1 hour)**	**1.80E-05 mg/m^3 (1 hour)**	**1.80E-03 mg/m^3 (1 hour)**	**4.00E-06 mg/m^3 (1 hour)**	**9.00E-05 mg/m^3 (1 hour)**	**1.80E-02 mg/m^3 (1 hour)**	**1.80E-04 mg/m^3 (1 hour)**	**5.0E-04 mg/m^3 (Annual)[4]**
Averaging period and percentile	**1 hour, 99.9th percentile**									**Annual, 100th percentile**
Bomaderry (R1)	4.1E-07	1.0E-03	1.7E-07	4.1E-08	4.1E-08	5.2E-08	8.7E-08	6.4E-08	1.7E-07	4.0E-09
North Nowra (R2)	3.3E-07	5.7E-04	1.4E-07	3.3E-08	3.3E-08	4.2E-08	6.9E-08	5.1E-08	1.4E-07	2.2E-09
Nowra (R3)	2.9E-07	5.4E-04	1.3E-07	2.9E-08	2.9E-08	3.8E-08	6.2E-08	4.6E-08	1.3E-07	1.1E-09
Terara (R4)	2.9E-07	5.6E-04	1.2E-07	2.9E-08	2.9E-08	3.7E-08	6.1E-08	4.5E-08	1.2E-07	1.0E-09
C1	7.8E-07	1.8E-03	3.3E-07	7.8E-08	7.8E-08	1.0E-07	1.7E-07	1.2E-07	3.3E-07	6.3E-09
C2	7.5E-07	1.8E-03	3.2E-07	7.5E-08	7.5E-08	9.6E-08	1.6E-07	1.2E-07	3.2E-07	9.5E-09
C3	7.1E-07	1.8E-03	3.0E-07	7.1E-08	7.1E-08	9.1E-08	1.5E-07	1.1E-07	3.0E-07	9.2E-09
C4	7.2E-07	1.6E-03	3.1E-07	7.2E-08	7.2E-08	9.2E-08	1.5E-07	1.1E-07	3.1E-07	8.4E-09
C5	6.8E-07	1.4E-03	2.9E-07	6.8E-08	6.8E-08	8.8E-08	1.5E-07	1.1E-07	2.9E-07	7.4E-09
C6	7.7E-07	1.6E-03	3.3E-07	7.7E-08	7.7E-08	9.9E-08	1.6E-07	1.2E-07	3.3E-07	1.1E-08
C7	6.8E-07	1.5E-03	2.9E-07	6.8E-08	6.8E-08	8.7E-08	1.4E-07	1.1E-07	2.9E-07	9.9E-09
Maximum level (on sampling grid)	9.6E-07	2.0E-03	4.1E-07	9.6E-08	9.6E-08	1.2E-07	2.0E-07	1.5E-07	4.1E-07	1.0E-08

[4] Lead criteria converted from µg/m^3 to mg/m^3 so that all results have consistent units

8. Conclusions

GHD was engaged by Manildra to conduct an air quality and odour impact assessment for a proposed modification to the approved SSEP. The modification seeks to deploy a suite of heat recovery updates and enabling infrastructure to capture and transform waste heat into usable energy to drive the ethanol, starch and gluten manufacturing processes. The assessment was undertaken in accordance with relevant legislation and government guidance.

Potential impacts associated with dust emissions during construction of the proposed modification were assessed using a risk assessment based on the UK IAQM guidance. Construction activities were identified to primarily consist of installation of prefabricated structures and minor earthworks. The risk identified for all construction activities was **low risk** for dust soiling, and **negligible risk** for human health and ecological impacts. Recommendations for dust management during construction were provided to further reduce the risk of dust impacts from construction of the proposed modification.

A quantitative assessment utilising dispersion modelling was adopted to assess odour and air pollutant (including particulates, combustion pollutants and metals) emission during operation of the proposed modification.

An updated odour emissions inventory was prepared based on the findings of the Odour PRS and NSW EPA feedback. Odour emissions inventories were prepared for the average of the last four quarters, as well as the highest quarter from the last four quarters, 2023-2024 Q4.

The odour modelling predicted compliance with the odour criteria for both the average quarter sampling data and the worst case quarter sampling data. Compliance was predicted at all residential receptors.

A source contribution analysis was undertaken and recommendations were provided to investigate potential management and mitigation options to reduce off-site odour impacts.

Review of recent odour complaints concluded that relatively few complaints have been received in recent years. Recent field ambient odour assessments undertaken by Northstar indicate that odour was not often detectable offsite, and on occasions where odour was detectable, it was characterized as either ‘Very Weak’ or ‘Weak’. The odour surveys tend to support model findings of predicted odour concentrations within the NSW EPA criteria range. Odours classified as weak would likely be below 5 OU which is often attributed as an annoyance threshold for odour.

An air pollutant emissions inventory was prepared incorporating the reduced gas consumption from installation of the heat recovery upgrades. Compliance with the assessment criteria was predicted at all receptors for all pollutants.

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:

– Review of available meteorological data and selection of a representative year
– Development of coarsely gridded prognostic meteorological data set using the Weather Research and Forecast model (WRF) model
– Development of refined site specific gridded meteorological data set which takes into account local terrain features using the CALMET diagnostic meteorological model. The CALMET model used WRF outputs as an initial guess field and incorporated surface observational data from the Manildra on site weather station.
– Verification of model performance using data measured at BoM Nowra RAN air station AWS (BOM ID: 068072)
– Extraction of predicted meteorological parameters from the CALMET model for use to drive the CALPUFF dispersion model.

A-2-1 Nearby meteorological station review

A review of nearby meteorological stations is provided in Table B.1. It is noted that the previous Manildra weather station (referred to as Farm paddock weather station in previous air quality assessments) was decommissioned and replaced with the new Manildra weather station.

The Manildra weather station was selected for inclusion in the meteorological modelling as it is located on site and records key parameters required for modelling. This enable creation of a site-specific meteorological model.

Table A.1 Nearby meteorological station review

Meteorological station	Approximate distance from Site	Available meteorological parameters	Meteorological station details
Manildra weather station	Within site boundary	– Wind speed – Wind direction – Temperature – Relative humidity – Rain	Located in cleared farmland setting Installed on 17/09/2022
Nowra RAN air station AWS (BOM ID: 068072)	12 km southwest of the Site	– Wind speed – Wind direction – Temperature – Pressure – Relative humidity – Cloud height – Cloud amount	Located in cleared airport setting. Exposed lands surround station in all directions.

A-2-2 Prognostic meteorology

The parameters for the prognostic WRF model are summarised in Table B.2.

Table A.2 WRF model parameters

Parameter	Value
Modelled period	1 October 2022 to 30 September 2023
Domain centre	Latitude = - 34.85 S
	Longitude = 150.6167 E
Number of vertical levels	35
Number of easting grid points	50
Number of northing grid points	50
Resolution	1 km

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 broad scale WRF modelling runs, a CALMET simulation was set up to run for the model period using the three-dimensional gridded data output from the WRF model as an initial guess field. This approach is consistent with guidance documentation.

CALMET was run using the 'Hybrid' mode (i.e. surface observational data was included in the model) incorporating observational data from the following locations, noting that use of data from the Manildra weather station was prioritised, however some meteorological parameters (such as pressure and cloud amount and cloud height) are not recorded therefore data from the next nearest station was used:

– Manildra weather station
  - Wind speed,
  - Wind direction,
  - Temperature
  - Relative humidity
– BoM Nowra RAN air station AWS
  - Pressure
  - Cloud amount and cloud height

All model settings were selected based on 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 southwest corner of the CALMET domain, or the origin, was located at UTM Zone 56 coordinates 262.1 kilometres east and 6121 kilometres north. The CALMET domain extended 40 kilometres to the east and north.

The CALMET domain consisted of 200 grid points in both the east and north directions, with a grid resolution of 0.2 kilometre.

The CALMET model parameters are summarised in Table B.3. The TERRAD value was selected based on inspection of the terrain elevations in the immediate vicinity of the subject site.

Terrain and land use data used for the CALMET modelling are presented in Figure B.1 and Figure B.2.

Table A.3 Summary of CALMET model parameters

Parameter	Value
Modelled period	1 October 2022 to 30 September 2023
Mode	Hybrid (NOOBS = 1)
UTM zone	56
Domain origin (south-west corner)	Easting: 262.100 km Northing: 6121.000 km
Domain size	200 x 200 at 0.20 km resolution (40.0 km x 40.0 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 = 3 km R1 = 3 km R2 = 3 km R1max = 6 km R2max = 6 km Rmin = 0.1 km
Initial guess field	WRF ..DAT files used as an initial guess field for CALMET
Surface data	Manildra Weather Station – E: 283.167 km N: 6141.515 km – Parameters: Wind speed, wind direction, temperature and relative humidity Nowra RAN air station – E: 274.922 km N: 6130.071 km – Parameters: Pressure, cloud amount and cloud height
Upper air data	Cloud data was sourced from Nowra RAN air station
Land use and terrain data	Land use data was developed based on NSW Landuse 2017 v1.2 created by the Department of Planning, Industry and Environment and manually adjusted via 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.

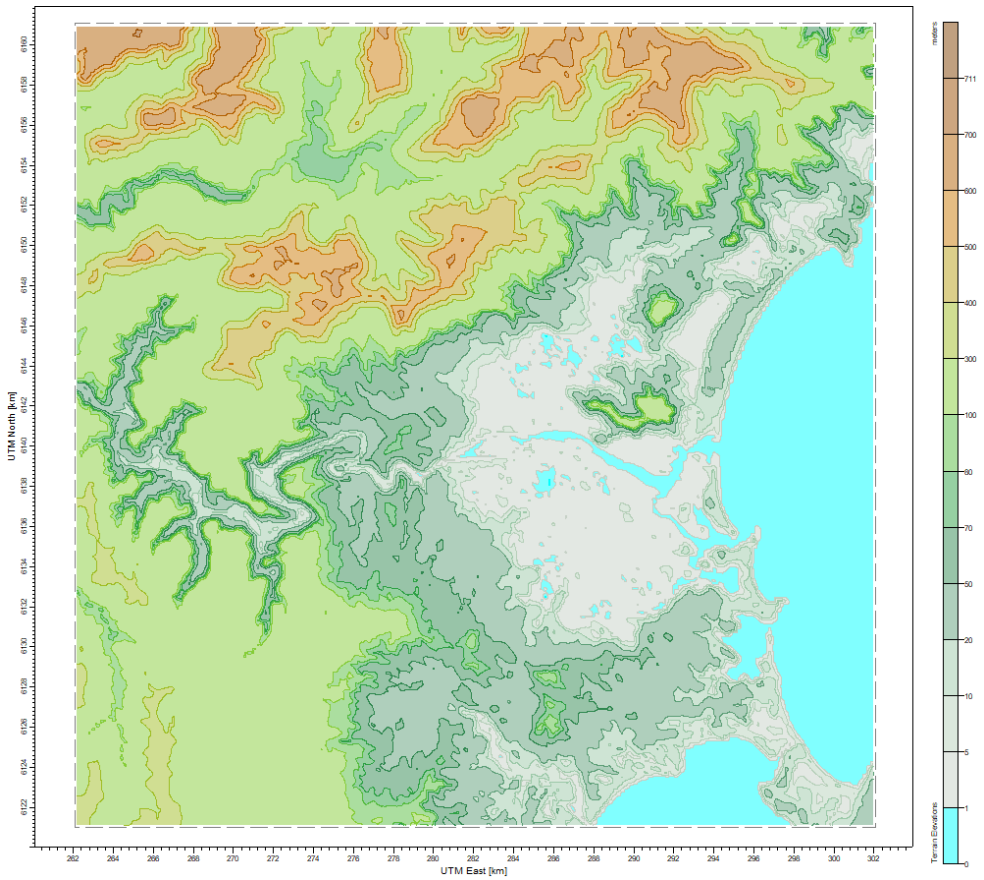


Figure A.1 Terrain data used for CALMET modelling

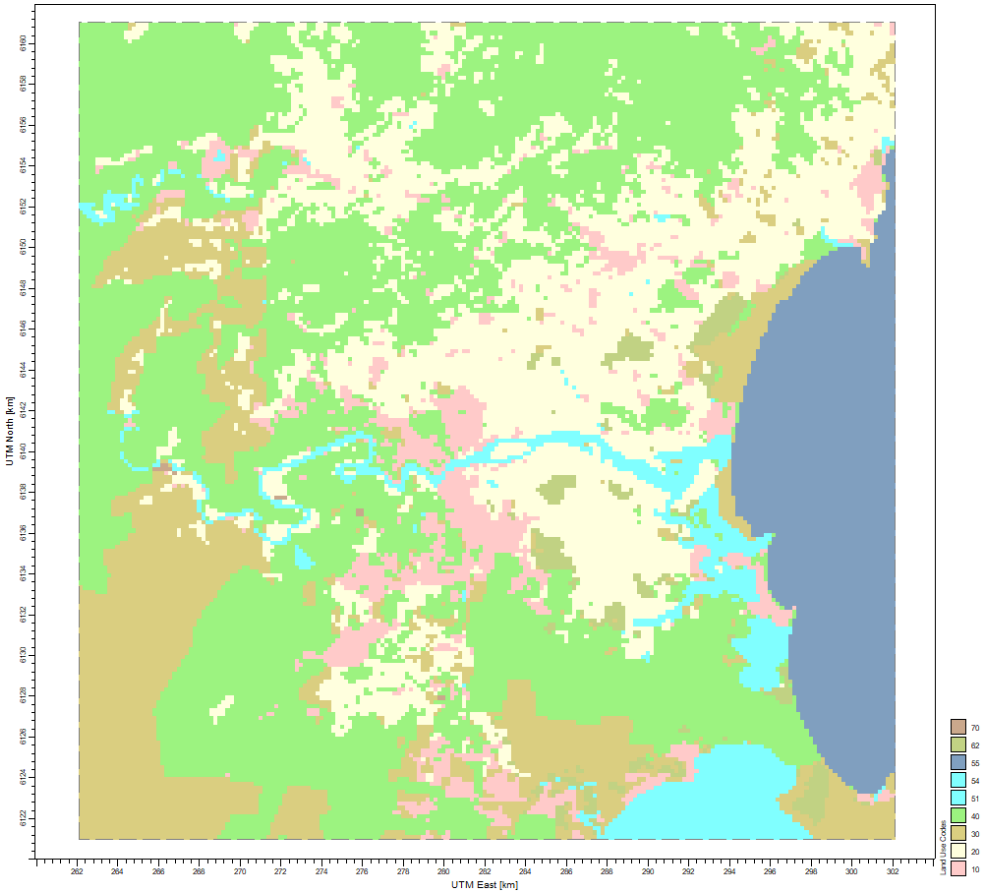


Figure A.2 Land use data used for CALMET modelling

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 B.3 and shows the following features:

– The predominant annual average wind directions are from the west.
– Lower wind speeds (0.5 – 1 m/s) are rare but generally occur from the west.
– The average wind speed predicted was 2.9 metres per second.
– Calm conditions (wind speeds less than 0.5 m/s) occurred 2.8 per cent of the time.

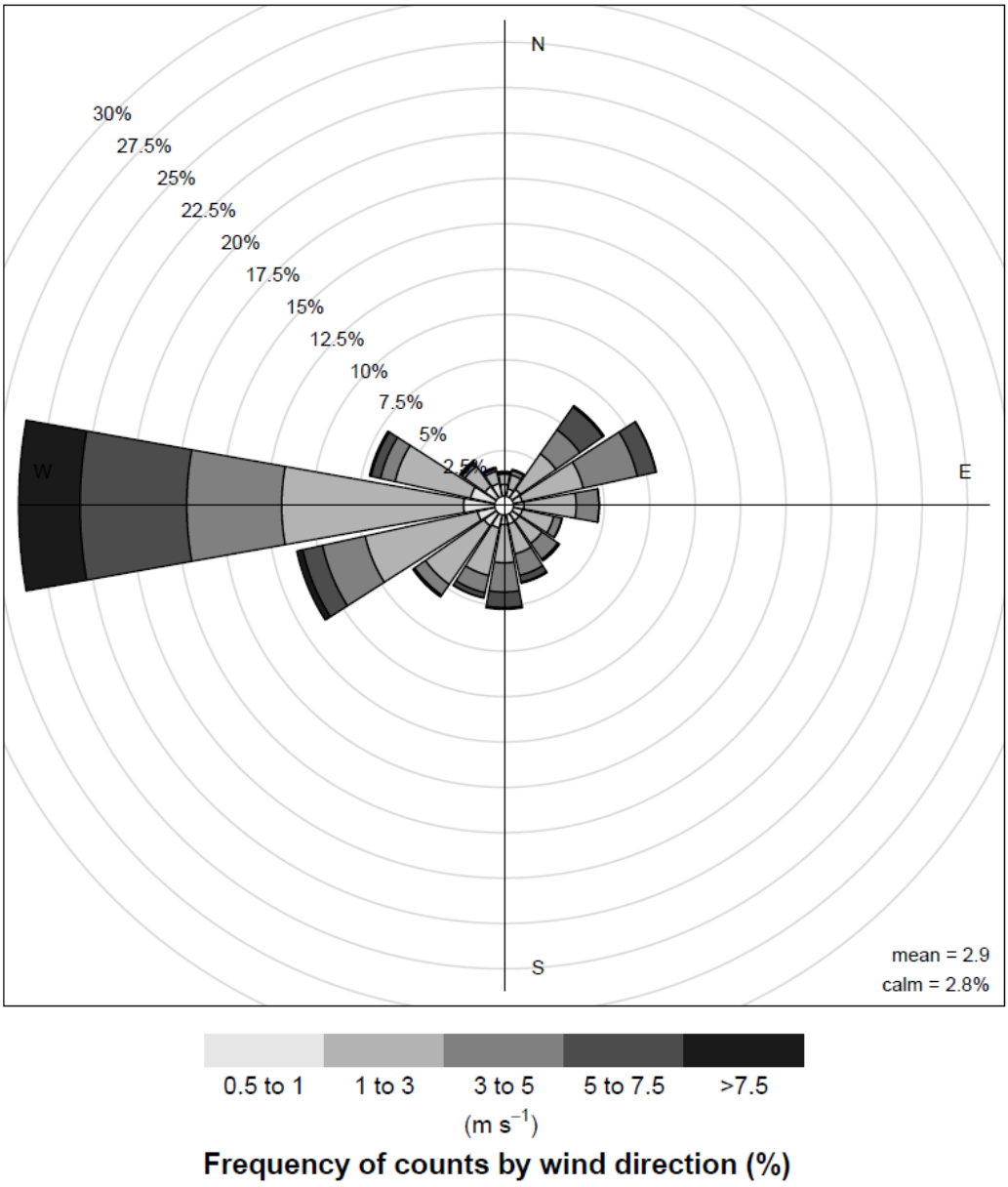


Figure A.3 Wind rose at site from CALMET (Oct 2022 – Oct 2023)

A-3-2 Pattern of atmospheric stability

Atmospheric stability substantially affects the capacity of a pollutant such as gas, particulate matter or odour to disperse into the surrounding atmosphere upon discharge and is a measure of the amount of turbulent energy in the atmosphere.

There are six Pasquill-Gifford classes (A-F) used to describe atmospheric stability and these classes are grouped into three stability categories; stable (classes E-F), neutral (class D), and unstable (classes A-C). The climate parameters of wind speed, cloud cover and insolation (solar radiation) are used to define the stability category as shown in Table B.4. As these parameters vary from day to night, there is a corresponding variation in the occurrence of each stability category.

Stability is most readily displayed by means of stability rose plots, giving the frequency of winds from different directions for various stability classes A to F.

Table A.4 Stability category relationship to wind speed and stability characteristics

Stability category	Wind speed range (m/s)[a]	Stability characteristics
A	0 – 2.8	Extremely unstable atmospheric conditions, occurring near the middle of day, with very light winds, no significant cloud.
B	2.9 – 4.8	Moderately unstable atmospheric conditions occurring during mid-morning/mid-afternoon with light winds or very light winds with significant cloud.
C	4.9 – 5.9	Slightly unstable atmospheric conditions occurring during early morning/late afternoon with moderate winds or lighter winds with significant cloud.
D	≥6	Neutral atmospheric conditions. These occur during the day or night with stronger winds, during periods of total cloud cover or during the twilight period.
E	3.4 – 5.4 b	Slightly stable atmospheric conditions occurring during the night-time with significant cloud and/or moderate winds.
F	0 – 3.3 [b]	Moderately stable atmospheric conditions occurring during the night-time with no significant cloud and light winds.

Note: a Data sourced from the Turner's Key to the P-G Stability Categories, assuming a Net Radiation Index of +4 for daytime conditions (between 10:00 am and 6:00 pm) and –2 for night-time conditions (between 6:00 pm and 10:00 am)

b Assumed to only occur at night, during Net Radiation Index categories of –2.

Figure B.4 shows the frequency of stability class for all hours of the model generated dataset. The following observations were made:

– Unstable atmospheres (classes A, B and C) occur 29 per cent of the time
– Neutral atmosphere conditions (class D) occur 26 per cent of the time
– Stable conditions (classes E and F) occur 35 per cent of the time

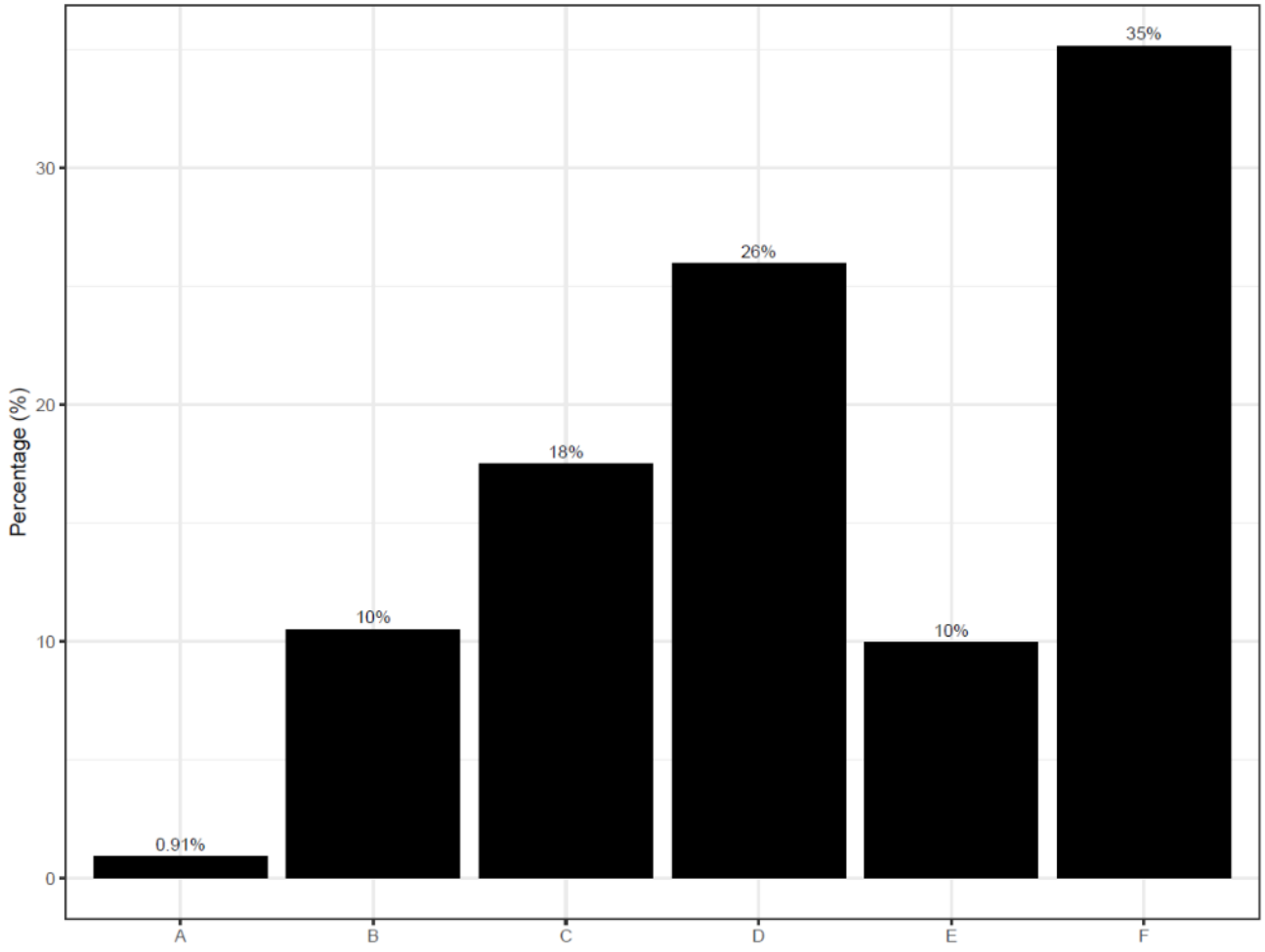


Figure A.4 Distribution of stability class for the model period

A-4 Model verification

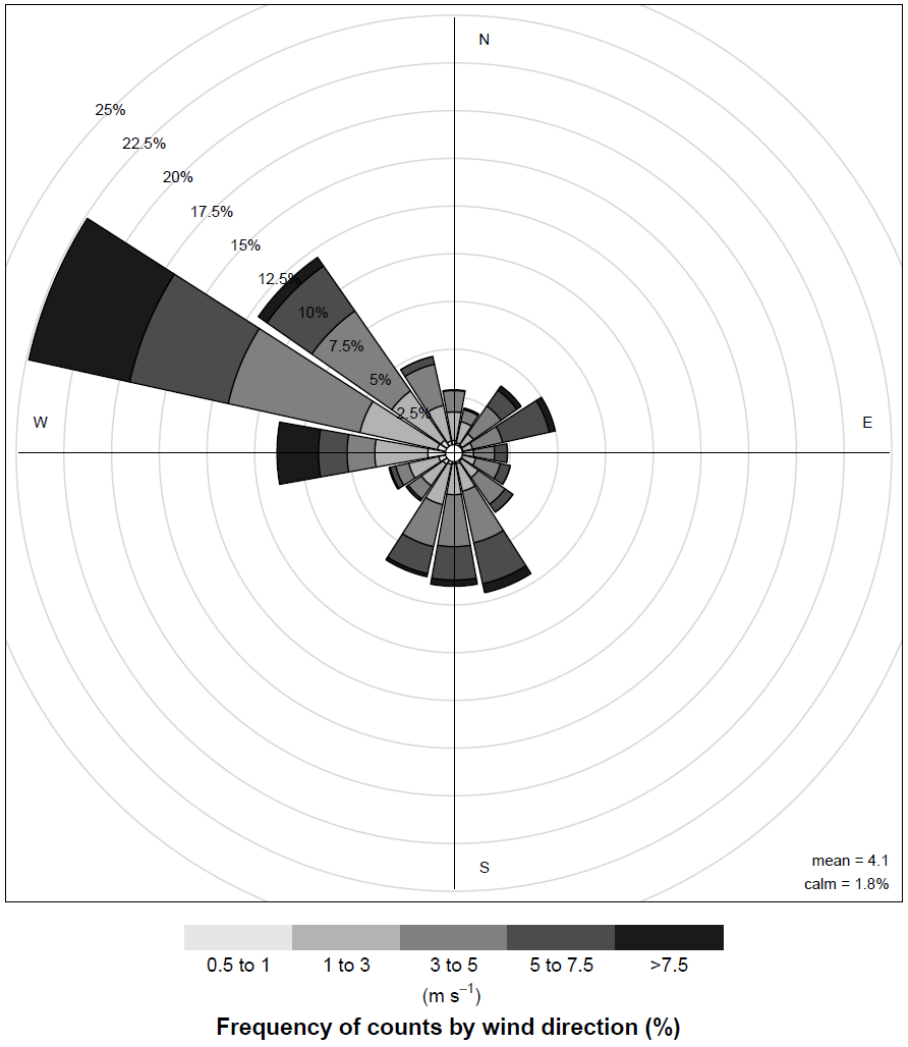
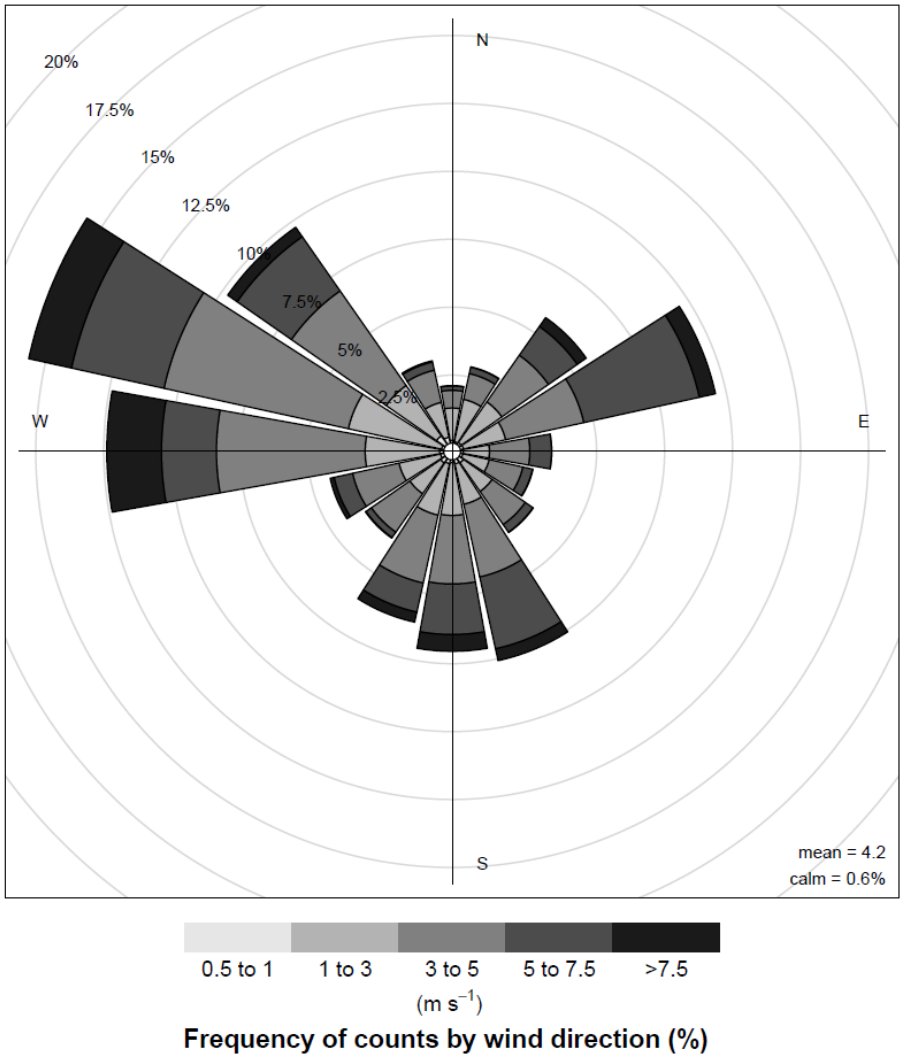
Verification of the meteorological model performance was carried out by comparison of model outputs to BOM observations at the Nowra RAN air station.

BoM data was sourced for the same time period as that of the CALMET model period (01/10/2022 through 01/10/2023) for verification.

A comparison of the BOM observations and the CALMET output are presented in Table B.5 and described below:

– The primary wind direction patterns (winds from the northwest, northeast and south) are consistent across both BOM and CALMET model outputs.
– The distribution of light wind speeds (0.5 to 3 m/s) aligns fairly well between BoM observations and CALMET model outputs
– The mean wind speeds and the frequency of calms (< 0.5 m/s) are relatively consistent across BoM observations and model outputs
– It was therefore concluded that the comparison of BoM station shows relatively good agreement between the observed and modelled data set.

Table A.5 Model verification of CALMET model output compared to observation data

Observation	CALMET output
BOM observations	
BOM observation – Nowra RAN air station AWS – 01/10/2022-01/10/2023	CALMET output – at Nowra RAN air station location – 01/10/2022-01/10/2023
	

Appendix B

Odour complaints record

A summary of recent odour complaint investigations is provided in Table B.1.

Table B.1 Recent odour complaint investigation history

Complaint Number	Date of complaint	Detail	Likely Source of Odour	Manildra Y/N
68	29/06/2022	The odour is described as sulphuric, like sewerage/sludge/rotten egg gas. Odour seems to be more frequent lately, over the past 6 months, and has been getting worse, though it does vary based on the weather.	Likely biogas release from Anaerobic BVF due to works on biogas recovery system.	Yes
69	26/07/2022	Described as a different odour to the typical Manildra odour from the Factory.	Investigation revealed odour likely to be caused by biogas odour from the BVF	Yes
70	25/07/2022	The odour has been present on and off all day on 25/7/22, wind from the NE, its a rotten milk odour a very bad smell rated as 4/5 strength and keeps wafting into the house.	Unknown. Possibly caused by Council sewage treatment plant (STP) de-sludging the biosolids and applying on land adjacent to the STP.	No
71	2/08/2022	Dreadful odour like rotten eggs, started at approximately 3:45pm. Odour has usually occurred only occasionally, approx once every two weeks	The likely cause is excessive biogas production due to high ‘food’ (organic) spikes from the factory operations. The BVF cover inflated resulting in biogas escaping from under the cover	Yes
72	24/11/2022	The complainant described the odour as “rank” and that the odour was of a biological nature, similar to manure or decomposing vegetation. There was no wind at the time. By 1am the odour was gone.	not consistent with the typical odour attributed to the Shoalhaven Starches factory or WWTP, we do not believe this complaint is attributed to Shoalhaven Starches on this occasion.	Unknown
73	29/11/2022	Complainant described the odour as the “normal Manildra rotten smell”, and that the odour has been an ongoing issue.	Unknown. Unable to verify the odour source as the complaint details were received 2 days after the complaint was lodged.	Unknown
74	5/12/2022	we have experienced unpleasant smells on most days from your facility. Some days are much worse than others, such as last Thursday (8/12/22) when we couldn't have the windows or doors left open.	Unknown.	Unknown

Complaint Number	Date of complaint	Detail	Likely Source of Odour	Manildra Y/N
75	3/01/2023	Complainant advised of odour coming from Manildra farm described as an off-sulfur smell.	Likey cause is biogas odour from the anaerobic BVF, caused by inflated cover due to high food (COD) spike from the factory wastewater.	Yes
76	11/01/2023	Complainant described odour as burnt toast, chemical odour, which comes and goes.	Unknown. Unable to confirm the cause of the odour as the complainant advised the odour was not present at the time of the complaint.	Unknown
77	17/01/2023	We've received an odour complaint that the complainant has attributed to Shoalhaven Starches, from around the WWTP area. The complainant describes the odour as a burning smell, like "something is cooking".	Unknown. Potential cause is biogas odour from the anaerobic BVF, caused by inflated cover due to high food (COD) spike from the factory wastewater.	Yes
78	18/02/2023	Complainant described the odour as a very strong yeasty odour, and was so bad they had to close their house windows.	Unknown.	Unknown
79	13/13/23	Odour is usually a strong yeasty odour, heavy in the air.	Unknown.	Unknown
87	14/12/2023	smelling a "foul" odour in the past few nights. The odour was described as similar to rotting vegetation,	Raw wastewater pumped into open pond 3	Yes
88	18/12/2023	He said since last week there has been a rotten smell off and on every day that's like rotten eggs. Today it was from around 3pm for about ½ an hour than it stopped but last week it seemed to be in the morning	Raw wastewater pumped into open pond 3	Yes
89	19/01/2024	Complainant is located on Beinda Street, and is impacted by odour at their residence. The complainant describes the odour as a "burning smell", and alleges this is from the DDG process, and that the dust from DDG impacts their home. They also alleged that there's an odour recovery unit that has yet to be installed.	Unknown.	Unknown
101	3/11/2024	Odour complaint received via community complaints hotline, no information, contact details or description of the smell was recorded.	Unknown	Unknown
102	3/11/2024	Odour complaint received via community complaints hotline, no information, contact details or description of the smell was recorded.	Unknown	Unknown

Complaint Number	Date of complaint	Detail	Likely Source of Odour	Manildra Y/N
108	26/2/2025	Smell described as coming from Manildra way and “very strong”	Unknown, complainant didn’t answer return calls or respond to messages	Unknown
112	8/04/2025	Smell described as vegemite/yeasty and has logged multiple instance in April	Manildra Biofilter	Yes

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