REGIONAL JOB PRECINCT

AIR, NOISE AND ODOUR TECHNICAL REPORT - RICHMOND VALLEY

Regional NSW

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Regional Job Precinct
Air, Noise and Odour Technical Report
Richmond Valley

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EXECUTIVE SUMMARY

The Richmond Valley Regional Job Precinct (RJP) is focused on providing planning support to help fast-track approvals to drive growth, investment and development opportunities within regional New South Wales. The Richmond Valley investigation area comprises multiple sites in the Casino area covering approximately 655 hectares, including the Nammoona Industrial Precinct, the Casino Food Co-op and surrounds precinct and the Johnston Street Industrial area and surrounds precinct. A Master Plan has been developed through a collaborative process identifying the possible location of certain types of industries within precincts with technical information on air and noise matters provided in this report.

The Richmond Valley RJP offers suitable zones for industrial use, including areas capable of accommodating higher-emission industries. The modelling of industrial uses in this report assumes that the necessary criteria are met at sensitive locations, and that introducing new receptors in areas considered vacant land could either further limit the operational capacity of industries or potentially expose them to potential impact from industry.

The baseline analysis identifies a mix of industries located within the Richmond Valley area which include livestock processing, sewage treatment, waste management and recycling, mechanics, landscape and construction supplies, and other operations. Generic modelling of the existing industries has been undertaken for the baseline analysis to show the likely shape of the zone of effect around existing industries as affected by the prevailing winds, terrain, and other known parameters. These existing uses have not been modelled in detail. The analysis shows a potential for medium to high risk level of impact between existing industries and receptors which arises due to the relatively close proximity of these existing receptors to existing industrial activities. This is a strategic risk assessment, with conservative assumptions regarding the emissions from these uses and the applicable standards to be met at receptors. Detailed assessment of the existing uses and air and noise mitigation measures will be required to accurately assess levels of risk associated with each of the existing uses in the Precinct. The existing uses remain subject to existing approvals and licencing requirements.

The Richmond Valley Master Plan considers the potential for Alternative Waste Treatment Solution (AWTS) facilities, as a possible future land use in the Nammoona precinct. Nammoona is listed as one of four possible Energy from Waste (EFW) sites identified in the Energy from Waste Infrastructure Plan (**NSW Government, 2021**). Richmond Valley Council is currently investigating EFW in consultation with the Casino community and is considering a range of AWTS. Any proposed AWTS facility will require detailed support studies, community engagement and assessment in accordance with NSW State legislation. At the time of preparation of this report, no site within the RJP has been nominated for AWTS and there is no indication of the type of facility that may be proposed.

Detailed air dispersion modelling and noise modelling was utilised to test the Master Plan. Sources representing general industrial activities were positioned to represent any location within the Richmond Valley RJP where potential air and noise emissions can occur. These sources were assumed to emit emissions continuously allowing source or receptors impact risk to be shown on a like-for-like basis. It is also assumed that appropriate planning measures will be put in place to ensure that there are no sensitive receptors within the sensitive receptor boundary in this report and that the use of existing dwellings within the RJP boundary will be resolved in conjunction with staged development of the RJP, as considered in the RJP Structure Plan. Existing sensitive receptors within the Precinct will be addressed

as staged industrial development in the Precinct is undertaken. The modelling results of the Master Plan indicates potential for elevated risk areas in places where residential and industries interface.

Detailed noise and air dispersion modelling was used to define the maximum noise, air and odour emissions that could be emitted from all sources within the industrial area without causing any adverse impacts at sensitive receptor locations outside the modelled receptor boundary.

The study recommends noise, air and odour emission allocations per lot area, that would minimise any potential noise, air and odour impacts outside of the Richmond Valley boundary. The emission allocations provided can also help potential new industries to identify the more suitable lots where, depending on their emissions, the facility can reasonably expect to be able to operate without causing impacts or to require any extra controls.

Overall, the results show areas of the Richmond Valley RJP is suitable for industrial use, and that some parts of the Precinct are likely to be suitable for higher-emitting industry types. It is important to note that the modelling assumes the criteria are to be met at all sensitive receptors assumed in the modelling. Adding new receptors in areas assumed as vacant land would further limit the capacity of industry to operate or conversely put receptors in area of potential impact from industry.

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GLOSSARY

Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
Background levels	Existing concentration of pollutants in the ambient air.
Background noise	The underlying level of noise present in ambient noise, generally excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.
CALPUFF	A multi-layer, multi-species, non-steady state Gaussian puff dispersion model that is able to simulate the effects of time- and space-varying meteorological conditions on pollutant transport. It is well suited to low-wind speed conditions that can often be associated with high periods of odour impact.
Decibel (dB)	A measure of sound level. The decibel is a logarithmic way of describing a ratio. The ratio may be power, sound pressure, voltage, intensity or other parameters. In the case of sound pressure, it is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure squared to a reference sound pressure squared.
Diffuse source	Activities that are generally dominated by fugitive area or volume-source emissions, which can be relatively difficult to control.
Dispersion modelling	Modelling by computer to mathematically simulate the effect on plume dispersion under varying atmospheric conditions; used to calculate spatial and temporal fields of concentrations and particle deposition due to emissions from various source types.
EPL	Environmental protection licence
H_2S	Hydrogen sulfide
Incremental impact	The impact due to an emission source (or group of sources) in isolation, i.e. without including background levels.
µg	Mass in micrograms.
m^3	Volume in cubic metres.
NO_2	Nitrogen dioxide.
NO_x	Oxides of nitrogen, including NO and NO_2.
PM_{10}	Particulate matter less than 10 µm in aerodynamic equivalent diameter.
$PM_{2.5}$	Particulate matter less than 2.5 µm in aerodynamic equivalent diameter.

Point source	Source of emissions, generally a stack. Emissions can generally be relatively easily controlled by using waste reduction, waste minimisation and cleaner production principles or conventional emission control equipment
Sensitive receptor	A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area.
SO_2	Sulfur dioxide
SO_3	Sulfur trioxide
Stack	A vertical pipe used to vent pollutants from a process and to disperse them into the ambient air.
O_3	Ozone
VOCs	Volatile organic compounds

1 INTRODUCTION

Todoroski Air Sciences has prepared this air, noise and odour technical report for the Department of Regional NSW (DRNSW). The report presents an analysis of the air, noise and odour impacts associated with the Master Plan developed for the Richmond Valley Regional Job Precinct (RJP) areas located around Casino, New South Wales (NSW).

This technical report incorporates the following aspects:

- A summary of the baseline air, noise and odour conditions for the RJP;
- An outline of the methodology proposed to assess air, noise and odour matters associated with the Master Plan of the RJP;
- Presentation of the predicted results for the analysis of the Master Plan for the RJP; and,
- A discussion on the key findings and the mitigation and management strategies for the RJP with regard to the air, noise and odour impacts.

1.1 Overview

The RJPs are an extension of the Special Activation Precinct (SAP) program, focused on providing planning support to help fast-track approvals to drive growth, investment and development opportunities within regional NSW.

To assist with the strategic planning of the RJPs an air, noise and odour study is required to help determine the appropriate planning response in relation to air, noise and odour emissions from industry and development within the RJP investigation area so as to limit potential future land use conflict.

The purpose of this technical report is to present the findings for environmental air, noise and odour matters for the Richmond Valley RJP to inform the master planning process of development standards and precinct-based planning controls to address air, noise and odour concerns. The findings and recommendations have been developed where possible in collaboration with other disciplines. It is acknowledged that some of the recommendations in this report may not be included in the Master Plan, such as where they are out of scope for the RJP, conflict with other elements of the project or are proposed to be managed via an alternate mechanism.

1.2 Relevant legislation

Air Quality (including odour) and Noise are regulated in NSW under the *Protection of the Environment Operations Act 1997* and subordinate regulations made under the Act. These are the Protection of the Environment Operations (Clean Air) Regulation 2021 and the Protection of the Environment (Noise Control) Regulation 2017.

The Regulation enables the appropriate regulatory authority (the NSW Environment Protection Authority [EPA]) to develop guidelines and policies for managing air quality and odour. The key guidelines applicable for the RJP investigation area include the following:

- Approved Methods for the Modelling and Assessment of Air Quality in New South Wales (2016) (Approved Methods);

- NSW Odour Policy, comprised of:
  - Technical Framework – Assessment and Management of odour from stationary sources in NSW (2006a); and,
  - Technical Notes – Assessment and Management of odour from stationary sources in NSW (2006b).
- Noise Policy for Industry (2017) (NPfI).

These guidelines set out suitable criteria for air pollutants, odour and noise to prevent adverse impacts on amenity and health for sensitive receptors such as residential areas, hospitals and schools. In addition to the above, other relevant policies and guidelines include:

- National Environment Protection Measure (NEPM) Ambient Air Quality (National Environment Protection Council, 2021);
- NSW Road Noise Policy (DECCW, 2011);
- Rail Infrastructure Guideline (EPA, 2013);
- Interim Construction Noise Guideline (NSW DECC, 2009); and,
- Assessing Vibration: A Technical Guideline (DEC, 2006).

1.3 Local setting

The Richmond Valley RJP investigation area comprises multiple sites in the Casino area covering approximately 655 hectares (ha). **Figure 1-1** presents the Richmond Valley RJP investigation area.

Key features of the Richmond Valley RJP include three distinct industrial development areas considered for assessment for potential employment growth, including the:

- Nammoona Industrial Precinct; the north western most RJP area located furthest from Casino town centre and aligned along the east of the Sydney to Brisbane rail line.
- Casino Food Co-op and surrounds precinct, positioned between the Nammoona Industrial Precinct and Casino and west of adjoining residential areas.
- Johnston Street Industrial area and surrounds precinct located to the northeast of Casino, adjoining residential land to the south and west and the Richmond River to the south.

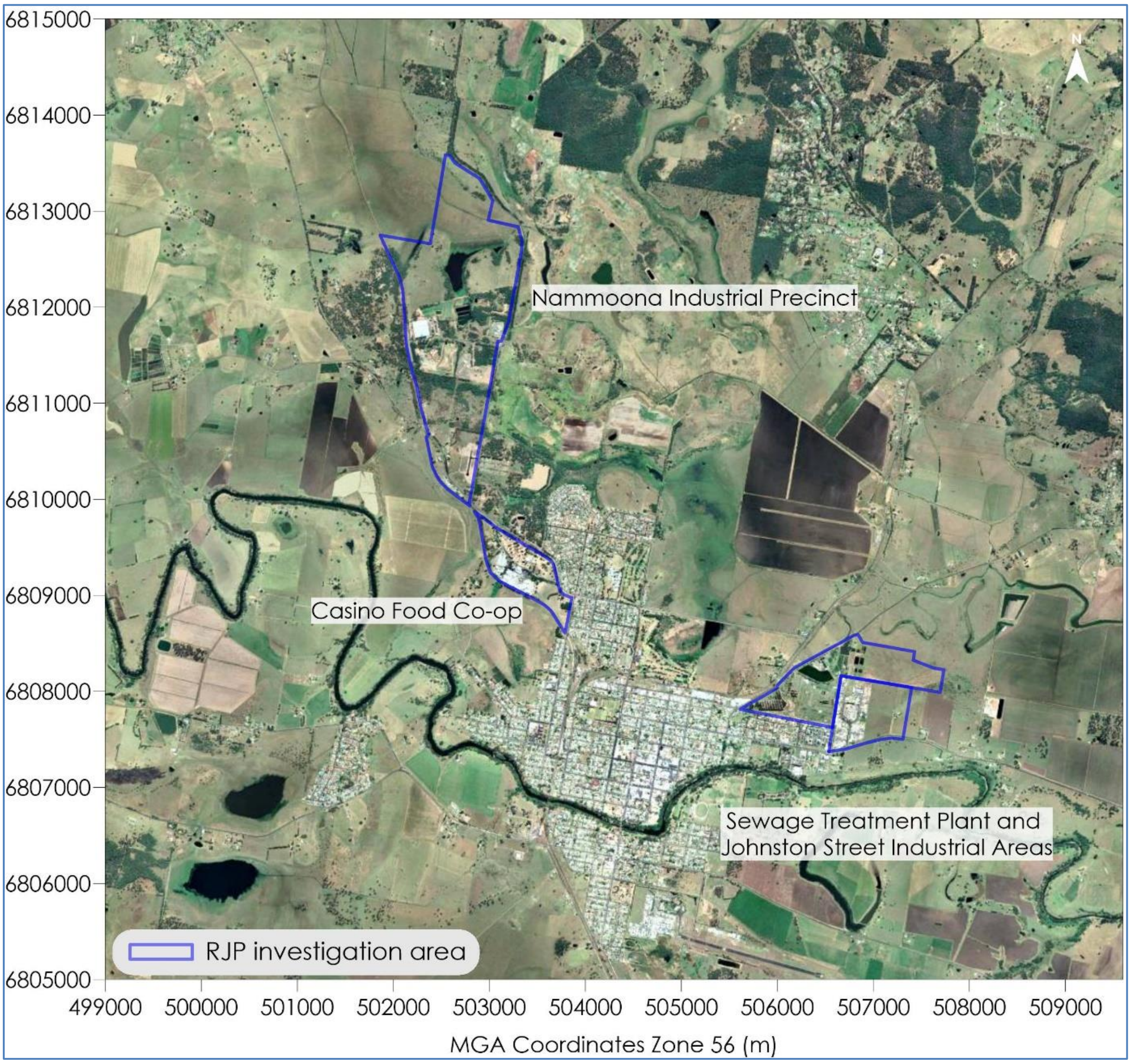

Figure 1-1: Local setting

1.4 Local topography

Figure 1-2 presents a representative three-dimensional visualisation of the terrain features surrounding the Richmond Valley RJP investigation area.

The local topography following the Richmond River is relatively flat, as is the majority of the Casino Town centre and surrounding residential areas. The terrain becomes more elevated to the northeast and north with the investigation areas to the northwest located more undulating terrain.

The terrain features of the surrounding area influence the local wind distribution patterns and flows which are important for the dispersion and propagation of air, noise and odour emissions. Local katabatic flows and drainage flows will exacerbate air quality impacts when sources are located on more elevated positions relative to receptor locations.

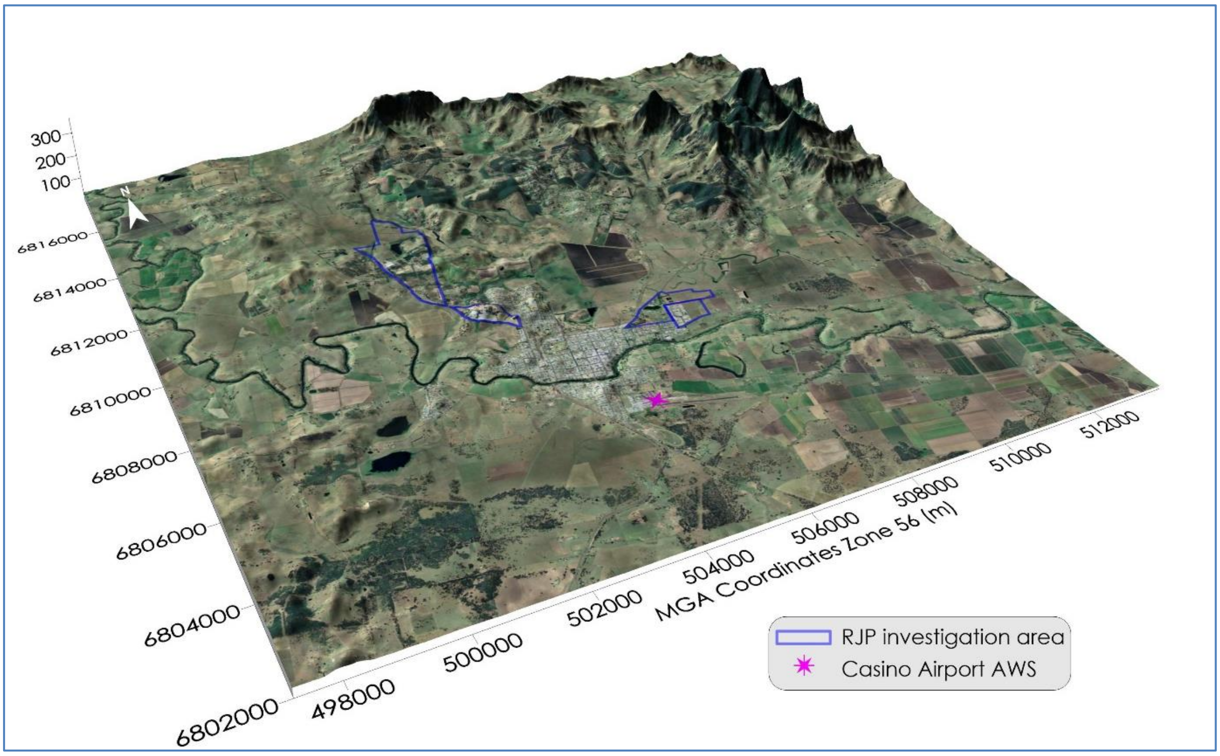

Figure 1-2: Representative visualisation of the local topography

1.5 Richmond Valley Master plan

The Richmond Valley Master Plan, developed by Gyde, is shown in **Figure 1-3** to **Figure 1-5**. Key features of the Master Plan include:

- Nammoona Industrial Precinct focusing on larger industrial and heavy industrial uses. The precinct would utilise the access to the existing rail line for a potential intermodal terminal, retain existing industrial uses to collocate with other like industrial uses;
- Casino Food Co-op and surrounds precinct would largely retain the existing abattoir and tannery uses with capacity for compatible uses on opportunity sites; and,
- Johnston Street Industrial area and surrounds precinct would see upgrades to the existing sewage treatment plant, a location for the Intensive Agricultural Catalyst Hub and utilise remaining land for suitable industrial uses.

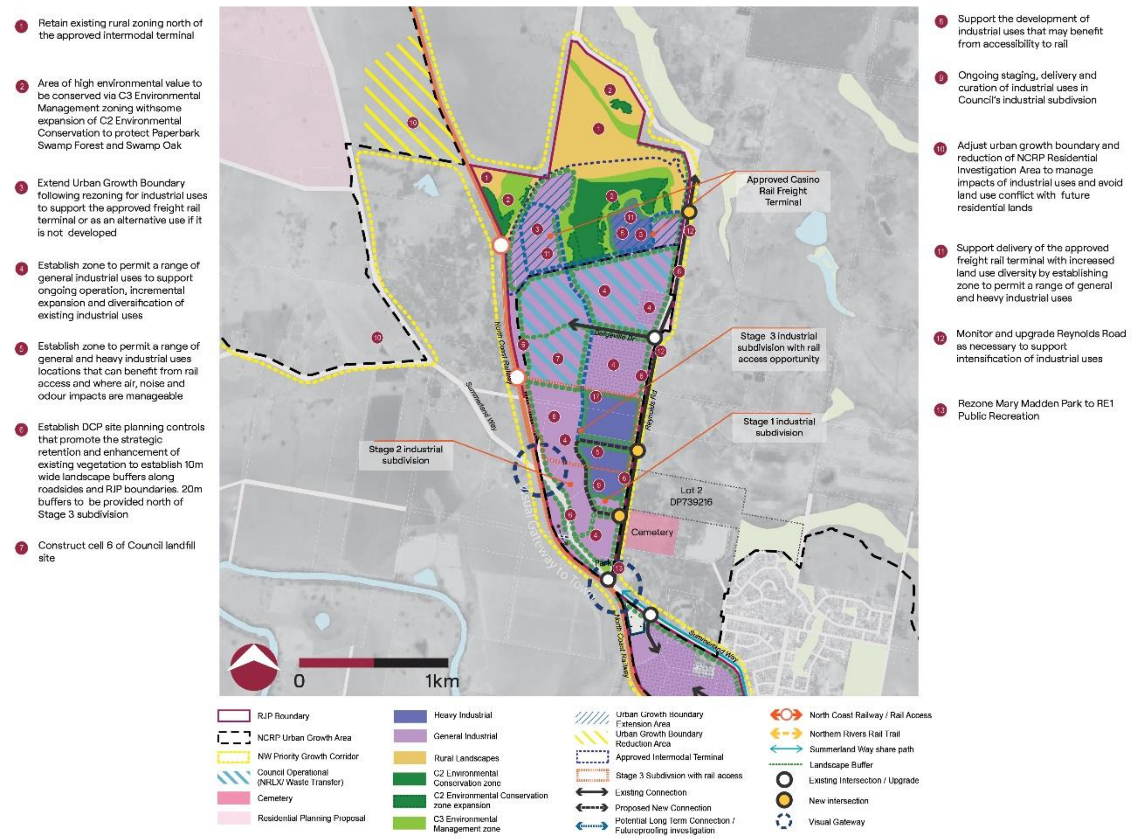

Figure 1-3: Master Plan for Richmond Valley RJP – Nammoona Industrial Precinct

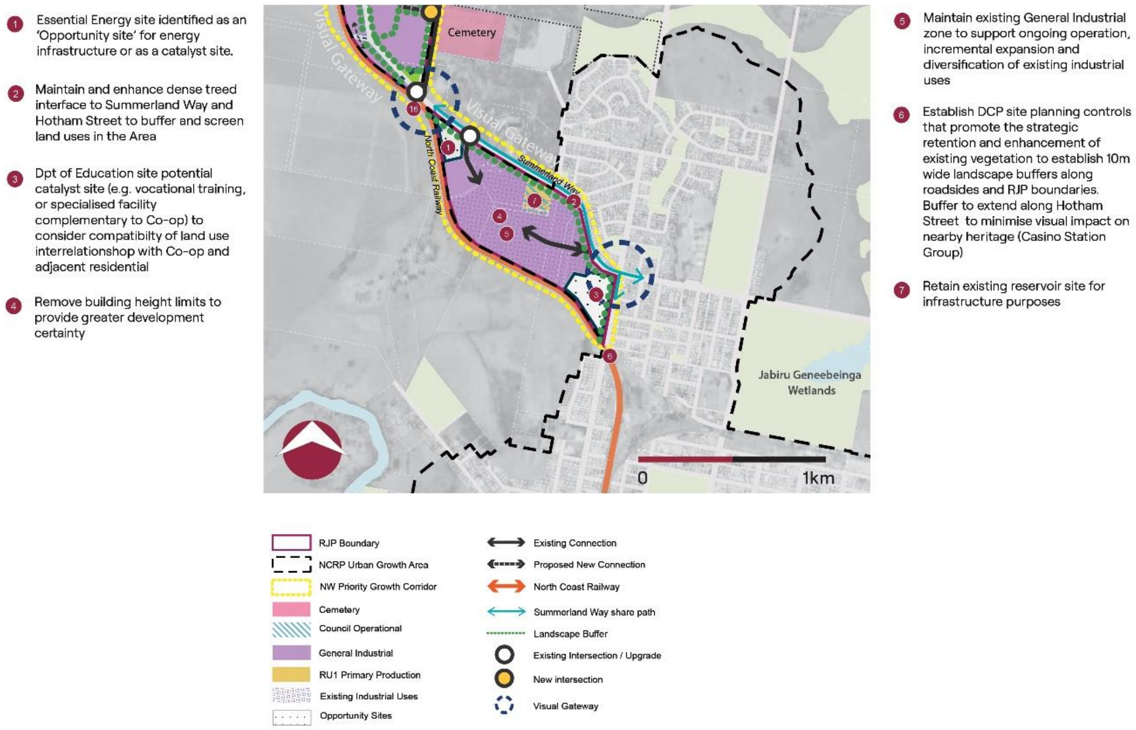

Figure 1-4: Master Plan for Richmond Valley RJP – Casino Food Co-op and surrounds precinct

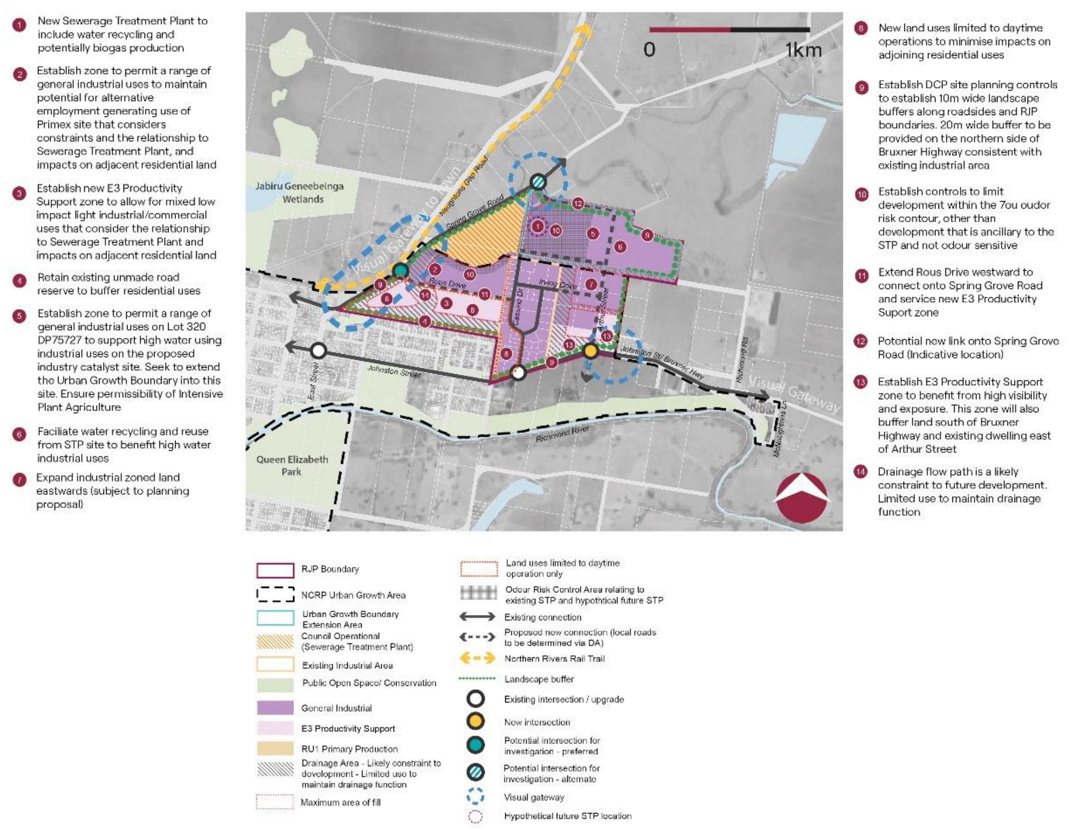

Figure 1-5: Master Plan for Richmond Valley RJP –Johnston Street Industrial area and surrounds precinct

2 BASELINE ANALYSIS

2.1 Existing conditions

In general, the local topography is elevated to the north and northwest relative to the generally flat central areas of Casino with the predominant local winds from the northwest. This means that air emissions from industrial facilities would have the propensity to impact areas to the southwest making it important that appropriate consideration of buffers or adequate separation distance is used to mitigate such effects.

Local background air quality data is not available, but the trends in the rural data within approximately 400km indicate that elevated particulate levels may arise in the general area, and short-term (24-hour average) particulate levels above the EPA criteria are most likely to be associated with wider regional influences that affect the wider NSW region such as the state of ground cover (this is affected by rain/ drought conditions and agricultural activities), bushfire and hazard reduction burns. The annual average background dust levels in the wider area are typically below the NSW EPA criteria for PM_{10}, however can be above for $PM_{2.5}$ due to the use of wood heaters in the wintertime.

Other pollutants such as NO_2, SO_2, CO and O_3 are not likely to exceed the NSW EPA criteria. The majority of these emissions originate from combustion.

There is a significant history of odour complaints and given that most odour sources are located near to ground level, and the prevailing west north-westerly winds, there is a critical need to ensure there are adequate buffers between industries and residential areas in order to minimise the scope for amenity impacts, from odour, but also potential harmful exposure to other pollutants.

For noise, the results are generally consistent with expected noise levels in proximity to an industrial area, when considering the local environment and proximity to sources. Note that the existing noise levels are not crucial inputs to the design of the RJP investigation area as the known criteria would be applied in the modelling which initially assumes all of the RJP land has operating industries on it. The modelled plans are then iteratively changed until the results show the extent and types of industrial uses which can be accommodated without causing any unacceptable cumulative impacts.

2.2 Existing industries

The existing industrial/ commercial operations that can generate air, noise or odour emissions were identified within and surrounding the Richmond Valley RJP investigation area, as set out in **Table 2-1**. The location of these existing industrial/ commercial operations is shown in **Figure 2-1**.

These operations include a mix of industries such as livestock processing, sewage treatment, waste management and recycling, mechanics, landscape and construction supplies, and other operations. The key substance (either air, noise or odour) for each of the operations is shown with an assigned amenity classification based on the scale of the operation and the likely potential to cause environmental air, noise or odour impacts.

Table 2-1: Existing Industries

Company	Description	Map identification number	Key substance emitted	Amenity classification
Casino Automatics	Mechanic	1	Air	High
Richmond Valley Holcim	Construction/ landscape supplies	2	Air & Noise	High
Richmond Valley Wreckers	Mechanic	3	Air	High
Casino Smash Repairs	Automotive smash repairs	4	Odour	High
Smith's Joinery	Manufacturing	5	Air	High
AJM Diesel Repairs	Mechanic	6	Air	High
Williams Group Australia	Construction/ landscape supplies	7	Air & Noise	High
Teeling Recycling Centre	Waste services	8	Air & Noise	High
Eric Box Mitsubishi	Mechanic	9	Air	High
Riverview Garden and Landscape Supplies	Construction/ landscape supplies	10	Air & Noise	High
Casino Wastewater Treatment Works	Sewage treatment	11	Odour	Low
Richmond Dairies	Food manufacturing	12	Noise	Medium
Casino Bus Service	Transport depot	13	Noise	High
Newstead Automotive Services	Mechanic	14	Air	High
Caltex Casino Depot	Fuel storage and distribution	15	Odour & Noise	Medium
Boral Cement	Concrete batching plant	16	Air & Noise	Medium
Casino Food Co-op	Livestock processing + waste water irrigation	17	Odour & Noise	Low
Riverina Stockfeeds - Casino	Animal feed production	18	Odour	Low
Boral Timber	Construction supplies	19	Air & Noise	High
Casino Community Recycling Facility (Landfill facility)	Waste Services	20	Odour	Low
Casino/Northern Rivers Livestock Exchange	Livestock saleyards	21	Odour & Noise	Low
Unknown	Composting	22	Odour	Low
Seine Australia	Food product processing	23	Odour	Medium

For the air emissions, the existing industries are modelled using the CALPUFF dispersion model as either a point (stack) source and as a fugitive (volume) source. The emission release parameters that would represent relatively standard sources associated with the industrial activities and the assigned amenity classification. The point sources were setup to represent emissions from a stack with generalised flow parameters (e.g. exit velocity, temperature) and an emission point which is elevated above the ground. The volume sources represent diffuse, fugitive ground based sources which commonly include dust and odour emitting sources. The modelled sources are assumed to emit air emissions continuously over the entire year.

Noise emissions were modelled in a similar manner to the air emissions with all existing industrial source locations per in **Table 2-1** and **Figure 2-1**. Noise sources were modelled using the ENM noise model under strong inversion conditions and generalised noise emissions profiles typical of the different industrial activities.

In other words, generic modelling has been undertaken over the RJP areas to show the likely shape of the zone of effect around existing industries as affected by the prevailing winds, terrain and other known parameters. As the exact emissions are not known, the modelling used assumed generic emissions and is only intended inform strategic planning for the RJP. The results are not intended to represent actual emissions precisely, and should not be used to indicate compliance or not with acceptable criteria.

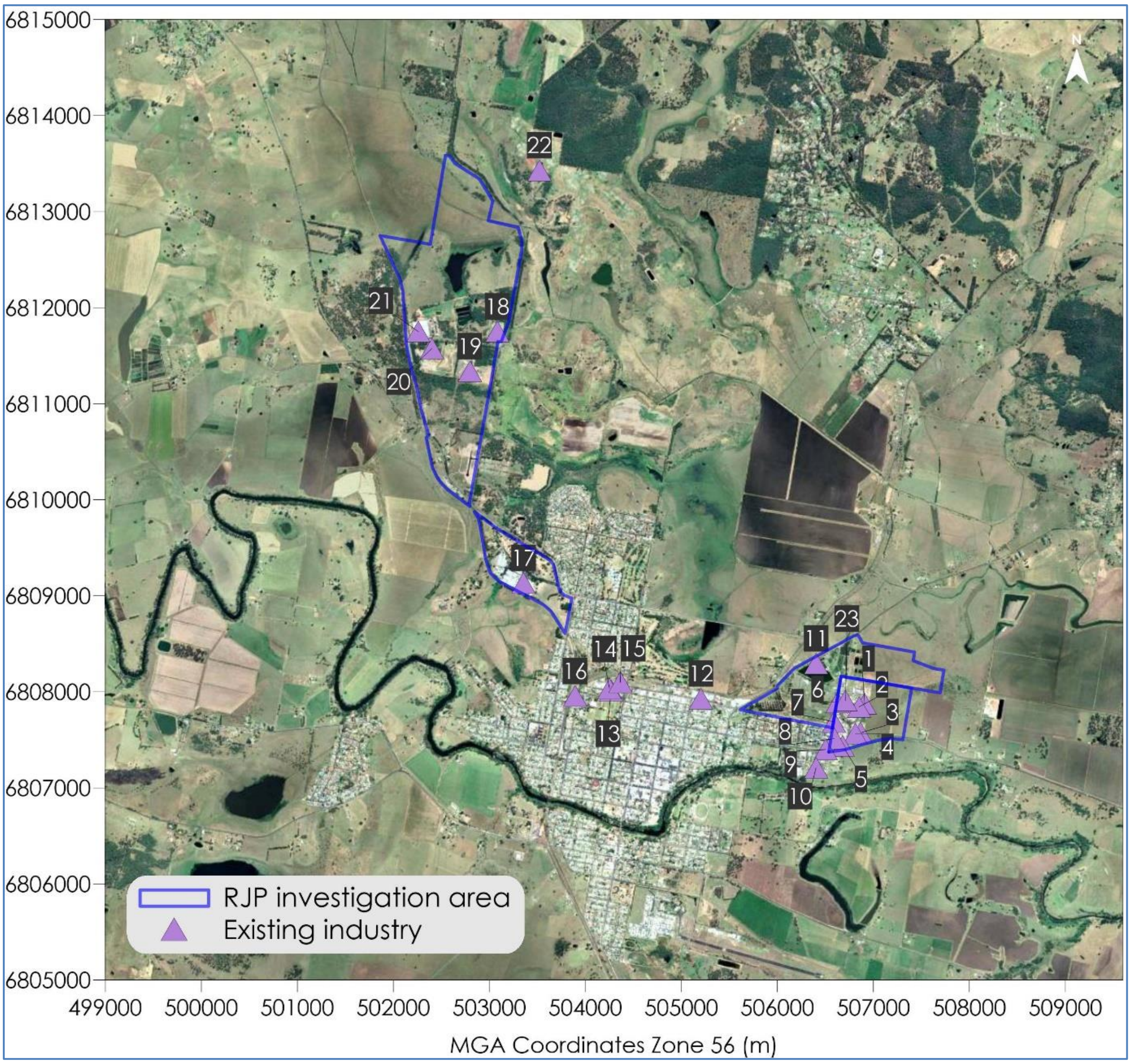

Figure 2-1: Existing industries

2.3 Analysis of modelling predictions for existing industries

Modelling predictions are presented based on a potential risk scale in terms of potential impact. The risk scale is not provided to indicate compliance/ non-compliance of the existing industries with the relevant criteria, rather to show the effect of dispersion/ emission from the existing sources due to the existing local terrain and winds. The shape of the modelling results is used to inform the shape of the buffers required and the risk profile of the land within the industrial area to be zoned and where like industries are best allocated.

The predicted maximum 1-hour average impacts for the modelled existing point sources are presented in **Figure 2-2**. The results indicate that potential high risk impacts from the point sources generally occur close to the source. The point sources located to the northwest areas of the RJP investigation area have some higher potential risks to the north which is expected considering the terrain elevations in this area.

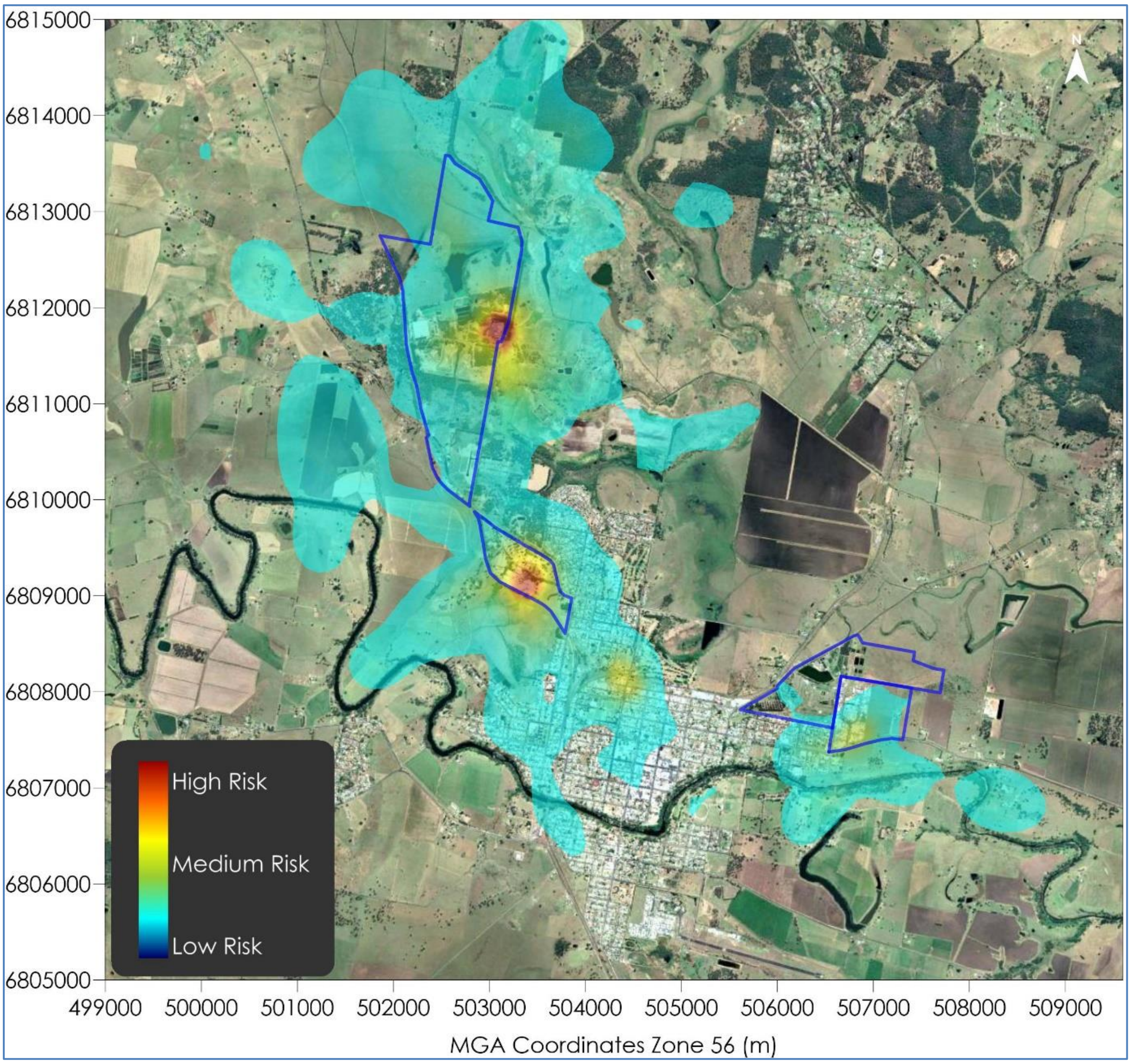

Figure 2-2: Predicted maximum 1-hour average impacts – Point (stack) sources

Figure 2-3 presents the predicted 99th percentile 1-hour impacts for the modelled fugitive sources which are representative of potential odour impacts. The modelled sources include the Casino Food Co-op irrigation areas to the north of the Casino Food Co-op and a composting facility identified further north. The highest potential impacts occur from the sewage treatment plant, saleyards and the Casino Food Co-op, however the indications are that these impacts are generally manageable even if close to exceeding criteria at receptors. As noted, the modelling predictions for these uses are based generic modelling, they are subject to existing approval and licencing requirements and that more detailed assessments will be required to determine actual emissions for individual uses.

The pattern of dispersion for fugitive/ odour sources is different to stack sources indicating the need to consider the types of industries that are located in specific areas when making planning decisions. (Note that later modelling for the Masterplan shows different patterns of effect because it assumes the RJP has been fully developed, and also that there is residential use fully surrounding the RJP land).

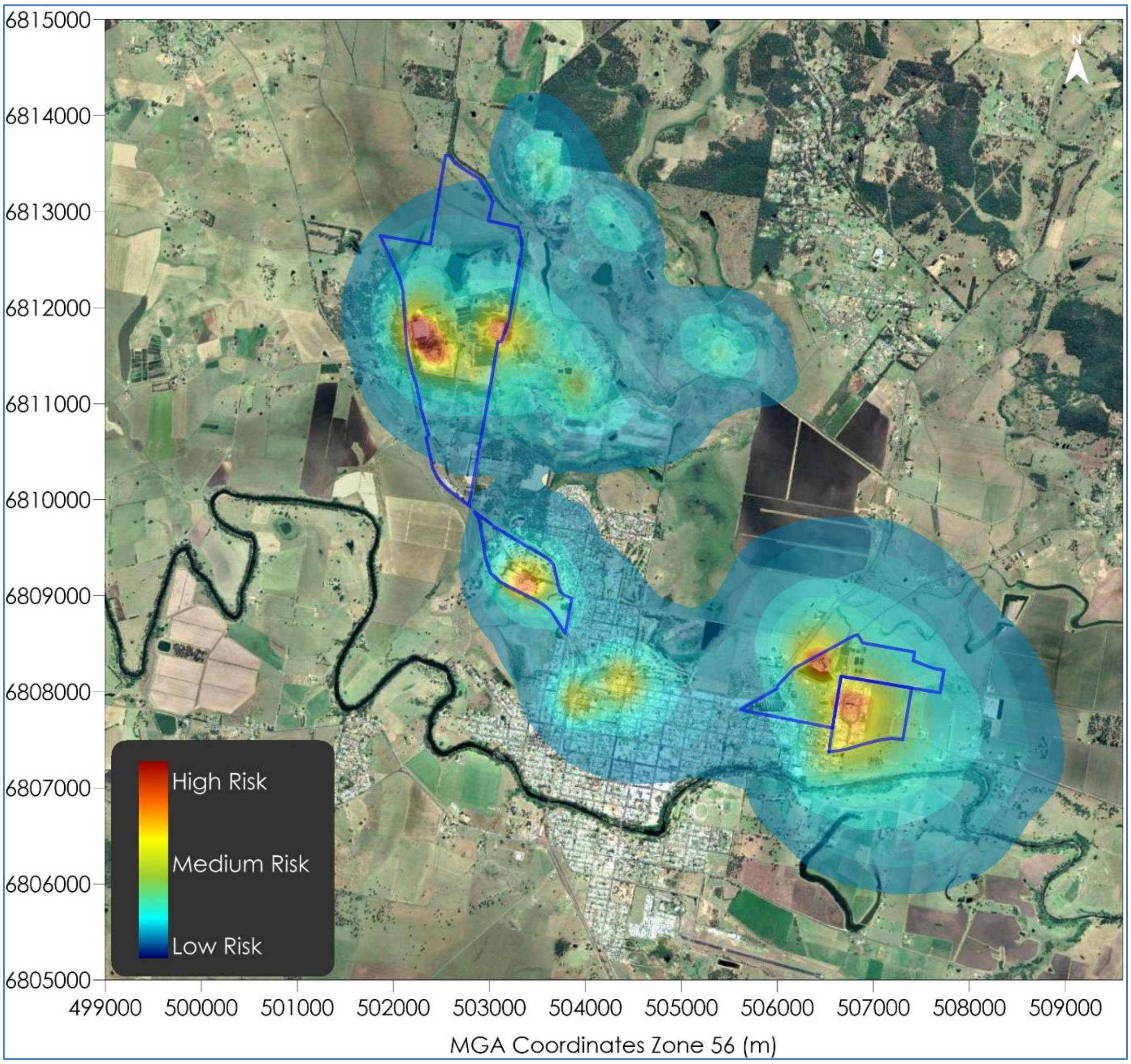

Figure 2-3: Predicted 99th percentile 1-hour average impacts – fugitive sources

Figure 2-4 presents the predicted worst-case 15-minute period noise levels for the modelled sources. The potential high risk noise areas are predicted to arise outside of the RJP investigation area and occur for existing noise sources in the town adjacent to existing receivers (as might be expected).

The modelling shows that the propagation of noise is influenced by the local terrain features and extends into lower lying areas compared to the noise source location. This is favourable for the Casino Food Co-op and there appears to be good shielding afford by the terrain between it and the receivers to the north and northwest. Development of new noisy sources over this crest in the terrain should not be encouraged, which places limitations on the potential for spatial expansion of the Casino Food Co-op. The results indicate the Johnston Street industrial area has scope to impact residential areas and consideration should be given to curtailing night time activity for industries on the residential boarder.

It should be noted that this is a strategic risk assessment, with conservative assumptions regarding the emissions from these uses and the applicable standards to be met at receptors. Detailed assessment of the existing uses and air and noise mitigation measures is required to determine compliance for each of the existing uses in the Precinct. The shape of the modelling results is used as an indicator to inform the potential risk profile of the land within the industrial area and where higher emitting industries are best allocated.

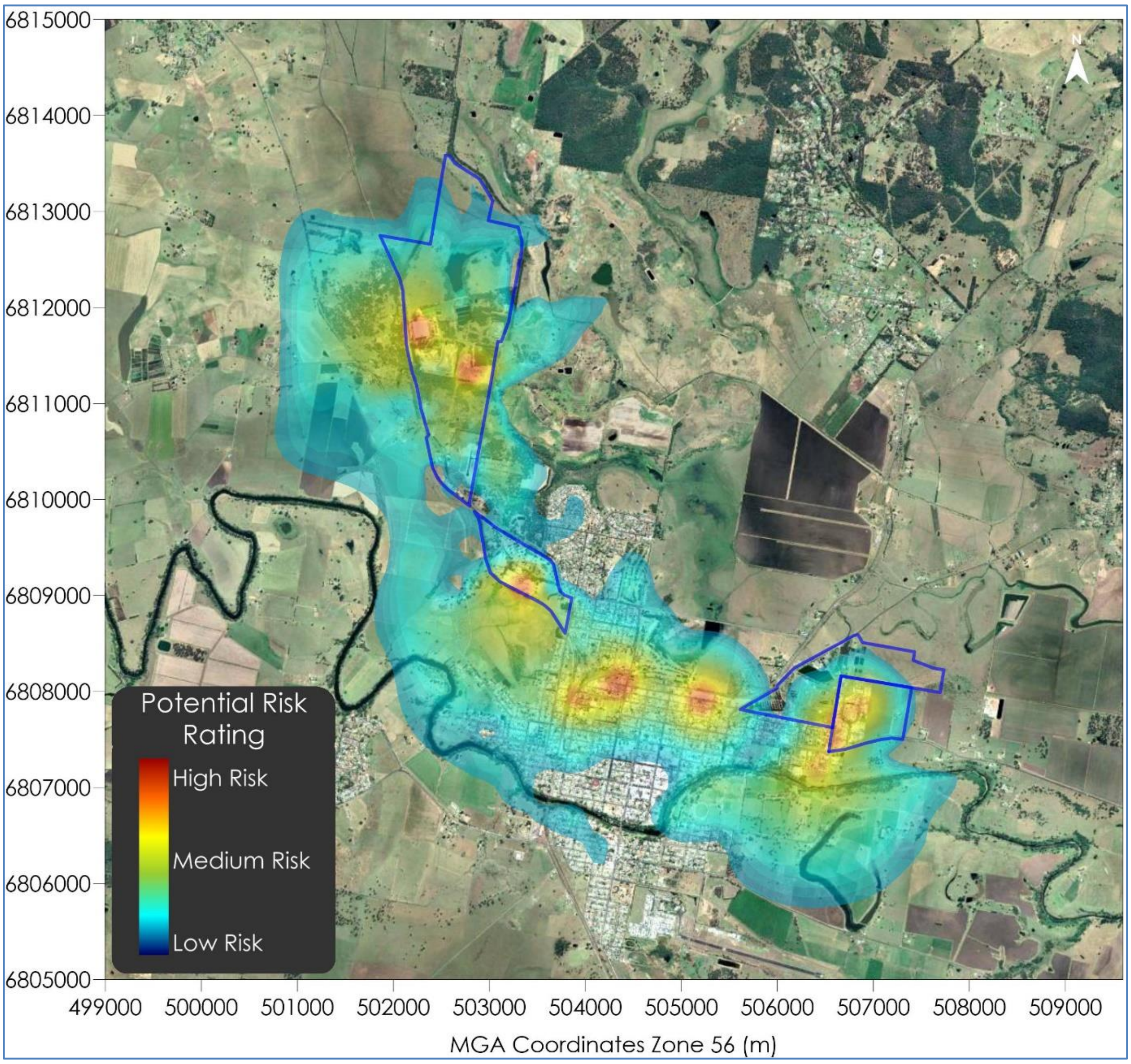

Figure 2-4: Predicted worst-case 15-minute period noise levels

2.4 Constraints and Opportunities

2.4.1 Constraints

The analysis shows a likely risk level of impact between existing industries and receptors, whicharises due to the relative proximity of these existing receptors to existing industrial activities.

Overall, the following can be determined:

- Odour ranks highest, followed by dust and other air pollutants. It is likely that air quality or odour levels may be near to criteria at the indicated locations.
- An appropriate setback or buffer area around the existing sources of emissions in the RJP investigation area could be defined. This work would also define an appropriate allowance of air emissions for industries within the RJP investigation area required to meet the relevant air quality criteria at these locations (or other suitable measures for use in planning instruments).
- Impacts from the existing volume sources, such as ponds, land surfaces and fugitive emissions from yards and buildings predominantly relate to odour emissions. Emissions from stacks include odour and air pollutants. Volume sources tend to have most influence near the source, and may concentrate in low-lying areas or drift along drainage lines. The stack (or point) sources tend to influence the surrounding high points of the landscape (though impacts are generally relatively smaller due to greater distance). High rise development artificially increases the landscape and increases the risk in impacts occurring at height. High-rise development near any parts of the RJP investigation areas is however unlikely.
- Existing sources in close proximity residential areas arise at Cassino Drive, however a closer inspecton of the situation identified that these uses, such as timber truss manufacturing, storage, a recycling/ scrap metal facility, warehouses, motor vehicle mechanical workshops, towing business, and panel beating/ restoration. Most of these industrial uses are daytime only activities (except towing) and this leads to low scope for adverse noise impact. Some of the industries have potential for air quality emissions in the form of dust, VOC's and odours, but due to the limited scale and limited hours of operation the actual reisk is relatively low.

2.4.2 Opportunities

The following opportunities aim to manage potential land use conflicts and enable industries to operate without undue compliance burden while at the same time provide residents with adequate amenity and health protection.

- Co-location of high impact industrial uses to minimise buffer requirements. This should extend to clustering such uses with an industrial area. Generally one should locate such high impacting industry clusters furthest from residential areas, but it is best to use the modelling results to identify the locations affording the most scope for emissions to occur without undue impacts arising.
- Delineating a suitable buffer between existing and future residences and any major new industrial developments.
- For existing industrial interface areas that are in proximity to residential areas, such as at Cassino Drive, planning controls that maintain the status quo would minimise or limit potential future impact by, for example the planning controls could require daytime only operation, and only allow new industries with relatively low scope for noise, dust, odour and air pollutant emissions.
- The future residences or sensitive receptors within the RJP investigation area would limit the potential for major industrial development nearby, especially due to the dominant west-north-westerly wind flows. A likely strategy for this area may be via staged planning approaches for

progressively expanding development within the RJP investigation area to defer or allow time to deal with this constraint.

- Introduce vegetation bands within the industrial area. Buffers nominally 50-100m wide which consist of dense, tall vegetation will add dispersion and dilution of fugitive or volume emissions, however this strategy may not assist greatly if new sources are predominantly from stacks. This strategy is best compatible with minimising visual impacts, which in-turn assists to minimise community perception of any potential odour impacts.

- In general, the weather data indicate that the township also experiences hot conditions in summer and would greatly benefit from strategic tree planting. There is no reason this should not extend onto the industrial areas. Using trees for shading roads and buildings will reduce future heat levels in the populated areas and reduce any urban heat island effects also.

2.5 Existing and potential future residential development

The existing and potential future residential development surrounding the Richmond Valley RJP investigation area is an important consideration to minimise potential future land use conflict.

Figure 2-5 presents the land zoning map from the Richmond Valley Local Environment Plan 2012. The current R1 zonings are identified to the east of the Casino Food Co-op boundary and west of the Johnston Street Industrial area and surrounds precinct. R5 zonings are located further afield to the north and east and have the potential for future residential development.

Figure 2-6 presents the Richmond Valley RJP investigation area with the identified existing residential dwellings, current residential land zonings and an urban growth boundary with a nearby proposed residential planning proposal.

It is important to note that there are several existing residential dwellings located within the Richmond Valley RJP investigation area.

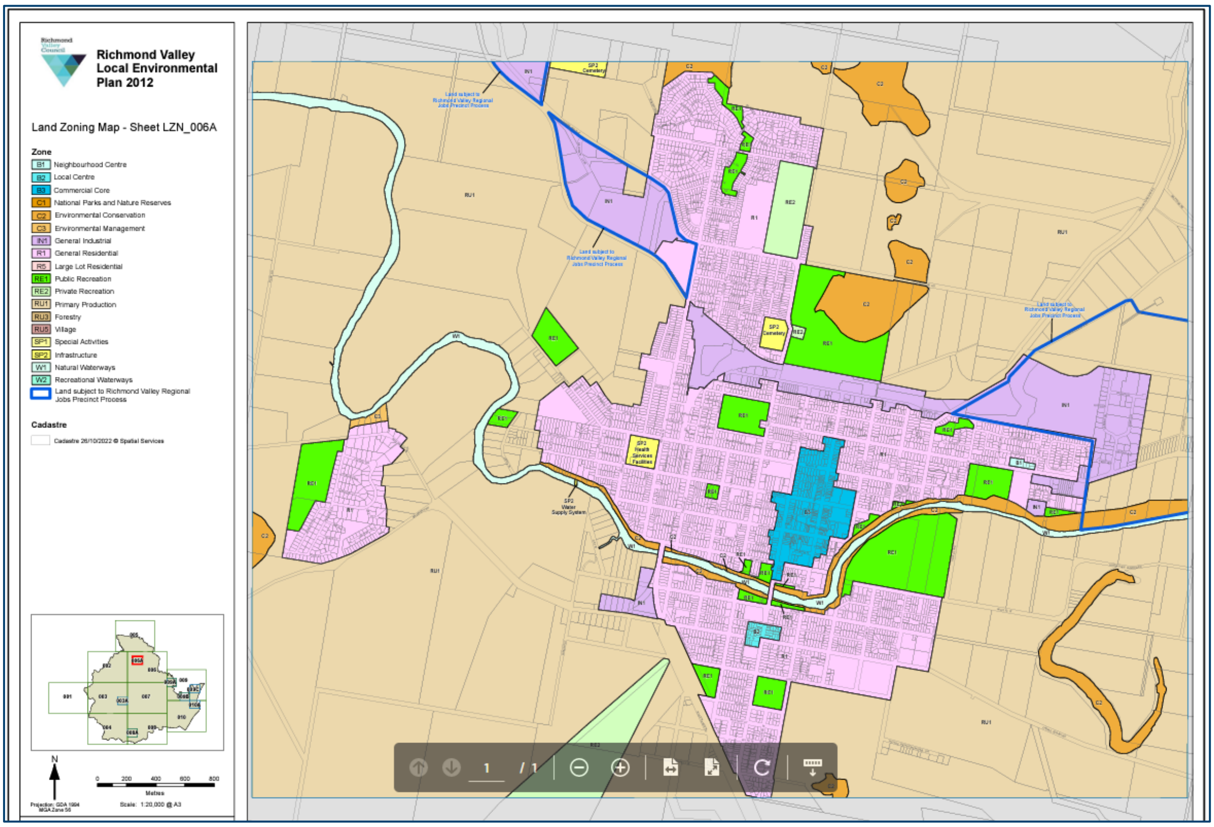

Figure 2-5: Richmond Valley Local Environment Plan 2012 land zoning map

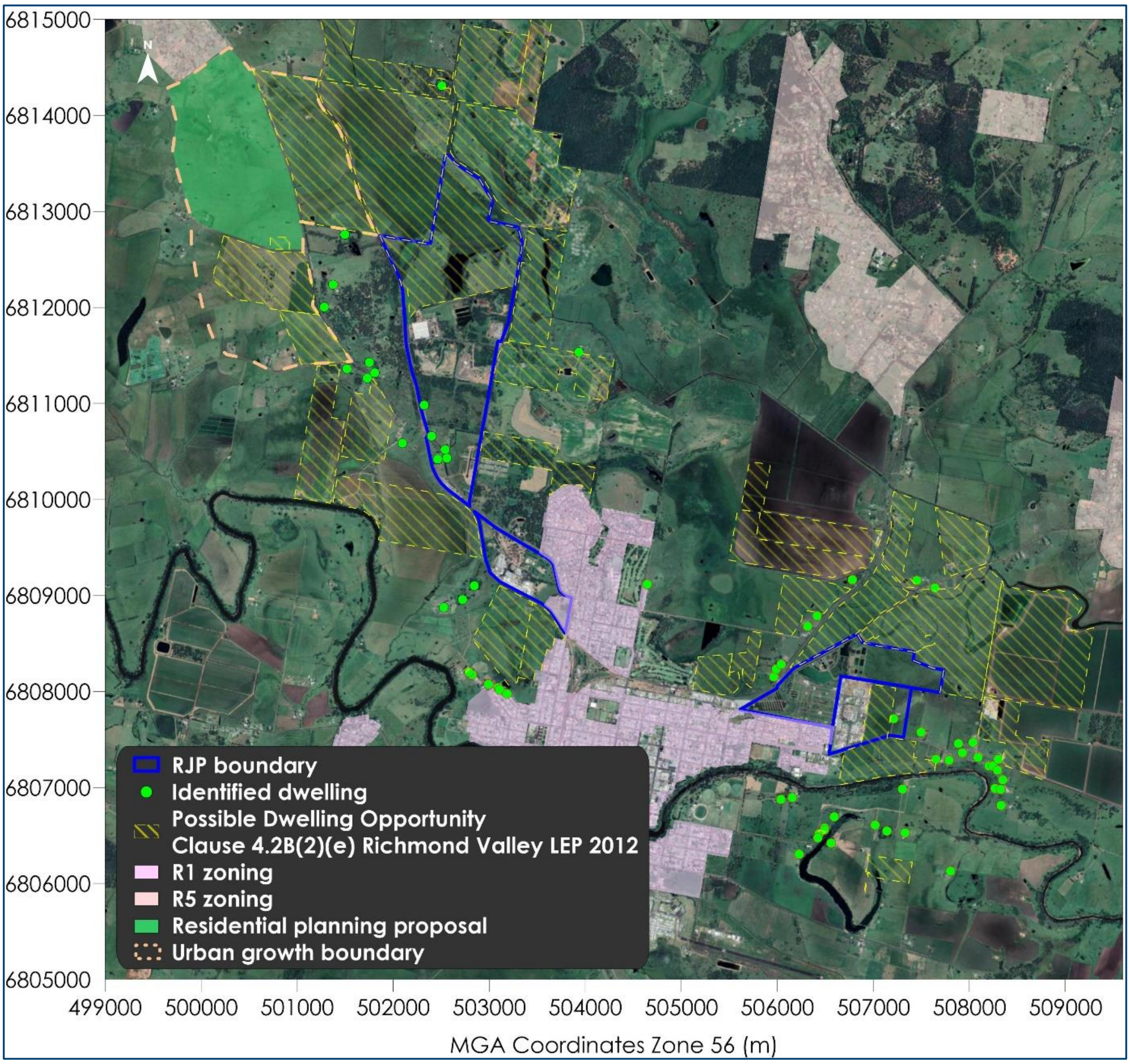

Figure 2-6: Existing and potential future residential development

3 MODELLING ASSESSMENT METHODOLOGY

The relationship between the permissible level of air pollution emissions from any source (e.g. Regulatory limit) and the permissible level at receptor (i.e. ground level or ambient air quality criteria set out in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**NSW EPA, 2016**)) was analysed to determine the limiting pollutants that will govern the findings of the air quality assessment. The limiting pollutants are those with the smallest ratio between the level that could be emitted (at the source) and the level permitted in the ambient air (at the receiver). This is the limiting pollutant ratio, as set in the applicable criteria.

For noise, we determined the difference between the sound energy released at the source and the applicable noise criteria at the receiver. This is the noise residual. The sound energy is derived for a typical array of noise sources in an industrial area, and the applicable night-time criteria (assuming 24/7 operations) will govern the noise residual (limiting case). For a 24/7 operation, it is taken that the sound energy from the source is the same, but the criteria are less stringent. Thus, when the night-time criteria are met, the evening and daytime criteria are also met. It is noted that even if there happens to be more noise energy released from the source in the evening or daytime, the less stringent criteria almost always adequately compensates for this.

The air pollutant levels (for any air pollutant) at the source are related to the level at the receiver by the degree of air dispersion or dilution of the pollutant as it travels from the source to the receptor. In a similar way, for noise, the sound energy at the source is related to the noise level at the receiver by the degree of noise attenuation between the source and receiver. Thus, for air pollution we apply a ratio, division or multiplication calculations, and for noise we use subtraction or addition calculations, but otherwise the same big picture principles apply.

Air dispersion modelling was used to determine the dilution ratio between all potential sources and all receptors (the modelling method is detailed later). At any receptor where the air dilution ratio approaches the limiting pollutant ratio, there is a risk of exceeding the criteria for the limiting pollutant i.e. a potential risk of air quality impacts arising. Medium and low risks are also defined according to the range of source emissions that can be expected to arise from industrial sources, and/or for other pollutants.

Similarly, noise modelling was used to determine the noise attenuation between all potential sources and all receivers (the modelling is detailed later). Risks were assigned on the same basis as air, i.e. per the limiting criteria at the receiver. Thus, at any receiver where the noise attenuation approaches the noise residual, there is a high risk of exceeding the criteria and a high risk of noise impacts arising.

The modelled outputs are therefore presented as risk levels to allow the risks from several pollutants, which may be dispersed differently (see later), but also noise to be compared on a like-for-like basis. The ability to make a valid comparison between all types of industries, air pollutants and noise pollutants is crucial for making good planning decisions.

The NSW EPA *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (**2016**) define a range of criteria for many air pollutants. However, the pollutants can be categorised in simple terms according to how they are released. In general:

- Stacks will release; air pollutants after capture and treatment, and generally common criteria pollutants (such as SO_2, NO_2 and fine particles) directly from a combustion process or a material handling process.
- The key fugitive emissions are dust and odour. These emissions may arise from wind erosion of an exposed site (dust), a pond (sewage, or process water odours), the openings of a building (paint fumes, dust, welding fumes etc.), or a land surface (manure, compost etc.).

How the pollutant is released is the key factor in determining the type of industry, and also the degree of dispersion between source and receiver.

In general, fugitive emissions result in most impact nearest the source and at ground level nearby, with less and less impacts as one moves further away. The spatial extent of the impact is usually governed by low wind conditions and inversions with the greatest impacts tend to be confined in a valley.

Noise, and especially noise at night-time, is most affected by inversions and gradient winds and is most similar to the fugitive sources. However, noise propagation is significantly affected by barriers, thus the terrain is a key factor. Similar to the fugitive sources, noise impacts can be confined within a valley (if the source is in the central part of the valley and the valley terrain is significant).

Unlike fugitive sources and noise, stacks are designed to disperse pollutant away from the ground. Emissions released from stack will have their highest impacts on the surrounding elevated terrain, and often somewhat away from the source. Placing stacks at the bottom of a valley is generally counterproductive as taller, more costly stacks will be needed to prevent impacts. On the other hand, whilst stack sources would ideally be placed atop ridges and hills, the types of industries that have stacks are generally large, and visually such industries can be an imposing eyesore (in the view of many).

Knowing the above, the air dispersion modelling between source and receiver could be limited to stacks and fugitive sources. The limiting pollutant ratio was determined to be air toxics for stack emissions and was odour for fugitive sources.

The air and noise modelling factors in the prevailing weather and terrain conditions for the specific locality.

For both the air and noise modelling, the modelling was "reverse engineered" such that the same risk profile could be applied to the sources as well as the receivers/ receptors. This was done so that it is possible to tell which sources cause the impact at receptors. Only high risk sources can cause high risk impacts. Removing either the high risk source or high risk impacted receptor (or both) eliminates the risk of impacts arising.

The modelling was then set up to allow this to be done quickly and to iteratively arrive at an optimal separation between source and receptor that would minimise impacts. Further refinement of the modelling was made to factor in low, medium and high amenity sectors to be developed, according to the types of industry that would emit low, medium or high levels of air pollution or noise.

Technical details of the modelling are set out in the next section.

3.1 Technical detail of air dispersion and noise modelling methodology

The following sections are included to provide the reader with an understanding of the model and modelling approach.

The air dispersion modelling was undertaken using a combination of The Air Pollution Model (TAPM) and the CALPUFF Modelling System which include three main components: CALMET, CALPUFF and CALPOST. TAPM is a prognostic air model used to simulate the upper air data for CALMET input. CALMET is the meteorological component for use in the CALPUFF dispersion model. CALPOST is a post processor used to process the output of the CALPUFF model and produce tabulations that summarise the results of the simulation.

CALPUFF is an air dispersion model approved by NSW EPA for use in air quality impact assessments. The model setup used is in general accordance with methods provided in the NSW EPA document *Generic Guidance and Optimum Model Setting for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'* (**TRC Environmental Corporation (TRC)**, **2011**).

The noise modelling uses the Environmental Noise Model (ENM) which is compatible with the NPfI.

3.2 Meteorological modelling

The meteorological modelling methodology applied a 'hybrid' approach which includes a combination of prognostic model data from TAPM with surface observations.

The TAPM model was applied to the available data to generate a three-dimensional upper air data file for use in CALMET. The centre of analysis for the TAPM modelling used is 28°50' south and 153°2' east. The simulation involved an outer grid of 30km, with three nested grids of 10km, 3km and 1km with 35 vertical grid levels.

The CALMET initial domain was run on a 12 x 12km with a 0.1km grid resolution for the 2015 modelled year. The available meteorological data for January 2015 to December 2015 from the Casino Airport AWS were included in the simulation. The 2015 calendar year was selected as the period for modelling based on an analysis of five consecutive six as outlined in **Appendix A**.

3.3 Meteorological modelling evaluation

The outputs of the CALMET modelling are evaluated using visual analysis of the wind fields and extract data. **Figure 3-1** presents a visualisation of the wind field generated by CALMET for a single hour of the modelling period (i.e., example only). The wind fields follow the terrain well and indicate the simulation produces realistic fine scale flow fields (such as terrain forced flows) in surrounding areas.

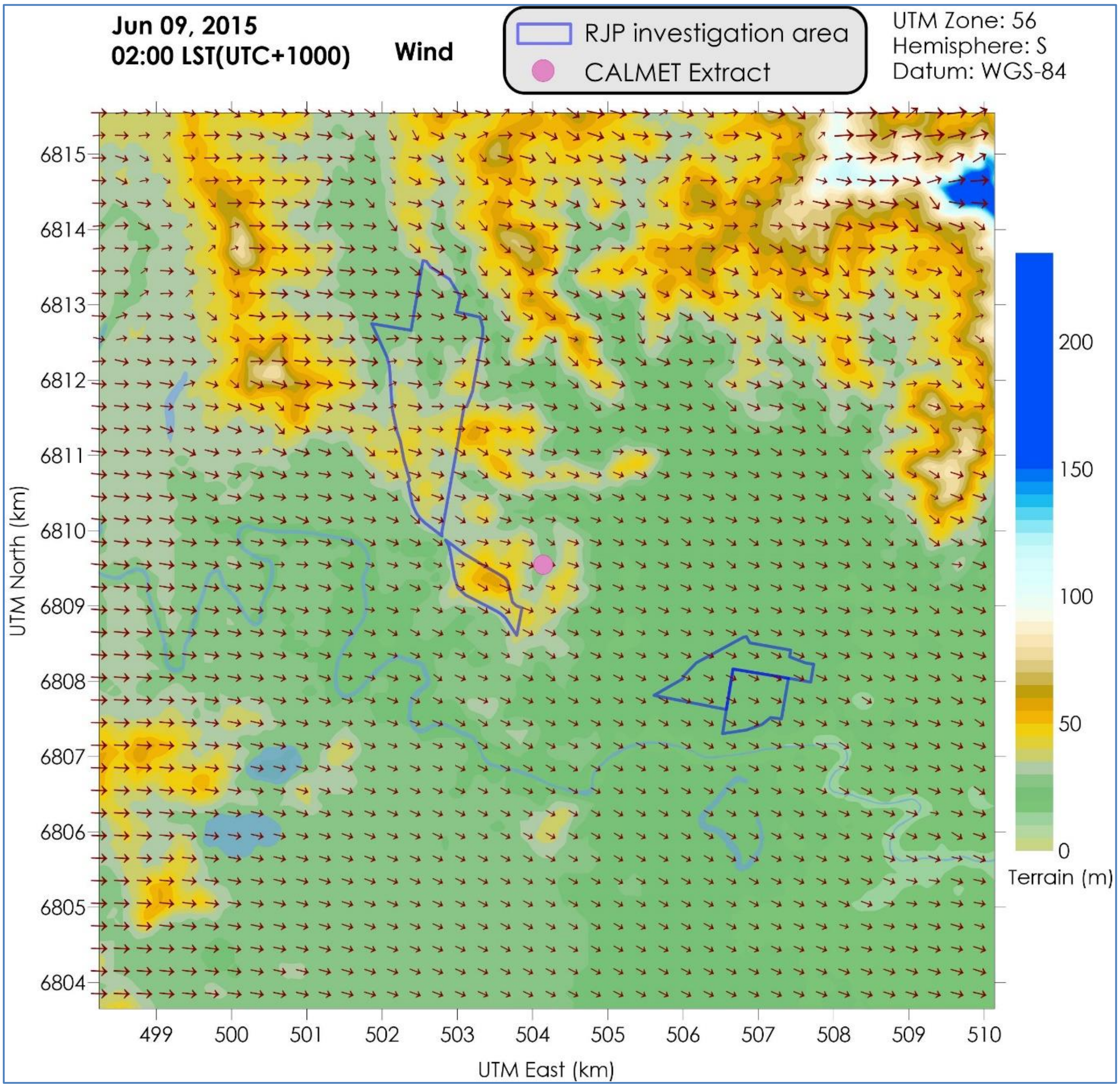

Figure 3-1: Representative 1-hour snapshot of wind field

CALMET generated meteorological data were extracted from a point within the CALMET domain and are graphically represented in **Figure 3-2** and **Figure 3-3**.

Figure 3-2 presents the annual and seasonal windroses from the CALMET data. Overall, the windroses generated in the CALMET modelling reflect the expected wind distribution patterns of the area as determined based on the available measured data and the expected terrain effects on the prevailing winds.

Figure 3-3 includes graphs of the temperature, wind speed, mixing height and stability classification over the modelling period for the modelled year and shows sensible trends considered to be representative of the area.

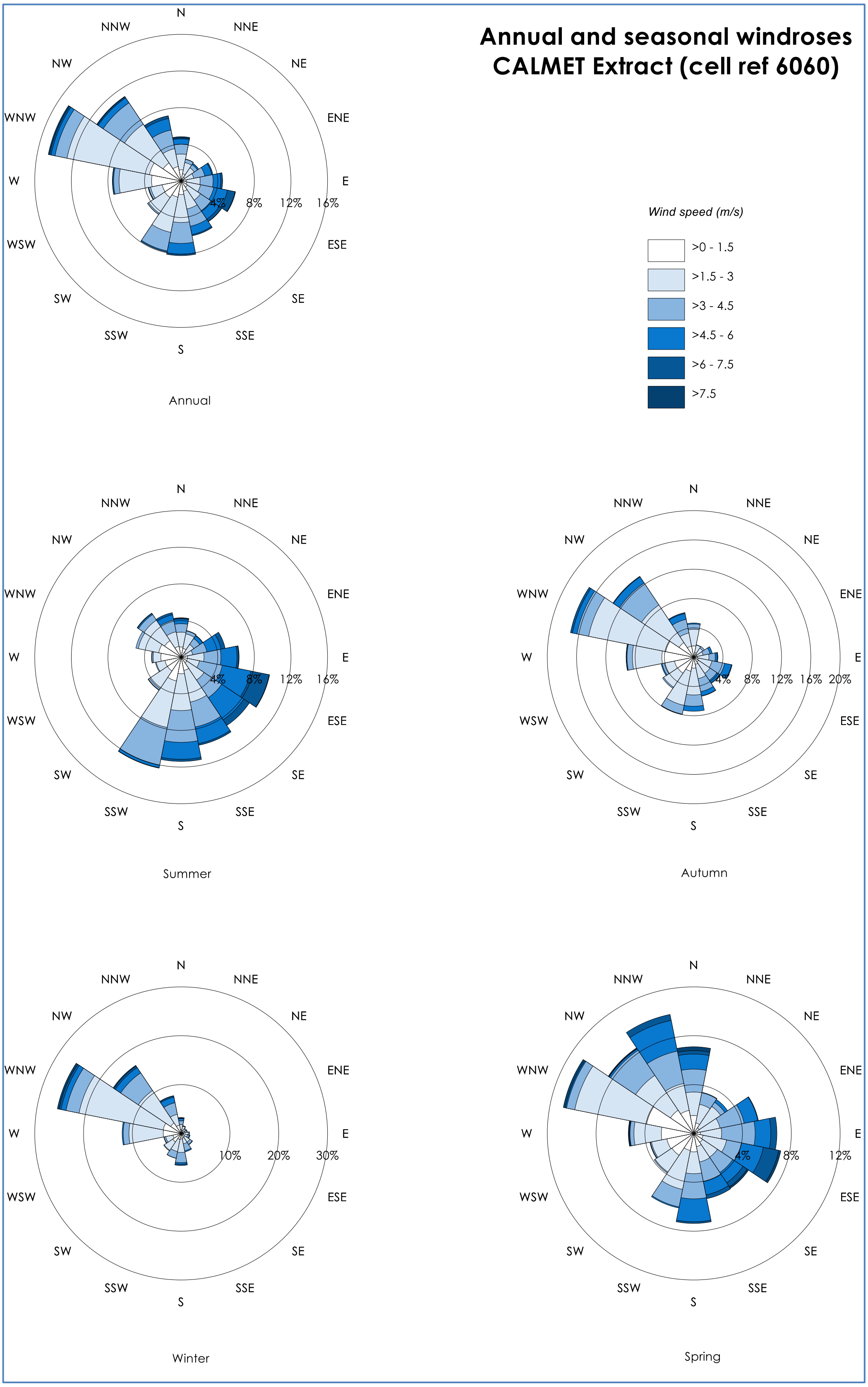

Figure 3-2: Annual and seasonal windroses from CALMET

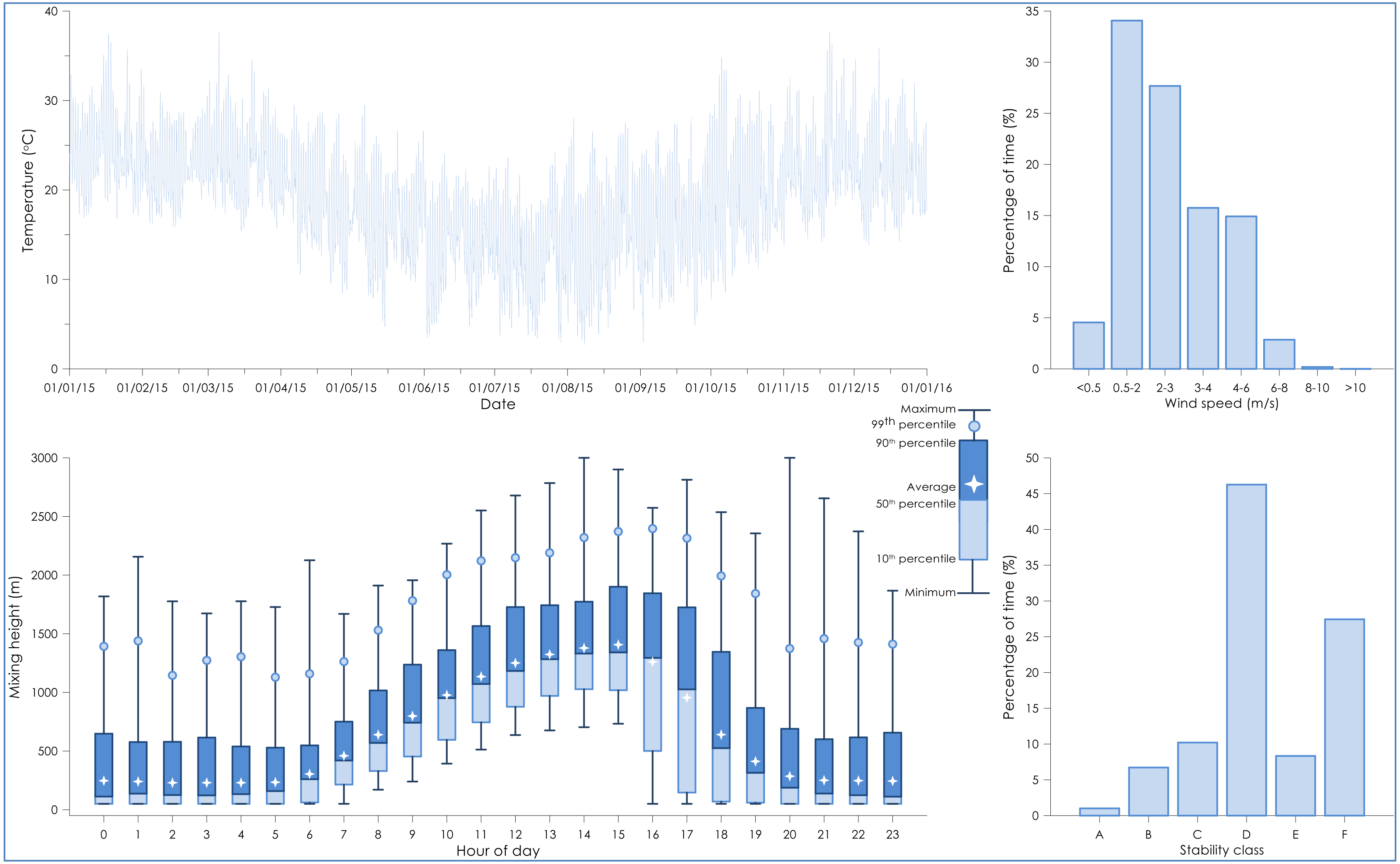

Figure 3-3: Meteorological analysis of CALMET

3.4 Air and odour modelling

The CALPUFF dispersion modelling is based on the emission of pollutants from sources within the meteorological modelling domain. The model was setup to include all potential future source locations arranged in a grid within the Richmond Valley RJP investigation area.

The sources represent any location within the Richmond Valley RJP investigation area where potential air emissions can occur. Each source was modelled separately as both a point (stack) source and as a fugitive (volume) source with emission release parameters that would represent relatively standard sources associated with the industrial activities and the assigned amenity classification. The point sources were setup to represent emissions from a stack with generalised flow parameters (e.g., exit velocity, temperature) and an emission point which is elevated above the ground. The volume sources represent diffuse, fugitive ground based sources which commonly include dust and odour emitting sources.

These sources were modelled over the entire year and are assumed to emit air emissions continuously using a unit emission rate. The emissions were modelled for only the key pollutants with scope to exceed EPA criteria. The different rates of emission of various key pollutants were accounted for, allowing source or receptors impact risk to be shown on a like-for-like basis, irrespective of the pollutant emitted.

3.5 Noise modelling

Noise emissions were modelled in a similar manner to the air emissions with all potential future industrial source locations arranged in a grid within the Richmond Valley RJP investigation area.

Industrial movement and handling of freight has been accounted for in each industry as part of the different industrial uses, however the movement of vehicles (such as via rail or road) along roads and highways are not specifically included. The movement of these vehicles are assessed differently to the industrial sources under different guidelines which are more conservative.

Noise sources were modelled using the ENM noise model under strong inversion conditions and generalised noise emissions profiles typical of the different industrial activities.

3.6 Modelled receptor locations

The modelled receptor boundary for the Richmond Valley RJP investigation area has been considered for potential air, noise and odour impacts and is presented in **Figure 3-4**. The modelled scenario considers the nearest existing residential dwelling or potential future dwellings based on current land zonings surrounding the Richmond Valley RJP investigation area. This excludes six potential dwelling sites (three to the east of the Nammoona Industrial Precinct, one to west of the Casino Food Co-op and surrounds precinct boundary and two to the north of the Johnston Street Industrial area and surrounds precinct). Based on available satellite of the area, these dwellings appear to not have structures or appear to be a shed. Accommodation for two potential future dwellings to the east of the Nammoona Industrial Precinct have been made in the modelled receptor boundary.

All existing dwellings located within the Richmond Valley RJP investigation area boundary are not included as residential dwellings (ten in total). These dwellings are located on existing or proposed industrial zoned land and each of these dwellings will be addressed as staged industrial development in the Precinct is undertaken. These dwellings are excluded to allow for the modelled predictions to represent the full utilisation of the available land within the RJP.

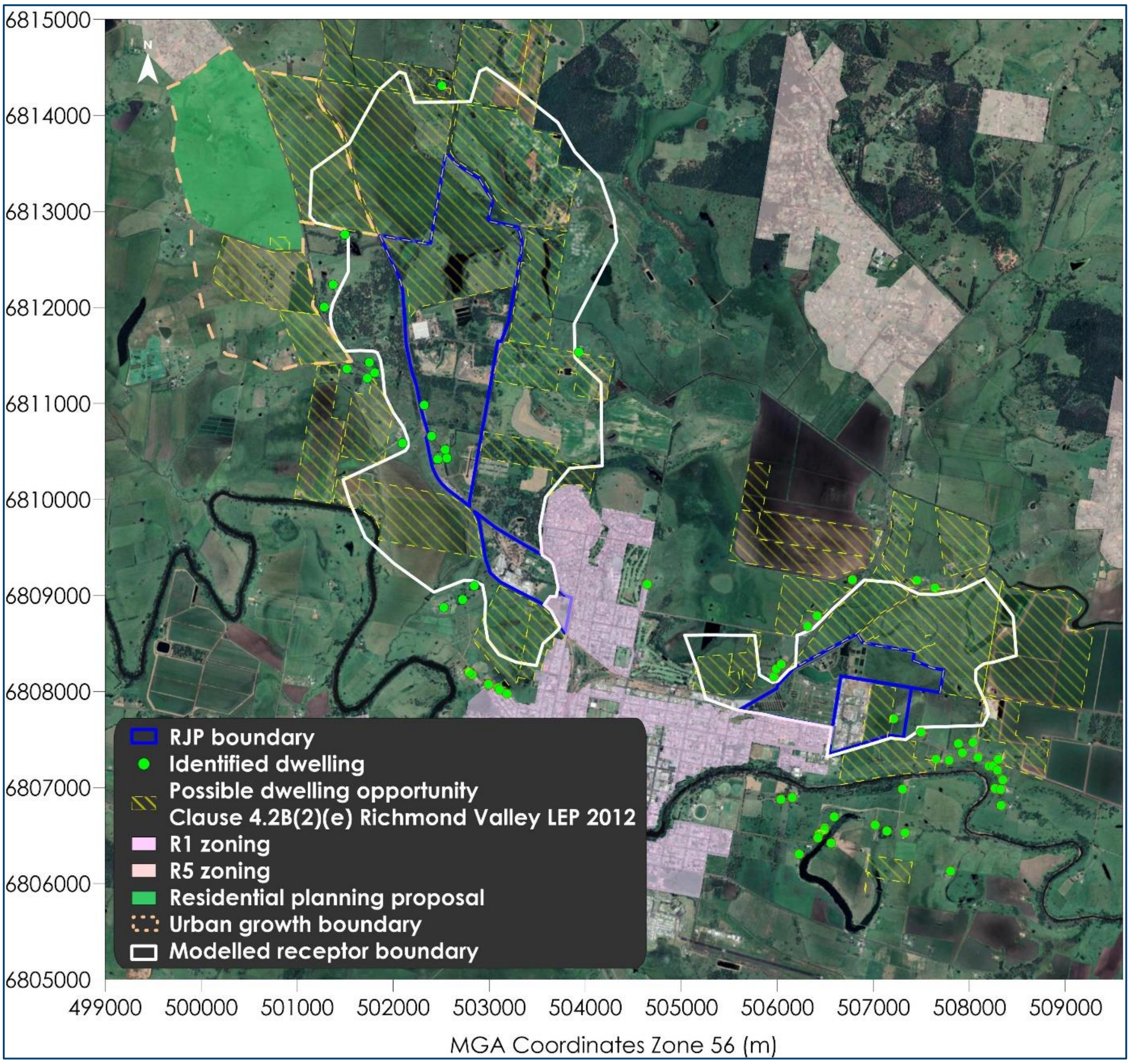

Figure 3-4: Modelled receptor boundary

3.7 Modelling assumptions and limitations

The assumptions and limitations include:

- Existing vacant land beyond the Richmond Valley RJP investigation area boundary is treated as a buffer, based on its current zoning and potential to provide sufficient protection for all existing sensitive receptors and existing and future industrial activities. Refer land located between blue boundary and white boundary in **Figure 3-4**. It is assumed that appropriate planning mechanisms would be applied to this land to prevent residential encroachment or other sensitive uses which can lead to future land use conflict.

- Sources were assumed to be high/medium/low amenity based on the potential future land use and their likelihood to emit low, medium or high levels of air and odour pollution. For example, a low emitting industry (as would be expected in a high amenity area) may include warehousing and distribution with only the emissions from a few trucks and forklifts as the main air pollution sources. A high emitting industry (as may arise in a low amenity area) may include industrial manufacturing or waste processing with fixed air pollution sources such as boilers, fugitive odours, dust and general air pollutant emissions. Generic assumptions about the rate of emissions were made to reflect the low, medium and high amenity areas, for example as set out above. The scale of the emissions is directly proportional to the size of the area modelled, with more emissions from larger areas. The low, medium and high amenity areas where adjusted iteratively in the modelling until the masterplan showed acceptable levels of effect, for sufficient industries to service community needs.

- Sources were modelled over the entire year and are assumed to emit air emissions continuously using a constant emission rate over the entire area. For this assessment is has been assumed that all sources operate for every hour of the year.
- Industrial movement has been accounted for within each amenity area, however the movement of vehicles (such as via road) into and out of the RJP are not specifically included. These are seen as transient sources and are assessed differently to fixed industrial sources (i.e. consistent with the various criteria and guidelines).
- There is also no distinction between scheduled and non-scheduled activities (i.e those approved and managed by State or Local government) in the modelling.

3.8 Master Plan testing

The Master Plan described in **Section 1.5** was tested using the approach outlined previously to identify the areas at risk of potential impact upon existing or potential future receptors and any associated land use conflict.

The dispersion risk results for air quality include both volume sources and stack sources combined showing a single prediction for the modelled scenario. The combined result shows the maximum risk of either air quality or odour issues arising at the receptor locations.

Different amenity areas are assigned to the proposed land uses in the Master Plan and represent low, medium or high potential for air, noise and odour emissions and factor in the types of industry and activities that may occur in these areas.

The amenity areas assigned for the Master Plan are presented in **Figure 3-5**. Areas that are already developed for industrial activity and have a single owner (Co-op and sewage treatment plant) are considered separately. These areas are either not amenable to the modelling/ planning process or have existing factors that are too specific to reasonably assess using a generalised modelling assessment. The Master Plan assumes the future relocation of the sewage treatment plant within the RJP boundary as shown in **Figure 3-5**.

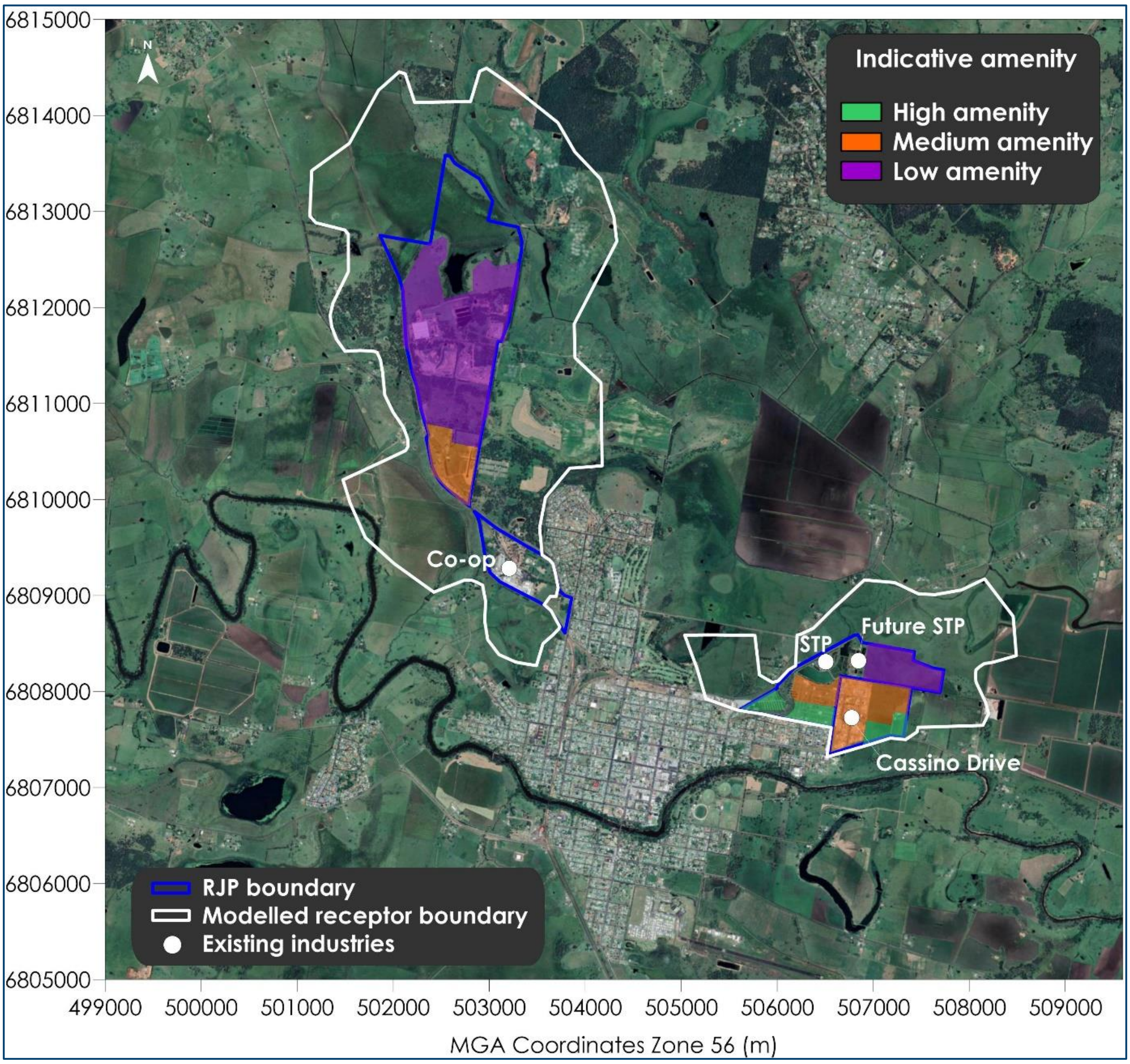

Figure 3-5: Master Plan - indicative amenity area

4 ANALYSIS OF MODELLING RESULTS

Figure 4-1 presents the potential constraints due to air and odour emissions at the receptors and source locations for the Master Plan. The risk classifications for the figures in this section are used to highlight potential risk areas that need to be addressed when refining the Master Plan.[1]

These potential risk areas are not representative of the existing impacts. These modelling predictions are conservative as it assumes all the available industrial is occupied by industry and is continuously emitting air and noise emissions. The modelling therefore presents a "worst-case" scenario. In reality, the future land use/ industry may not have any tangible air or noise and there would not be any risk of impact. The modelling predictions are used to gauge locations which may not be suitable for a

[1] The numerical basis for the potential impact/ risk is shown in the figures in the next section, however it is for the final master plan, that has been refined in response to the initial modelling shown here.

particular industry that emits significant air and noise emissions or would require a high level of mitigation to prevent impacts.

Figure 4-1 shows that the potential risk areas are identified at the interface of the RJP boundary and the modelled receptor boundary. These occur near the proposed/ not fully developed Nammoona Industrial Precinct. There would also be existing such risks near the Casino Food Co-op and surrounds precinct, the Johnston Street Industrial area and surrounds precinct (specifically the Cassino Drive interface with residential areas).

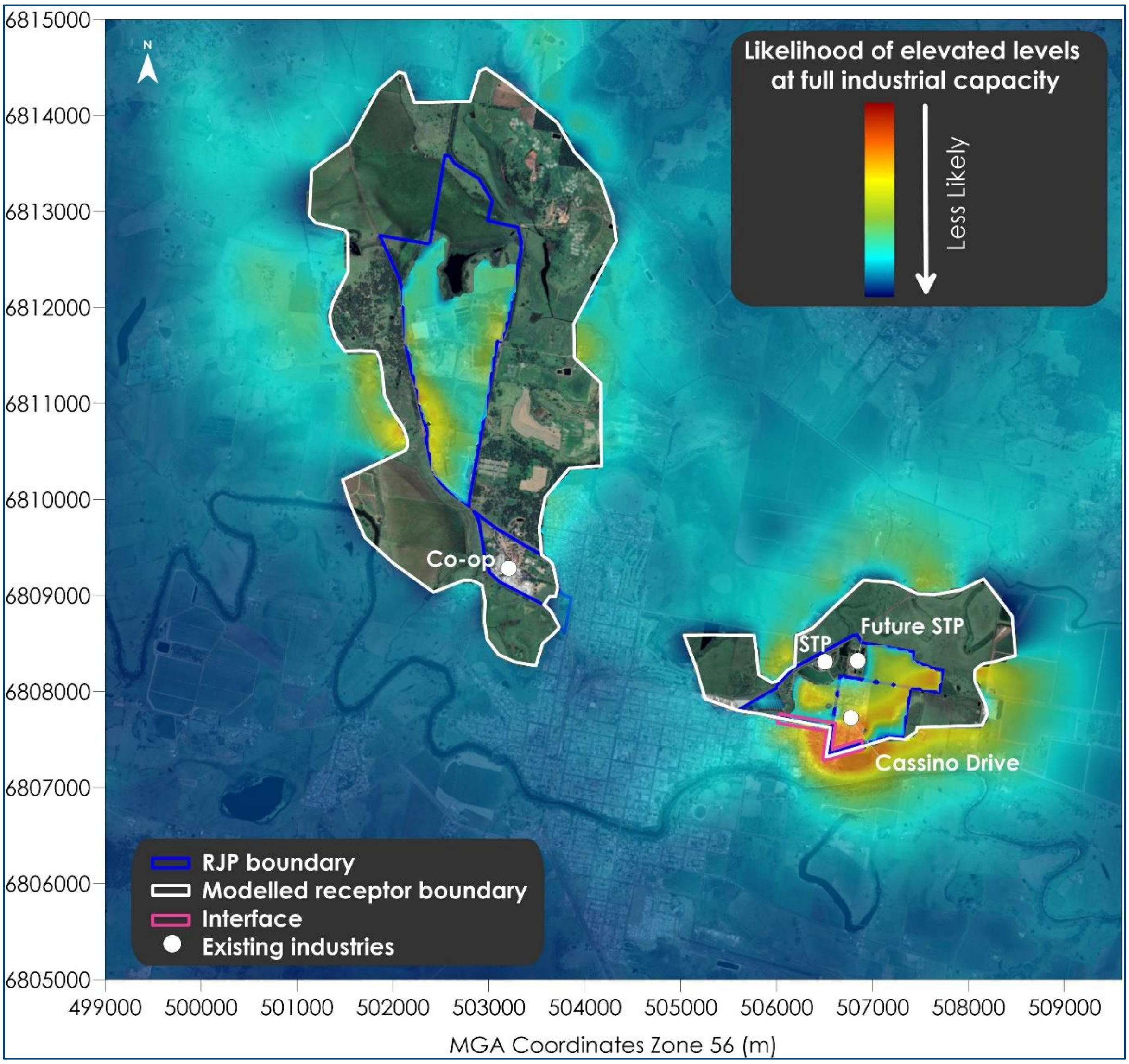

Figure 4-1: Air and odour modelling results for the Master Plan

Figure 4-2 presents the potential constraints due to noise emissions at the receptors and source locations for the Master Plan.

The existing and future relocation of the Sewage Treatment Plant, the Casino Food Co-op and surrounds precinct, and Johnston Street Industrial area and surrounds precinct (specifically the Cassino Drive interface with residential areas) as considered in more detail in the **Sections 4.1** to **4.3**.

Potential risk areas are also identified to the west of the Nammoona Industrial Precinct which are expected due to the proximity of sensitive receptors and to the west of Summerland Way.

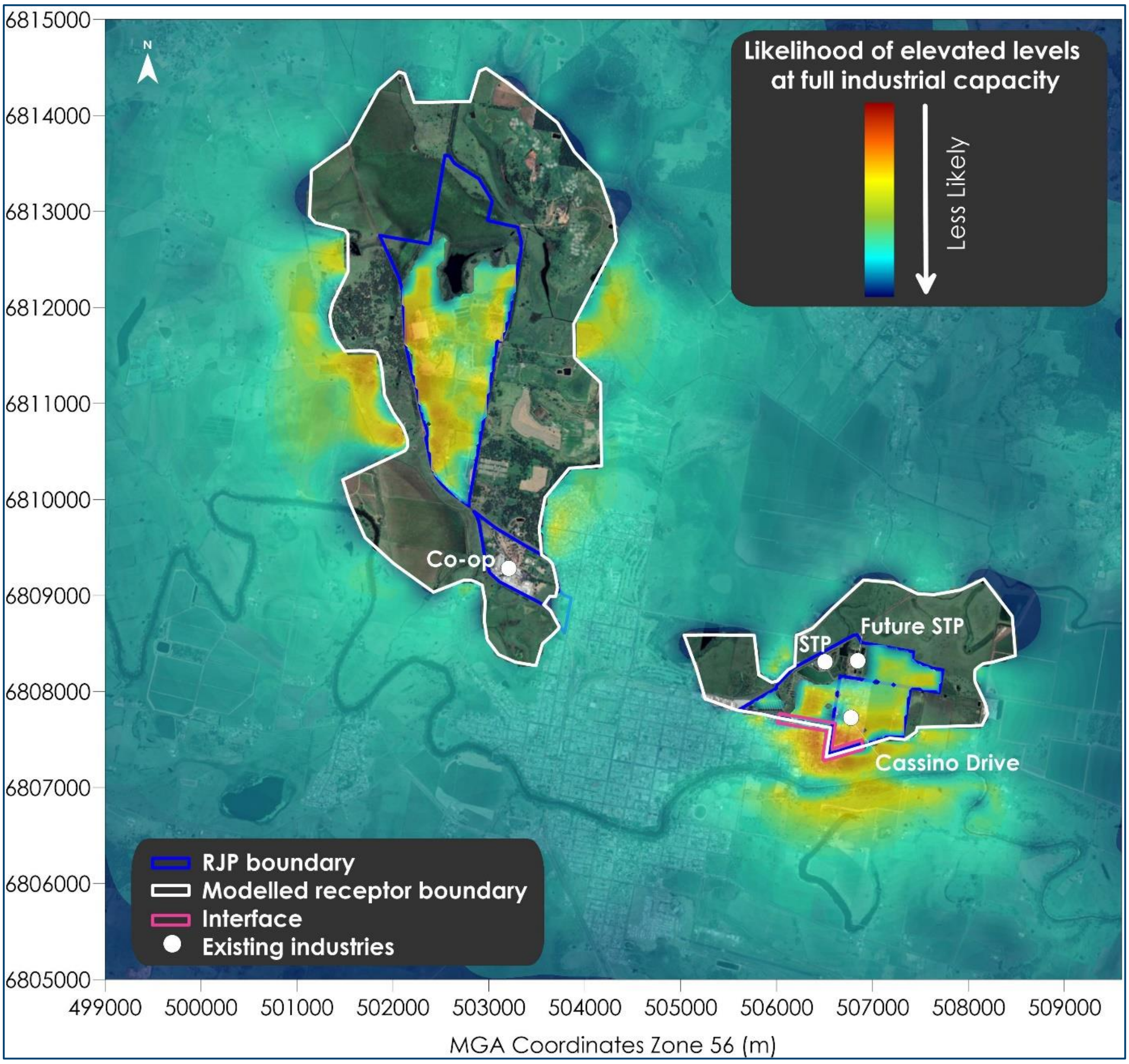

Figure 4-2: Noise modelling results for the Master Plan

4.1 Casino sewage treatment plant

Specific air quality modelling can be conducted for the Casino sewage treatment plant (STP) located in the Johnston Street Industrial area and surrounds precinct based on the expected odour emissions for similar operations and odour sources.

The odour criteria used are those in the NSW odour policy and NSW EPA guidelines.

The modelling results are presented in **Figure 4-3** and can be used to infer the following:

- The 2 odour unit contour line should be used as the buffer for any new residential development.

  Residential development and any place with young children or elderly or sick people (childcare, school, aged care, day care, hospital, etc.), should not be located within the 2 OU contour line.

- The 7 odour unit buffer is needed for new industrial receptors, however farming (e.g. cropping) can occur within the line.
- Between the two buffer lines, general industrial activities are suitable, especially activities that also make air emissions themselves (panel beater, mechanic, sawmill, fabrication, spray painting). However, any sensitive commercial or industrial uses should be avoided, for example places where people may sit down to eat, or places with large numbers of people (e.g. cafe, call centre, business office/ business centre, church, movie theatre etc).

The yellow dashed line is an indicative 400m buffer, as set out in various separation distance guidelines (e.g. The Department of Urban Affairs and Planning's *Circular E3 — Guidelines for buffer areas around sewage treatment plants,* recommends buffer zones of at least 400 metres surrounding sewage treatment plants). This is a generic buffer suitable for such an STP plant in the absence of modelling data (i.e. the modelled contour line should be used in preference to the buffer line). The land area within the modelled contour line and the 400m buffer line is reasonably similar in size, however the shape of the buffer land is affected by the prevailing wind or the site orientation. The modelling contour line is preferred as it factors in both the prevailing wind and the shape of the site.

There are 3 existing receptors within (or on) the modelled 2OU contour line. This means that where possible, for any new plant, best practice plant and controls should be selected to minimise impacts, rather than utilising the full buffer extent.

Richmond Valley Council expect that the existing sewage treatment plant (STP) will need to be replaced in the next 5-10 years. The proposed new location of the STP is located to the east of the existing site. The design and location of the proposed new facility is subject to ongoing planning by Council.

In the short term, the STP will be assumed to remain in its current location, but for the future development will be in the future relocation.

Air quality modelling of the future relocation of the STP has been prepared for the basis of strategic planning for the RJP. The modelling predictions are based on generic modelling for assumed sources at the site and do not reflect the final configuration. The modelling predictions are presented in Figure 4-4. The results indicate that there are no existing receptors within (or on) the modelled 2OU contour line and the future relocation site would have a suitable buffer.

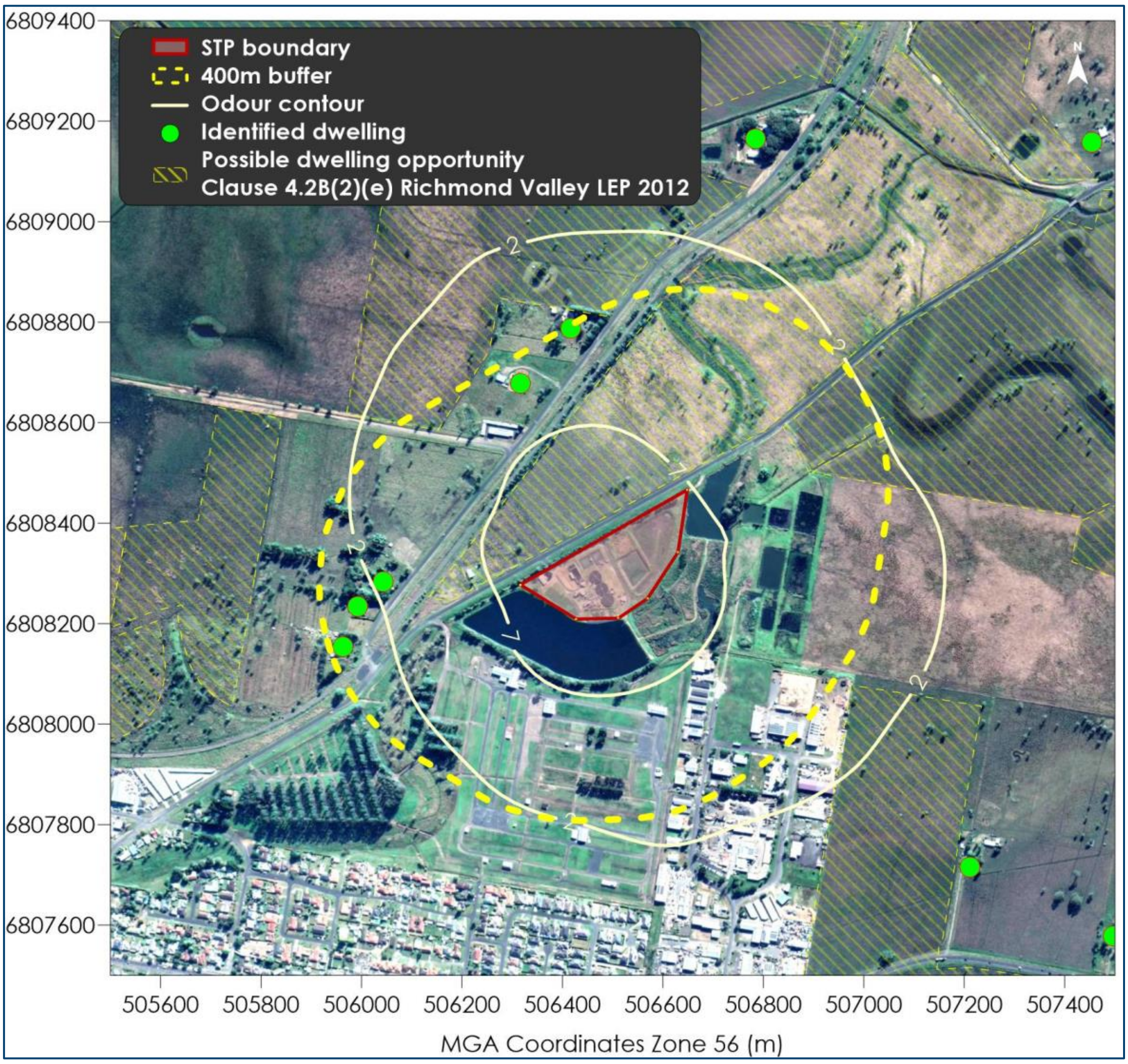

Figure 4-3: Predicted 99th percentile nose-response average ground level odour concentrations for STP (OU)

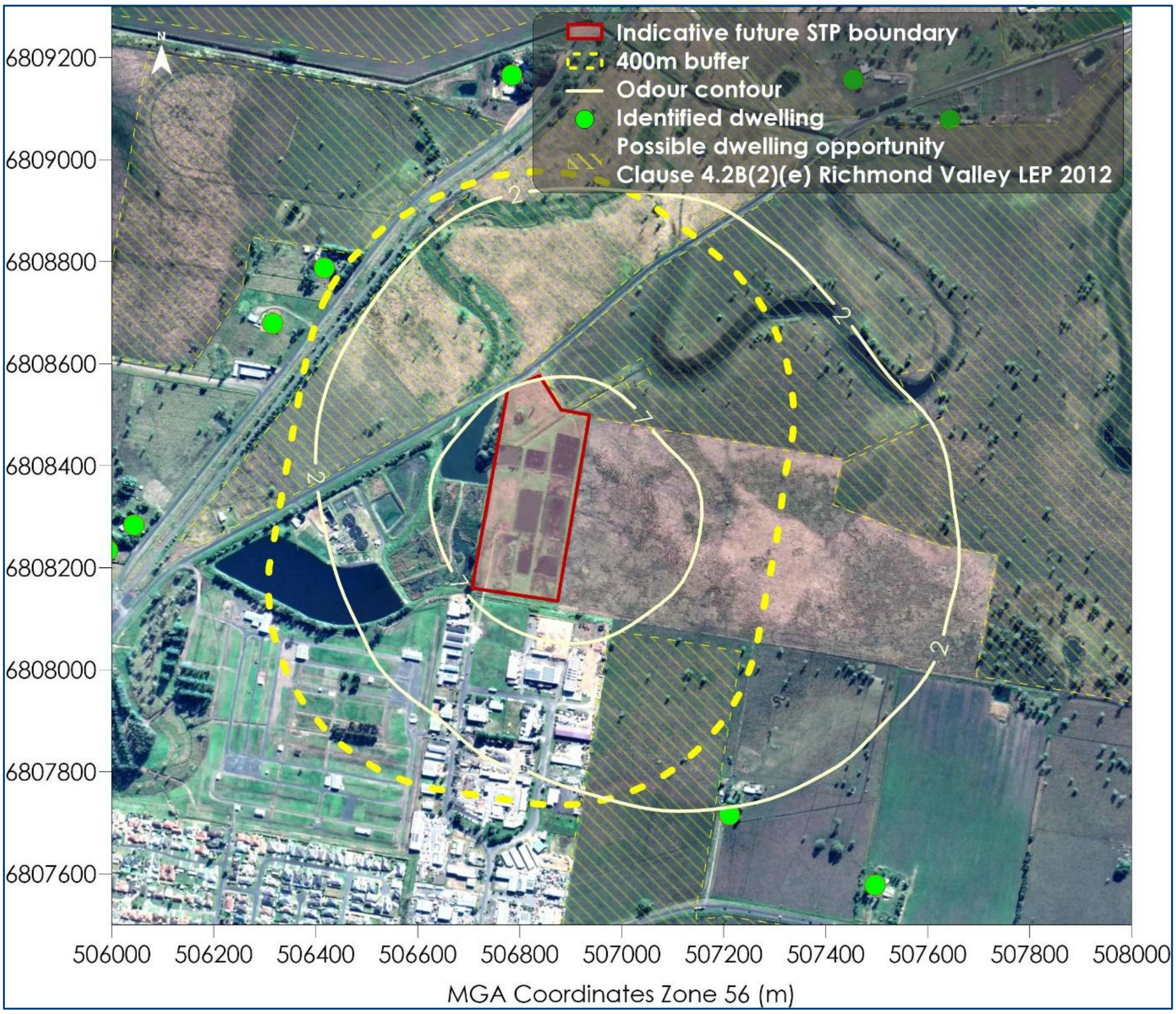

Figure 4-4: Predicted 99th percentile nose-response average ground level odour concentrations for future relocation of the STP (OU)

4.2 Co-operative meat works plant

Detailed air quality modelling of the Co-op was not possible in the absence of detailed air, noise and odour data for the abattoir and related uses. Unlike sewage treatment plants, which exhibit generally similar emissions, abattoirs and meat processing facilities can have greatly varying emissions between plants that are otherwise outwardly similar. The land that could potentially be developed for industrial uses near the co-op is essentially owned by the Co-op, and thus any such development would need to be evaluated via the existing processes for environmental assessment.

The assessment in this report is focussed on ensuring the cumulative impacts of many new developments in the RJP are planned appropriately to minimise land use conflicts, allowing the industrial uses to be productive whilst not impinging adversely on residential areas. The situation at the Co-op is one where there is a single large operator, and the generic assessment approach would likely under or overestimate the existing situation by potentially a large degree.

The following assessment however can be made to assist with the planning of the available land, owned by the Department of Education (DoE). The DoE land is zoned for residential uses, but if it were fully developed for residential use, this may bring receptors closer to the co-op which may adversely impact on the ability of the Co-op to operate efficiently.

Figure 4-5 shows the existing odour contour extending to sensitive receptors (i.e. the nominal 2 OU odour contour line corresponding with the current edge of the residential areas in Casino). The Co-op would generally be expected to apply best practice controls with the aim of minimising odour above 2OU outside of this contour line as far as is practicable. Hence the line represents the nominal extent of the existing buffer as shaped by the prevailing winds, topography etc.

The nominal 2OU contour line thus serves to delineate the area within which no new residential or other sensitive development should be permitted, as this would directly compromise the capacity of the Co-op to continue to operate adequately.

Presently there are no sensitive receptors within this contour line, and that situation needs to be maintained in the future as a minimum.

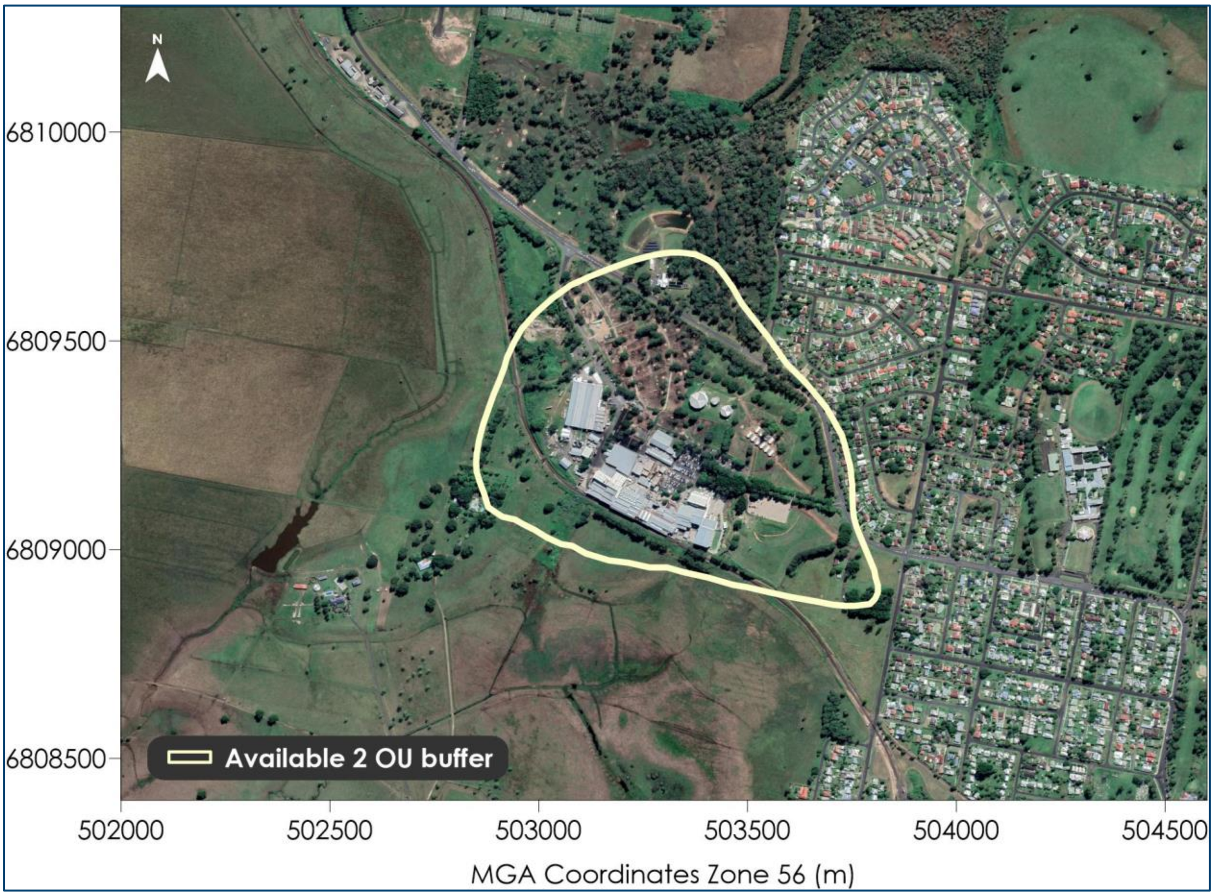

Figure 4-5: Co-op guideline buffer area and available existing buffer area

4.3 Cassino Drive industrial area interface

The industrial buildings in the south-west of the existing Cassino Drive Industrial Estate are separated by a narrow drainage easement from established residences to the west. The industries in this area include Timber Truss manufacturing, Storage, a recycling/ scrap metal facility, warehouses, motor vehicle mechanical workshops, towing business, and panel beating/ restoration. Most of the industrial uses are daytime only activities (except towing) and this leads to low scope for adverse noise impact. Some of the industries have potential for air quality emissions in the form of dust, VOC's and odours.

In general, the existing situation is considered low to medium risk of any impacts. Modelling this existing situation using generalised conservative values to represent potential emissions (if more polluting or night-time operations are permitted) is likely to show a higher risk for potential impact that at present. Thus, due to their proximity, impacts can arise in future if the uses are not adequately managed.

The interface zone is currently managed by Council via a subdivision plan and 88B instrument which creates a covenant on the land title regarding maintaining noise attenuation measures.

This should be considered in developing any planning controls that could be applied to industrial uses near the residential interface, as shown in **Figure 4-6**. In general, it is preferable that high amenity, daytime only industries be considered for the interface area. Ideally, limited noise generating industries, i.e. with generally daytime activity would be best suited to locations in approximately the southern half of the existing industrial area shown in the figure.

The modelling in this report has assumed that the southern part of the vacant land to the west of the Cassino Drive industrial estate will be developed for higher amenity uses, to minimise impacts on the adjoining residential development to the south.

Figure 4-6: Existing industrial area and interface

5 ALLOCATIONS FOR AIR, ODOUR AND NOISE

The aim of this report is to inform the preparation of a strategic Master Plan for the RJP. This is achieved by determining the appropriate level of industrial activity in different parts of the RJP, having regard to site specific variables such as location, topography, and sensitive receptors. This is a strategic analysis and that detailed assessment of the actual proposed uses and associated air and noise mitigation measures will be required to accurately assess levels of risk.

Planning considerations to minimise or control land use conflicts for air, odour and noise are set out in this section.

The approach provides numerical criteria applicable to the land as a means of assessing the relative risks and for optimally shaping the potential interface between different zones to minimise landuse conflicts. This is only possible for noise and odour given that there is a limiting criterion for an emission noise or odour, noting that odour sources are represented in this study with area and volume sources, (i.e. fugitive emissions). For air pollutants however there are many criteria for many different pollutants which apply at various locations and averaging periods (and also many and varied pollution control options and configurations). As such, only general preferences or guidance can be provided for air emissions released from point sources such as stacks.

The key consideration in making the assessment is that there are no sensitive receptors within the precinct boundary. It is assumed that appropriate planning measures will be put in place to ensure that there are no sensitive receptors within the sensitive receptor boundary in this report and that the use of existing dwellings within the RJP boundary will be resolved in conjunction with staged development of the RJP, as considered in the RJP Structure Plan.

The objective of the modelling and assessment task is to define the maximum extent of emissions from within the industrial area that do not cause impacts, in this case both outside of the precinct boundary (blue line) and also outside of the receptor boundary area (white line in the figures in **Section 3.6**). The corresponding noise and odour emissions from any part of the industrial area are also identified to provide scope to better allocate any sub zones within the industrial area.

For air however, only general good practice guidance can be provided.

5.1 Noise

Figure 5-1 shows the results for noise. The left hand side of the figure shows sound power levels as 2dB contour lines up to 100dbA/ha and 1db thereafter within the RJP investigation area. The right hand side shows the noise level outside of the RJP investigation area.

The contour lines within the industrial area represent the maximum attenuated sound power level per hectare (i.e., noise that can leave the site, per hectare).

The following formula can be used to convert the contour line value crossing the middle of a specific lot into that lot's permitted sound power level based on the lot size. Per the formula, bigger lots get more sound power, smaller lots get less.

Equation 1: $PWL(lot) = PWL(ha) + 10\log(A/10{,}000)$, where:

PWL(lot)	= Allowed attenuated sound power level per lot, dB(A)
PWL(ha)	= Sound power level of contour line crossing middle of the lot (OK to use a decimal if between lines);
A	= Lot area in square metres

Upon subdivision, and where there is funding to maintain a centralised regulatory oversight authority (as may not be the case here) this sound power (PWL(lot)) can potentially be set as a property right for the lot, perhaps as part of a Section 10.7 Notice attached to the property, and/ or as part of the total tally of lot sound power within a database or electronic register/ tool for managing the approval of developments in the industrial area.

From a regulatory view point, measuring PWL(lot) at the site is more swift, direct and reliable than measuring the intrusive noise level at receivers, especially for a lot within a large industrial area where it can be very hard to determine which source/ lot/ operation is causing the actual industrial noise at the receiver.

From an application/ assessments/ approval point of view, this pre-set allowance for the lot's sound power level reduces the work a noise consultant may need to do, saving time and money. It may prompt some operators to design the plant to pollute up to the limit so to speak. However, in this approach the PWL(lot) is easily measurable and so potential transgressions can be swiftly and efficiently regulated.

Should a lot be found to exceed its allocation, the degree of sound abatement needed would immediately be known, and the normal (existing) process to ameliorate the noise can commence immediately (and be validated more swiftly and cheaply). In this regard, the approach provides scope for a potential future noise trading scheme or noise management precinct, which can minimise noise abatement costs. For example, rather than paying to further abate noise from its activity, the lot owner may be able to acquire some or all of the unused noise allocation from another lot. Whilst this is not proposed here, it is something that can potentially be set up if desired at a later time. It is noted that for scheduled activities and the application of an alternate assessment approach would require further consultation and engagement with the EPA.

The right hand side of **Figure 5-1** shows the sound pressure levels outside of the RJP investigation area.

As per the Noise Policy for Industry (**NSW EPA, 2017**), the limiting criterion is the amenity criterion of 40dB(A) which is a 9-hour average noise level over the night time period (10pm to 7am) and applies to the cumulative noise of all industrial noise sources, whereas the intrusive criteria is 35dB(A) and applies to each individual site. As the noise sources in the industrial area will be a mix of constant sources (e.g., fan or transformer which is always on) and intermittently noisy sources such as vehicles and mobile plant, and other batch activities, many sources will only make noise intermittently over the 9 hours of night time. Therefore, the measured cumulative 9-hour noise level will be less than the maximum measured 15-minute level (from all sources) in that same 9-hour period.

The sound power limits above correspond with all lots operating at the individual intrusive noise limit for each lot which is set at 35dB, LAeq(15min) to protect the amenity of the nearest receptor outside of the sensitive receptor boundary, and both limits are commensurate with the industrial area meeting the cumulative noise amenity level of 40dB, LAeq(9hr).

The pink line in **Figure 5-1** represents the required buffer area which is both the 35dB, LAeq(15min) individual site intrusive criteria compliance boundary line (or the location of the nearest sensitive receptors at which the intrusive criteria apply) and also the cumulative noise amenity level extent for 40dB, LAeq(9hr).

The land within the pink buffer line is not suitable for residential use. It is recommended that suitable strategies to prevent any new residential use and ideally to also progressively reduce any existing residential use in the buffer area over time should be developed. Less restrictions on residential development leads directly to more restrictions on industrial uses and capacity to operate (and vis-à-vis).

The data indicates that all likely industrial noise sources can fit within the specified sound power level allowances in the industrial area, noting the constraint risks the scenario has highlighted.

5.2 Noise mitigation options

As for any operation in NSW, as a minimum, general or commonly used noise mitigation is expected for industries in the industrial area that have potential to release noise emissions.

The RJP investigation area and buffer is designed such that industries incorporating general levels of control should be able to operate within the industrial precinct without causing impacts. But there are limitations, for example a facility that would have high levels of noise emissions may need to have extra noise mitigation if it chooses to locate close to the edge of the estate near receptors. Such a location is better suited to an operation which has noise emissions within the specified allowance as it is unlikely to need extra abatement.

The left hand side of **Figure 5-1** provides an allowance per hectare for potential noise emissions. This can be used as part of the approvals process, where a proposed development with less emissions per hectare than the allowance for the proposed lot would be suitable. The figure also serves to help potential new industries to identify the more suitable lots where, depending on their emissions, the facility can reasonably expect to be able to operate without causing impacts (outside of the precinct boundary) or to require extra noise controls.

General mitigation options for industries to manage noise emissions would vary depending on the nature of the source and the effectiveness of potential mitigation options need to be considered in each case. Some examples of general noise mitigation measures include:

- Mitigation at the source;
  - Selection of equipment – select equipment with low sound power levels when purchasing new equipment or substituting equipment.
  - Modifying equipment – silencers, mufflers and dampeners may be retrofitted to existing equipment to reduce noise emissions.
  - Operational time – consider adjusting operating times for when equipment is in use.
  - Implementing quiet work practices – using equipment in ways to minimise noise, this includes reducing throttle setting and turning off equipment when not being used.
  - Maintain equipment – regularly inspect and maintain equipment to ensure it is in good working order.
  - Limit equipment use – reduce the amount of equipment operating simultaneously, avoid clustering of equipment.
- Mitigation along the path between source and receiver;
  - Barriers – construct barriers between source and receiver.
  - Direction – orient noise emissions away from receiver.
  - Distance – provide as much distance as possible between source and receiver.
- Mitigation at the receiver;

- Barriers – construct barriers at the receiver.
- Architectural treatments – treatment options will vary depending on the level of noise at the receiver.

As outlined in the previous section, a noise management precinct can be developed if desired in future.

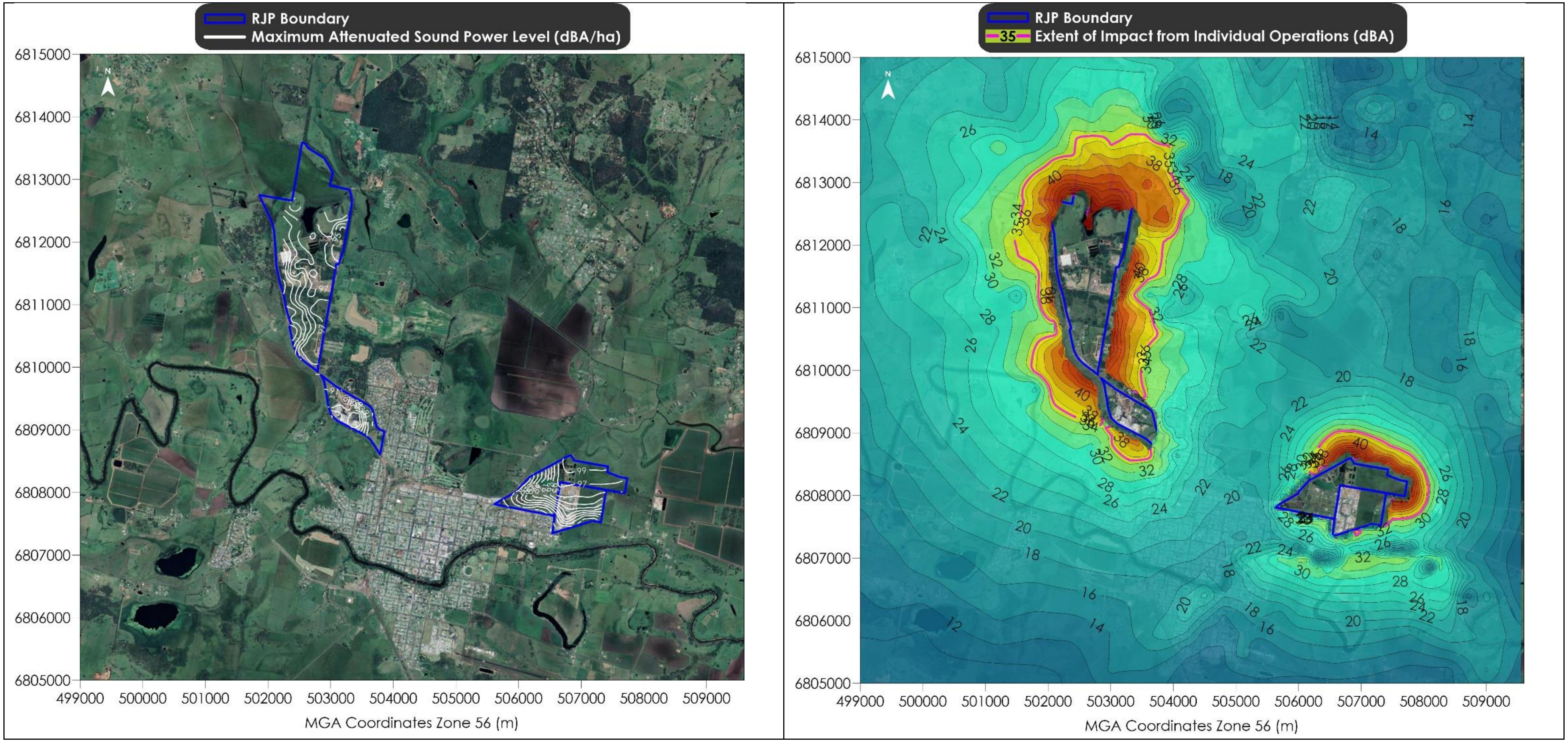

Figure 5-1: Source sound power level per Ha (left) and received sound pressure level (right) due to noise emissions from the RJP investigation area

5.3 Odour

As per the NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (**2016**) the most stringent 2 Odour Unit (OU) NSW criteria applicable to densely populated urban areas has been applied. A level of 1 OU can be described as the concentration of an odour at which it is detected.

The NSW odour goals are based on the risk of odour impact within the general population of a given area. Thus, in sparsely populated areas the criteria assume there is a lower risk that some individuals within the community would find the odour unacceptable, hence higher criteria apply. An odour criterion of 2 OU is used in this study at the assessed sensitive receptors.

Figure 5-2 presents the results for odour. The left hand side of the figure shows the odour emission rate per hectare for sources of odour in the RJP investigation area and the right hand side shows the recieved odour level outside of the RJP investigation area.

Referring to the left side of **Figure 5-2**, the contour lines within the RJP investigation area represent the maximum attenuated odour emission rate (OU.m^3/s/ha) (i.e., rate of release of odour that can leave the site, per second per hectare). The maximum attenuated odour emission rate for an industry can be estimated from odour measurements taken at the source of an existing/ similar facility and from odour measurements presented in available literature studies. This converts linearly to any lot's odour emission allowance. For example, if the lot is half a hectare, it can emit odour at half the rate of the contour line level passing through the middle of the lot. If the lot area is two hectares, it can emit double the contour line level.

Like noise, this odour emission rate allowance can potentially be set as a property right for the lot, perhaps as part of any Section 10.7 Notice attached to the property. Referring to the right side of **Figure 5-2**, the pink line represents the 2 OU criteria boundary line. This is the area outside of which any receptors/sensitive receivers would not experience unacceptable odour levels above the criteria.

Also, like noise, should a lot be found to exceed its allocation, the degree of odour abatement needed would immediately be known and the normal (existing) process to ameliorate the odour can commence immediately (and be validated more swiftly and cheaply than via a process of measuring odour at the receiver can achieve). In this regard, the approach provides scope for a potential future odour trading scheme, which can minimise abatement costs. For example, rather than paying to further abate odour from its activity, the lot owner may be able to acquire some or all of the unused odour allocation from another lot. Whilst this is not proposed here, it is something that can potentially be set up if desired at a later time. It is noted that for scheduled activities and the application of an alternate assessment approach would require further consultation and engagement with the EPA.

5.4 Odour mitigation options

As for any operation in NSW, as a minimum, general or commonly used pollution controls are expected for industries in the industrial area which have potential to release air emissions.

The RJP investigation area and buffer is designed such that industries incorporating general levels of control should be able to operate within the industrial precinct without causing impacts. However, there are limitations, for example a facility that would have high levels of odour emissions may need to have extra odour mitigation if it chooses to locate close to the edge of the estate near receptors. Such a location is better suited to an operation which has odour emissions within the specified allowance as it is unlikely to need extra abatement.

The left hand side of **Figure 5-2** provides an allowance per hectare for potential odour emissions. This can be used as part of the approvals process where a proposed development with less emissions per hectare than the allowance for the proposed lot would be suitable. The figure also serves to help potential new industries to identify the more suitable lots where, depending on their emissions, the facility can reasonably expect to be able to operate without causing impacts (outside of the precinct boundary) or to require extra pollution controls.

General mitigation options for industries to manage odour emissions would vary depending on the nature of the source, and the effectiveness of potential mitigation options need to be considered in each case. Some examples of general odour mitigation options include:

- Mitigation at the source;
  - Handling of malodourous material within enclosed building or within a closed system. Aim to minimise exposure of material and prevent odour emissions into the environment.
  - Capture and ventilation of odour emissions at the source (e.g., hooding and extraction, negative pressure enclosures, etc.).
  - Exhaust odour emissions via a stack to allow for adequate dispersion.
  - Treatment of odour emissions before release (e.g., biofilter, carbon filter, thermal oxidiser, ozone reactors, etc.).
  - Regular cleaning of work space, clean up any spills.
  - Routine preventative maintenance on equipment.
  - Regular inspection of work place areas to identify odour.
  - Build continuous dense landscaping (bunds and vegetation) along odour source boundaries to assist in odour dispersion from the odour source. Provide guidance and training to on-site personnel to assist in identification of problematic odour sources at the site and taking proactive action.
  - Position the most odorous sources as far away as possible from receivers (the odour allowance will be higher there also).
  - Establish incident or complaint management system to assist with identifying odour sources and take preventative measures.
- Mitigation at the receiver may only provide small benefits but is appropriate for new dwellings outside of the receptor boundary;
  - Orientate buildings to provide adequate air flow around the building and design buildings to encourage air flow in a particular direction. This can be aided by block size and shapes and understanding of prevailing wind flows. Avoid construction of dead end courtyards or

long narrow spaces perpendicular to the prevailing winds where air can lay dormant and stagnate.

- Design buildings so living spaces do not face odorous sources and position any air conditioning and ventilation intakes away from the odour source.
- Consider site orientation and street frontages for existing residential subdivisions.

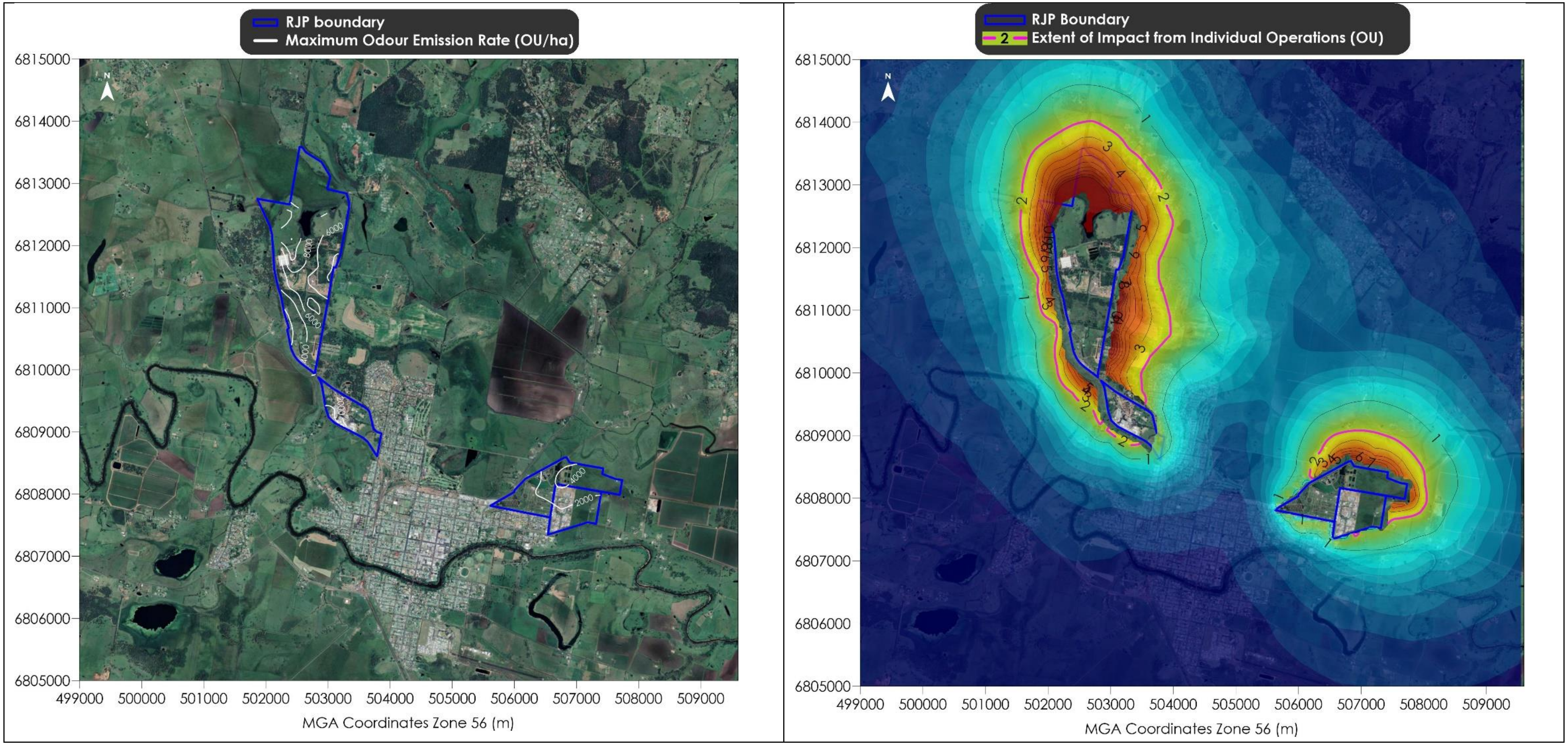

Figure 5-2: Source odour emissions rate per Ha (left) and received odour (right) due to odour emissions from the RJP investigation area

5.5 Air

For air emissions, it is not possible to ascribe a maximum quantity of emissions per hectare, given that there may be hundereds of different types of air emissions each with differing criteria averaging periods or locations for compliance.

For air, the approach taken is to accept that all air toxic emissions must be minimised to the maximum practicable extent, as set out in Section 7.2.1 of the NSW EPA Approved Methods (**2016**). Previous work identified that for fugitive air emissions, odour is the most limiting emission affecting potential compliance. As fugitive emissions will arise from area or volume sources, their zone of potential impact is considered as part of the odour assessment. Thus stack emissions are considered in more detail here.

Stacks have the potential to cause most impact at locations where the dispelled plume may reach the ground. For stacks, this is most likely to arise in elevated locations in the surrounding terrain but may also occur nearby due to plume down wash effects. The earlier work has shown, it is prefereable to locate stacks in more elevated areas. This however is not mandatory to impose thisas it is feasible for an applicant to simply specify a taller, higher velocity or higher temperature stack that has better dispersion and can perform equally well in a low lying area than a less highly performing stack in an elevated area.

Figure 5-3 shows the results for a generic source of air emissions represented by a typical industrial boiler stack. The figure shows no constraints beyond those for noise and odour.

The left side of **Figure 5-3** shows the concentration of NO_X emissions within the RJP investigation area which can be emitted from the stack (mg/m^3) that would meet an NO_2 concentration at receivers of 95 µg/m^3, which when combined with an assumed background level of 85 µg/m^3 at 100% conversion of NO_x to NO_2, is well below the NSW EPA impact assessment criteiron for 1-hour averge NO_2 and a little above the proposed new NEPM limit for 1-hour averge NO_2. This concentration is also shown in the left hand side of the figure as the pink buffer line.

Note that there are two equally applicable limits/ criteria for a stack; the emissions concentration limits which apply to emissions in the stack (as set out in the POEO Clean Air Regulation); and, the ambient or ground level concentration limits which apply at a receptor (as set out in (**EPA, 2016**)). Hence where the level shown in the industrial area is greater than POEO Regulation limit for a stack, this means more emissions than are lawful for the stack would need to be emitted in order to exceed the criteria at a receptor. It does not mean that more than the lawful level of stack emissions are proposed in this industrial area.

The right hand side of **Figure 5-3** shows generalised guidance for locating industries with stacks. The general preferences shown cannot be used in planning documents other than for general guidance. The figures aim to assist applicants to identify locations within the industrial area where installing a stack will be less costly (preferrred locations) and also guide approval bodies as to the level of scrutiny warranted for applications with a stack. For example a stack with higher specifications may be needed in the zone between the "preferred" and "no stacks preferred" for stacks and a higher level of regulatory scrutiny would be needed for approval of stack applications in the "no stacks preferred" areas.

5.6 Air mitigation options

As for any operation in NSW, as a minimum, general or commonly used pollution controls and mitigation is expected for industries in the industrial area which have potential to release air emissions.

The RJP investigation area and buffer is designed such that industries incorporating general levels of control should be able to operate within the industrial area without causing impacts. But there are limitations, for example a facility that would have high levels of air emissions may need to have extra pollution controls if it chooses to locate close to the edge of the estate near receptors. Such a location is better suited to an operation that does not require a stack to manage pollution.

The right hand side of **Figure 5-3** provides a guide for new industries to help identify the more suitable lots where, depending on the type of industry and emissions, the facility can reasonably expect to be able to operate without causing impacts (outside of the precinct boundary) or requiring extra pollution controls.

Specific stack parameters will be tailored to the requirements of the industry it services and should be designed with consideration of good engineering practice.

General mitigation options for industries to manage air emissions from stacks include:

- Mitigation at the source;
- Increase stack height to allow for additional dilution.
- Increase stack velocity to promote dispersion.
- Increase stack temperature to promote dispersion of exhaust gases.
- Treatment of air emissions before release (e.g., carbon filter, thermal oxidiser, Bag filter etc.).
- Maintain equipment – regularly inspect and maintain equipment to ensure it is in good working order.

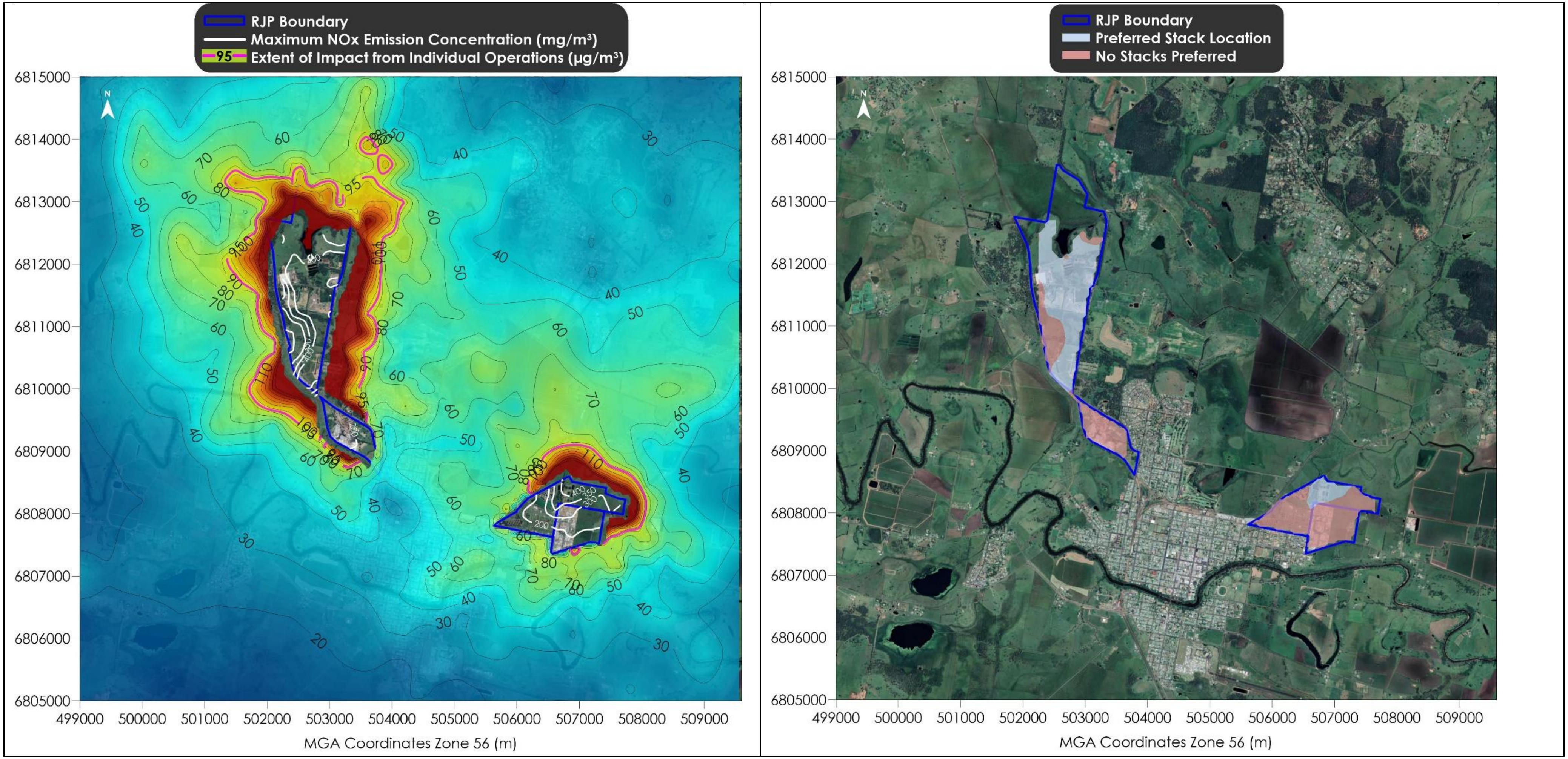

Figure 5-3: Example of Air emissions rate per stack and received air pollutant concentrations due to NO_x emissions from the RJP investigation area (left) and generalised guidance for locating industries with stacks within the RJP investigation area (right)

6 CONCLUSIONS AND RECOMMENDATIONS

The modelling indicates that the general Master Plan layout is relatively well suited to the situation, however there are existing constraints around the northeastern and western sections of the Nammoona Industrial Precinct, the Casino Food Co-op and surrounds precinct, and also the Johnston Street Industrial area and surrounds precinct.

The areas of higher likelihood of elevated levels at full industrial capacity are shown in **Figure 4-1** and **Figure 4-2**, both internally and externally to the RJP investigation area. These figures identify the areas within the RJP investigation area where there would need to be relatively strict controls on air, odour or noise emissions from industry, and where (without such mitigation) there may be impacts at receptor areas outside of the RJP. The assessment assumes the industrial areas have been fully developed and that there is residential use up to the boundary (or the white residential land use line)

The figures in **Section 5** quantify the degree of mitigation needed with in the RJP investigation area, or in other words the emissions per unit of land that may potentially be emitted without causing impacts outside of the pink criteria line (noting that presently there are some sensitive receptors within the pink line. It is assumed in this report that appropriate planning measures will be put in place to ensure that there are no sensitive receptors within the pink line for the development of the RJP). These figures are useful to evaluate the likely buffer around the RJP needed to prevent land use conflicts if fully developing the RJP (i.e., the pink line). They also assist to identify the relative scale of potential emissions from any part of the RJP area; these are the white lines, or the preferred stack zones.

The white lines within the RJP area can be used to identify the parts of the RJP where the greatest emissions may be released without impact, and these are relatively similar for odour and noise. But for stack sources the location most favourable for emissions is more centrally located within the RJP (away from receptors and nearby elevated terrain). Overall, the results show large areas land which is suitable for industrial use, and importantly this covers most of the existing industries (but not all, see further below).

It is important to note that the modelling assumes the criteria are to be met at all sensitive receptors, (i.e., the pink criteria line is always adjacent to any potentially impacted existing or likely future receptor). In some cases it may not be feasible to meet criteria at the existing receptor. For example, by looking at the red areas inside the RJP per the figures in **Section 3.8** or the relative emissions values per the white lines within the RJP area on the figures in **Section 5**, we can see that the results are heavily influenced by the close proximity of a limited number of receptors.

Adding new receptors within the pink criteria line shown in the figures would further limit the capacity of industry to operate in the RJP (or conversely put receptors in area of potential impact from industry).

When considering these results and also the specific assessment of existing industries, the following planning considerations can minimise the potential for future air noise and odour impacts;

1. Zoning the central core of Nammoona for low amenity uses (higher emissions of air, odour and noise), rather than having such uses in the west, east or southernmost parts.

2. Minimise residential encroachment within the pink line (see also **Section 4.1** to **4.3**).

3. Seek daytime only uses in the southern half of the Cassino Drive industrial area, and the industrial land within 250m of the residential areas. (see **Section 4.3**).

7 REFERENCES

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Appendix A
Selection of meteorological year

Selection of meteorological year

A statistical analysis of the latest six contiguous years of meteorological data from the nearest BoM weather station with suitable available data, Casino Airport AWS weather station, is presented in **Table A-1**.

The standard deviation of the latest six years of meteorological data spanning 2015 to 2020 was analysed against the available measured wind speed, temperature and relative humidity. The analysis indicates that the 2015 and 2016 dataset are the closest for wind speed, 2015 and 2020 are the closest to the long term for temperature and 2015 the closest for relative humidity. On the basis of a score weighting analysis, 2015 was found to be most representative.

Table A-1: Statistical analysis results for Casino Airport AWS

Year	Wind speed	Temperature	Relative humidity	Score
2015	0.2	0.8	2.6	3.9
2016	0.2	1.0	4.9	6.3
2017	0.3	1.0	5.2	6.7
2018	0.3	0.9	5.3	6.8
2019	0.4	1.3	6.9	8.9
2020	0.3	0.8	3.9	5.3

Figure A-1 shows the frequency distributions for wind speed, wind direction, temperature and relative humidity for the 2015 year compared with the mean of the 2015 to 2020 data set. The 2015 year data appear to be reasonably well aligned with the mean data.

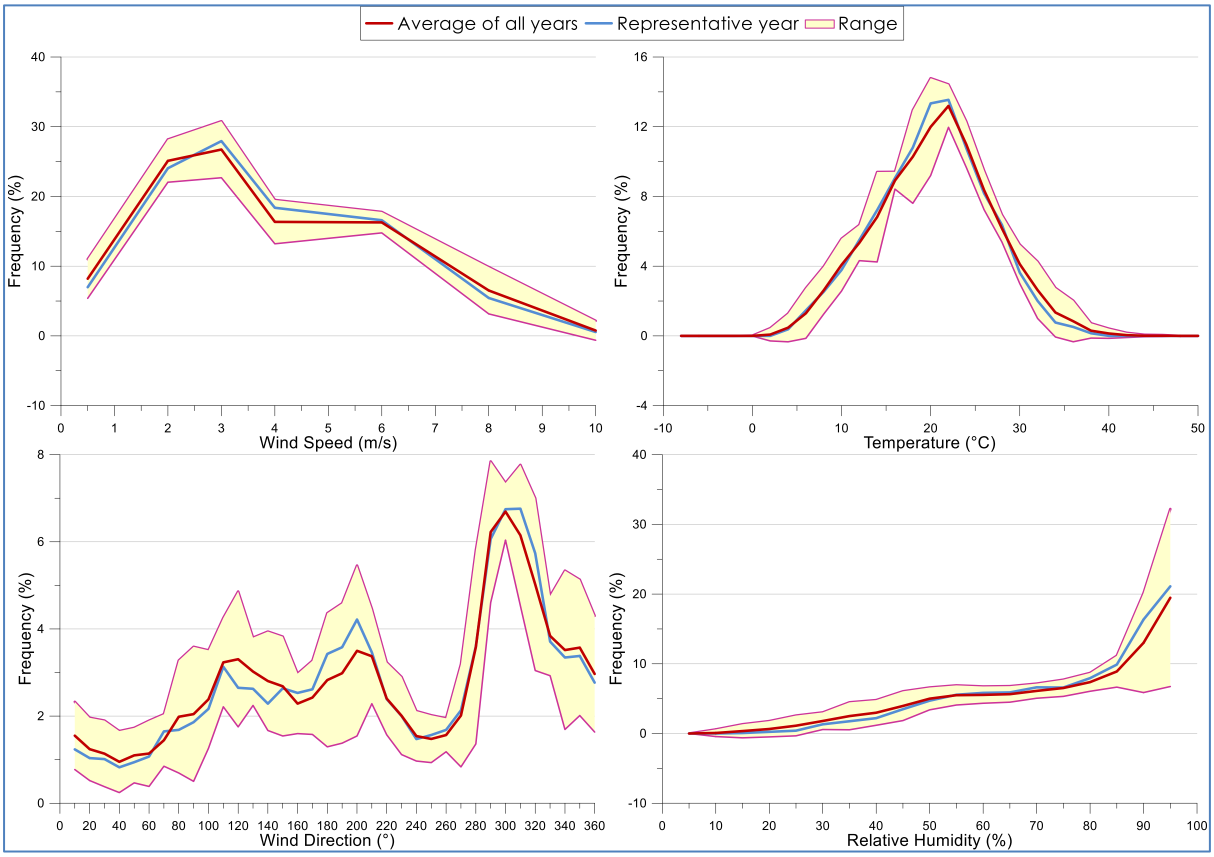

Figure A-1: Frequency distributions for wind speed, wind direction, temperature and relative humidity