Appendix C - Air Quality Impact Assessment

Townsville City Council

Infrastructure, Traffic, Transport & Air Quality

Air Quality Impact Assessment

May 2019

Table of contents

Table index

Figure index

1. Introduction

1.1 Context

GHD Pty Ltd (GHD) was engaged by Townsville City Council (TCC) to undertake an Air Quality Impact Assessment (AQIA) for the Lansdown Planning Scheme Major Amendment (PSMA) in relation to the Lansdown Station site (herein after 'the site') located on the Flinders Highway at 132 Bidwilli Road, Calcium.

The site is currently used for rural pursuits, however, TCC is now considering a major amendment to the Townsville City Plan to remove the land identified as Lansdown Station from Rural zone and include the site within both the Medium and High impact industry zones.

In addition to the AQIA, baseline monitoring of air quality, noise and vibration was carried out at the subject site. The aim of the air, noise and vibration monitoring was to obtain a better understanding of the existing environmental conditions at the site. The results of the baseline monitoring was presented in the GHD 2019, Air, noise and vibration baseline monitoring report (GHD 2019).

The AQIA consists of a buffer assessment, the purpose of which is to provide sufficient separation between sensitive land uses (such as residences) and industries that have the potential to generate emissions so that on the occasion of an upset or malfunction, the off-site disamenity is minimised.

This report utilises Ranbury 2017, *Lansdown Opportunities Assessment Masterplan and Infrastructure Strategy* (Ranbury 2017) which outlines a number of existing, proposed and suggested/potential industries that may be suitable within the site.

1.2 Purpose of this report

The purpose of this assessment is to identify and report on potential buffers and emissions arising from existing, proposed and suggested industries located within the site, based on national guidance and guidance from individual states/territories within Australia. An assessment of local meteorology will also be undertaken to understand the directions of good and poor dispersion and will form the basis of a directional buffer'. GHD will then provide key recommendations for the PSMA to assist in land use allocation.

This report is subject to, and must be read in conjunction with the limitations presented in Section 1.3 and the exclusions, assumptions and qualifications contained throughout the report.

1.3 Limitations

This report has been prepared by GHD for Townsville City Council and may only be used and relied on by Townsville City Council for the purpose agreed between GHD and the Townsville City Council as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Townsville City Council 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 section 1.5 of this report and throughout this report. GHD disclaims liability arising from any of the assumptions being incorrect. The results of the analysis presented in this report are also subject to any limitations of the AERMOD modelling software package.

GHD has prepared this report on the basis of information provided by Townsville City Council 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 in part on an onsite inspection undertaken by GHD in September 2018. Note that it is the nature of environmental assessment that all variation in environmental conditions as well as the existing facility's operating conditions cannot be assessed and all uncertainty concerning the conditions of the ambient air quality environment cannot be eliminated. 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. Site conditions (including the presence of hazardous substances and/or site contamination, dust, odour, and/or noise sources) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

1.4 Scope of works

The scope of works for the AQIA was as follows:

- Identify the relevant industrial uses based on information provided to GHD by TCC.
- Determine the relevant separation distances (buffer) associated with the existing and proposed industries based on national guidance and guidance from individual states/territories within Australia
- Investigate meteorological conditions of the site
- Identification of the types of emissions associated with the proposed industry and qualification of the risk to air quality being impacted due to the nature of emissions from the individual sources.
- Use the meteorological data and dispersion modelling to develop a directional buffer to better understand the directions of good and poor dispersion.
- Recommend strategies to reduce risk that future development on land parcels that adjoin with the Lansdown Station site are not located in an area that may put future industrial activities at risk. Discussion of mitigation measures to reduce the risk including identification of areas requiring different levels of engineering controls. .

1.5 Assumptions

The following assumptions were made during the preparation of this report:

- The prognostic generated meteorological data is representative of the subject site.
- Information surrounding the operations and throughput of surrounding industries are from documents/reports provided to GHD and have been assumed to provide accurate information surrounding the existing, proposed and suggested industries located within the site.
- At the time of writing this report, limited information surrounding many of the industries was available. Where necessary, GHD has made conservative assumptions with regards to potential emissions, size, throughput and operations of some industries. Assumptions made about each particular industry are outlined in Section 4 and throughout the document.

2. Project description

2.1 Site location

Lansdown Station is located in Calcium, Queensland on Flinders Highway at 132 Bidwilli Road, Calcium. The subject site is surrounded by mainly rural zoned land to the south, north and west and is bounded by Flinders Highway to the East. The site also adjoins the Calcium Quarry to the southwest.

The Lansdown Planning Scheme Major Amendment (PSMA) will involve the currently rural zoned land as per the current Townsville City Council Planning Scheme, forming the Woodstock Industrial Precinct. The extent of the proposed Woodstock Industrial Precinct is shown in Figure 1.

2.2 Sensitive receptors

The Queensland Government Department of Environment and Science (DES)[1] defines a sensitive receptor/sensitive place as a 'dwelling, library, childcare centre, medical centre, or a public park' in which companies are required to 'not cause [offsite] environmental nuisance from dust, odour, light or smoke at.'

For the purpose of this report, the following sensitive receptors have been identified around the site, as outlined in Table 1 and shown in Figure 1. The nearest current sensitive land uses in relation to the site are residences located to the east and east-southeast of the site, along Flinders Highway.

Table 1 Identified sensitive receptors

ID	Easting	Northing	Approx. distance to site boundary	Description/Comment
R1	480222.56 E	7824552.78 S	1,580 m	Appears residential (1)
R2	480820.65 E	7824291.09 S	1,460 m	Appears residential (1)
R3	481643.12 E	7824380.90 S	1,280 m	Appears residential (1)
R4	483028.92 E	7824247.76 S	1,900 m	Appears residential (2)
R5	483530.01 E	7824666.29 S	1,930 m	Appears residential (2)
R6	482414.78 E	7826346.90 S	35 m	Appears residential (2)
R7	482794.61 E	7826382.16 S	240 m	CSRIO Lansdown Pasture Research Station
R8 (3)	483114.58 E	7827121.09 S	540 m	Residential – Refer to Note 3
R9 (3)	482940.40 E	7827195.82 S	340 m	Residential – Refer to Note 3
R10	483349.01 E	7827270.40 S	740 m	Appears residential (2)
R11	482875.85 E	7827648.21 S	240 m	Appears residential (2)
R12	483515.92 E	7827880.61 S	840 m	Appears residential (2)
R13	483356.29 E	7828271.39 S	650 m	Appears residential (2)
R14	483157.63 E	7828905.16 S	450 m	Appears residential (2)

[1] https://www.ehp.qld.gov.au/management/non-mining/noise-light-odour.html

ID	Easting	Northing	Approx. distance to site boundary	Description/Comment
R15	483188.24	7829033.78	480 m	Appears residential (2)
R16	483151.81	7829531.11	470 m	Appears residential (2)
R17	483178.57	7830464.13	480 m	Appears residential (2)
R18	483142.20	7830988.53	450 m	Appears residential (2)
R19	483777.15	7831739.97	1,070 m	Appears residential (1)
R20	482952.14	7832586.95	840 m	Mixed use with potential dwelling (4)
R21	482307.60	7832380.53	560 m	Appears residential (2)
R22	481136.00	7833025.92	1,140 m	Appears residential (1)
R23	477975.08	7834008.29	2,910 m	Appears residential (2)
R24	477059.58	7834293.92	4,000 m	Appears residential (2)
R25	476813.58	7834063.60	3,910 m	Appears residential (1)
R26	476941.78	7832011.56	1,870 m	Appears residential (1)

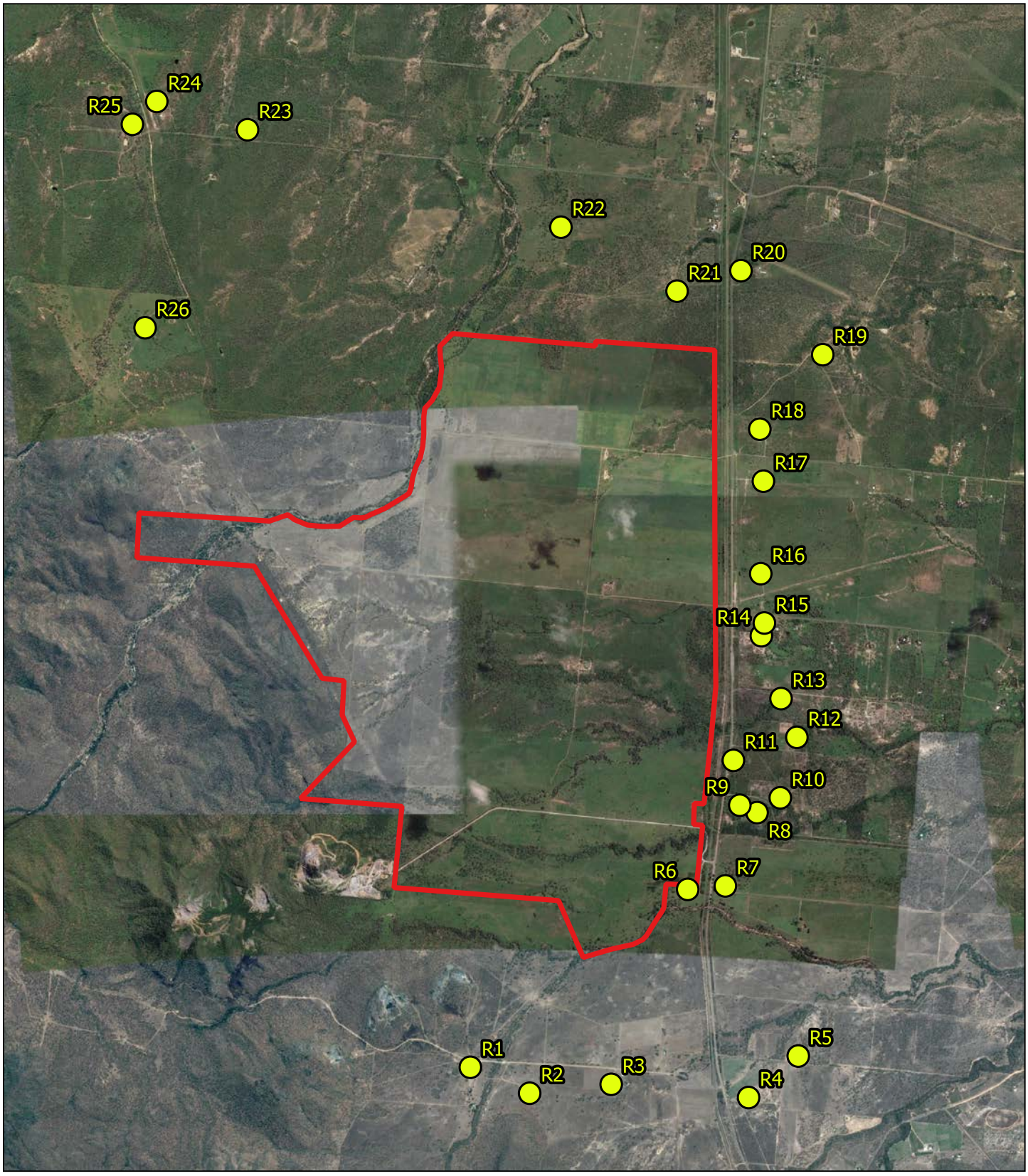
Notes:

(1) Land identified in the Townsville City Plan with Property Code Description of *Rural - Cattle Grazing (Breeding & Fattening)*.

(2) Land identified in the Townsville City Plan with Property Code Description of *Residential – Single Unit Dwelling*.

(3) R8 and R9 are located on the same land identified in the Townsville City Plan as *Property 361871* and described as *22 Skydiver Road, Woodstock* with Property Code Description of *Residential – Single Dwelling*. From aerial imagery it is not clear which of the R9 or R10 is the single dwelling and hence both are shown here as sensitive receivers.

(4) The land is known as Donnington Airpark, also known as Townsville Satellite General Aviation Airport, a privately owned airfield. The Land is identified in the Townsville City Plan with Property Code Description of *Showgrounds Racecourses Airfields*. From aerial imagery and information available it appears that it also includes a residential dwelling at the front.



LEGEND

Site area

Sensitive receptors

Paper Size ISO A4

0 400 800 1200 m

N

Map Projection: Mercator Auxillary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxillary Sphere

GHD

Townsville City Council
Infrastructure, Traffic, Transport & Air Quality
Air, noise and vibration baseline monitoring

Site location and identified sensitive receivers

Project No. **42-20641**
Revision No. **A**
Date. **14/1/2019**

FIGURE 1

Document Path: \\ghdnet\ghd\AU\Townsville\Projects\42\20641\GIS\Maps\Working\Sensitive receptors.qgz

Data Source: Google Earth Imagery 2018. Created By: SM

3. Industry identification

A review of the information provided by TCC to GHD was conducted to inform the likely industries located within and surrounding the subject site. This report utilises Ranbury 2017, *Lansdown Opportunities Assessment Masterplan and Infrastructure Strategy* (Ranbury 2017) which outlines a number of existing, proposed and suggested/potential industries, in conjunction with other relevant documents provided to GHD.

Various existing and proposed premises with the potential to attract a buffer were identified in the documents and are listed in Table 2. For each identified industry, Table 2 shows the company, type of operation, any relevant information and primary concern.

Ranbury 2017 also outlines a number of suggested/potential industries that may be suitable within the subject site. The suggested industries with the potential to attract a buffer are listed below and have also been included in this assessment, as follows:

- Food and drink outlet
- Abattoir
- Asphalt plant
- Concrete batching plant
- Boilermaker
- Metal foundry
- Piggery
- Poultry production (meat)
- Egg production
- Waste incineration
- Manufacturing and/or storing explosives
- Mineral processing
- Oil refinery
- Rendering plant
- Transport depot
- Sewage/water treatment plant
- Agricultural product processing

.

Table 2 Identified industries

Company	Operations	Relevant information	Primary concern
Existing industry			
Hy-Tec/Adelaide Brighton	Quarry	The quarry is located adjacent to the south western corner of the Lansdown site. The site currently operates under the following permits: • EPPR03415815 • EPML00871413 Which allows for the extraction (including blasting), screening and processing of minerals. The quarry is licenced to extract and screen 100,000 to 1,000,000 tonnes per year and process 1,000 to 100,000 tonnes per year. The quarry provides raw materials to the Adelaide Brighton masonry operations in the Townsville area.	Dust
Donnington	Airstrip	Donnington airstrip is an unsealed airstrip located to the north east and in the vicinity of the Lansdown site. The airstrip is classified as an aeroplane landing area and is not considered a registered or certified airport.	Air quality
Sun Metals	Solar farm	A 125 MW solar farm.	N/A
Proposed industry			
Adani	Solar farm	A proposed 150 MW solar farm.	N/A
Davco	Abattoir and feedlot	A development application was submitted in regard to a feedlot and abattoir located on Dingo Park Rd (~15 km from the Flinders highway)	Odour
Not specified	Stockfeed pelletisation facility	A proposed facility located east of the Flinders Highway on Woodstock Giru Road	Dust, odour,
Drive it NQ	Motorsport and driver training facility	A development application was put forward to TCC on 10 May 2017. The activities anticipated at the site include: drag strip, speedway, race circuit, off road and rally circuits, go kart track	Dust

Company	Operations	Relevant information	Primary concern
Wellard Rural Exports	Integrated Live Export Facility (ILEF) (cattle)	A live cattle and export proposal has been put forward by Wellard. The ILEF proposes to have a total capacity of 20,000 head one-time holding capacity for pre-export. However, this one time holding capacity was normalised to a capacity of 5,000 Standard Cattle Units (SCU) given the short occupancy of the yardage, at the end of Stage 2. The ILEF will also hold some livestock for short feeding (~30 days); this will have an equivalent feedlot capacity of about 2,500 SCU at the end of Stage 2. Therefore the maximum total SCU has been assumed to be 7,500.	Odour
Anroca	Metal (nickel) processing	A proposed metal (i.e. nickel) processing facility.	Air quality
Not specified	Grain processor	A proposed grain storage and drying hub. The facility would have potential throughput of 20,000 to 30,000 tonnes per annum initially with ultimate forecast to 100,000 tonne per annum	Dust
Gumloo	Vegetable processors	Cold vegetable processing and storage.	Odour
Hughenden Beef	Beef freezer facility/cold storage	Frozen beef quarters storage and export.	N/A
Not specified	Prepared meal food processor	Preparation and export of meals.	Odour
Boston Energy and Innovation	Battery manufacture	Proposed 15 GWh battery manufacturing plant.	Air quality
Oz Cain	Biorenewable project	Biorenewable project located in lower Burdekin.	Air quality
NQ Bioenergy	Biorenewable project	-	Air quality
Renewable Developments Australia	Biorenewable project	-	Air quality
Agripower	Fertiliser manufacturing	-	Air quality
Lepidico	Lithium processing	-	Air quality

4. Default buffer assessment

4.1 Purpose

A buffer distance is a planning instrument used to provide separation of sensitive land uses (i.e. residential, schools, hospitals) from premises with the potential for off-site emissions that can cause disamenity in the event of an upset or malfunction. Under routine operations, any adverse impact is to be confined on-site so that an external buffer should not be required.

The purpose of the separation distance guidelines is to provide recommended minimum separation distances between industrial land uses with the potential for off-site emissions and sensitive land uses. Accordingly, the relevant uses for a buffer assessment involve the following:

- Provide clear direction on which land uses require separation.
- Inform and support strategic land use planning decisions.
- Prevent new sensitive land uses from impacting on existing industrial uses.
- Prevent new or expanded industrial land uses from impacting on existing sensitive land uses.
- Identify compatible land uses that can be established within a separation distance area.

Note that the terms ‘buffer distance’ and ‘separation distance’ have been used interchangeably in this report.

4.2 Relevant guidelines

4.2.1 Buffer guidelines

There are currently no buffer/separation distance guidelines in the context of planning in the state of Queensland. The most relevant separation distance guideline is incorporated in the Brisbane City Council planning scheme. However it is noted that this document does not provide specific separation distance values but instead provides distances based on industries categorised as high, medium or low risk. In order to conduct a more thorough buffer assessment, GHD has utilised the buffer distance guidance from other states/territories within Australia to recommend the appropriate buffer distance for the industries identified in Section 3. The following buffer guidance has been used:

- EPA Victoria, Recommended separation Guideline distances for industrial residual air emissions (2013) (Victorian guidelines)
- South Australia EPA, Evaluation distances for effective air quality and noise management (2016) (SA guidelines)
- Western Australia Environmental Protection Authority, Guidance for the Assessment of Environmental Factors - Separation Distances between Industrial and Sensitive Land Uses (2005) (WA guidelines)
- Australian Capital Territory Government, Separation Distance Guidelines for Air Emissions (2018) (ACT guidelines)

Where industry specific guidance exists (such as cattle feedlots), these guidelines have been applied in place of the above listed guidelines.

It is noted that the South Australian and Western Australian guidelines are applicable to air and noise impacts, whilst the distances in the Victorian and Australian Capital Territory guidelines apply to air emissions only (specifically odour and dust).

4.2.2 State Planning Policy (SPP 2017)

The State Planning Policy (SPP) expresses the state's interests in land use planning and development. The SPP has effect throughout Queensland and sits above regional plans and planning schemes in the hierarchy of planning instruments under the *Planning Act 2016*.

The SPP identifies state-wide planning matters requiring protection and enhancement and outlines seventeen state interests and relevant policies that must be appropriately integrated in the planning and development outcomes where relevant.

Of the seventeen state interests, "emissions and hazardous activities" is the only interest applicable to the environmental emissions including air and odour. This interest is discussed below.

Statement

"Community health and safety, and the natural and built environment, are protected from potential adverse impacts of emissions and hazardous activities. The operation of appropriately established industrial development, major infrastructure, and sport and recreation activities is ensured."

Relevance

Some activities have the potential to cause nuisance to communities and other sensitive land uses through environmental emissions such as air and odour

Relevant policies

With regards to appropriately locating industries that have the potential to cause off-site disamenity, the policy states the following:

"Certain developments need to be planned and effectively managed to avoid or minimise any potential adverse impacts from emissions and hazardous activities. This can be achieved by:

- *Locating the development or activity away from incompatible land uses (including sensitive land uses) and where practical, incorporating any required buffers within the site of the development*
- *Ensuring development for an incompatible use does not encroach on land that is affected by the adverse impacts of hazardous and hard-to locate land uses*
- *Designing incompatible developments to avoid or mitigate any potential impacts."*

The provisions of the SPP in relation to control of environmental emissions of air and odour are addressed throughout this report. The air quality within and surrounding the site should be managed in accordance with the *Environmental Protection (Air) Policy 2008* (Air EPP) which also addresses the provisions of the SPP.

4.3 Application

As majority of the industries outlined in Section 3 are proposed or suggested, details such as the exact location, specific operations, size and throughput amounts of the facilities are unknown or yet to be determined. Many of the guidelines recommend varying separation distances based on these variables. In order to protect the future growth of the industries, GHD

has applied the maximum (i.e. worst-case) buffer distance, where specific operational details are unknown and/or where numerous guidelines apply.

The guidelines outlined in Section 4.2 all detail similar methodologies for determining the separation distance from the industry to the sensitive receptor. The Victorian, South Australian and Australian Capital Territory guidelines state that the separation distance is to be measured from the activity boundary of the industry (i.e. a convex polygon containing all the potentially emitting activities of the industry). The Western Australian guideline states that the distance should be taken from the boundary of the area that may potentially be used by an industrial land use. The latter is the more conservative approach. All of the guidelines (with the exception of the ACT guidelines – which does not specify) state that the separation distance should be measured to the property boundary of the sensitive land use.[2] Therefore, it is suggested that if the activity boundary of the industry is unknown, the separation distance is measured from the property boundary of the industry to the property boundary of the sensitive land use.

4.4 Buffer risk rating

In addition to the buffer distance, a high, medium or low risk rating has been applied to each of the industries identified in Section 3 attracting a buffer. The risk rating was developed based on the buffer distances as follows:

- Low impact: buffer distance less than 500 m
- Medium impact: buffer distance between 500 m and 1,500 m
- High impact buffer distance greater than 1,500 m

The risk rating for each industry is provided in Table 20.

The existing industrial premises attracting buffers as identified in Section 3 are listed in Table 20 and are detailed below with a description of the industrial category and relevant buffer distance, if any, for each identified industrial premise.

4.4.1 Hy-Tec

The buffer distances for quarrying/mining activities are outlined within the following guidelines, as shown in Table 3. It is not known if Hy-Tech quarry hard rock material, therefore a maximum buffer distance of 1,000 m is recommended to be applied to the quarrying areas of the facility, as per the WA guidelines. An additional buffer of 500 m has also been applied to the material handling (processing) portion of the land, as per the ACT guidelines.

Table 3 Summary of buffers applicable to Hy-Tec quarry

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Quarrying, crushing, screening, stockpiling and conveying of rock	With blasting	500
ACT guidelines	Abrasive blasting	Blasting outside	500
	Material handling	Processing (by crushing, grinding, milling or separating into different sizes by sieving, air elutriation or in	300

[2] If Method 1 of the Victorian guidelines is adopted

Guideline	Description	Scale and industry description	Buffer distance (m)
		any other manner) of chemicals or rubber	
		Rock, ores or minerals excluding lease or private mine or wet sand	**500**
SA guidelines	Abrasive blasting	Dry abrasive cleaning	500
		Wet abrasive cleaning	300
	Mineral works	-	Individual assessment
WA guidelines	**Quarrying (including blasting), crushing and screening**	**Hard rock, Darling Scarp**	**1,000**
	Blasting, grinding and milling works – material processed by grinding, milling or separated by sieving, aeration etc	No hard rock	Case by case
	No grinding or milling works	Sand and limestone extraction	300 – 500 depending on size

4.4.2 Donnington

There is no specific category for airstrips in any of the relevant guidelines, with the exception of the SA guidelines. It is stated in the SA guidelines that an individual assessment is required for aerodromes. The next most relevant category to an airstrip is 'major roads' as outlined in the WA guidelines and requires a buffer distance of 100 m. This buffer distance is expected to provide sufficient amenity protection from the airstrip.

4.4.3 Sun Metals

The relevant guideline with respect to solar farms is the Queensland Government, Queensland Solar Farm Guidelines. However it is noted that neither of the guidelines make reference to air quality or buffer distances and therefore no buffer should be applied to the site.

4.5 Buffer distances from proposed industry

The proposed industrial premises attracting buffers as identified in Section 3 are summarised in Table 20. Each industry buffer is detailed below with a description of the industrial category and relevant buffer distance, if any, for each identified industrial premise.

4.5.1 Adani

As mentioned above the Queensland Solar Farm Guidelines does not make reference to air quality or buffer distances and therefore no buffer should be applied to the site.

4.5.2 Davco

There are two buffer categories relevant to Davco with regards to the proposed abattoir and feedlot operations.

Abattoir buffer distances

A summary of the buffers relevant to abattoirs are provided in Table 4. The specific details of the abattoir, such as whether the abattoir will process poultry only and whether or not rendering will occur are not known. Therefore, the largest buffer distance of 1,500 m is recommended to be applied to the abattoir site, as per the WA guidelines.

Table 4 Summary of buffers applicable to abattoirs

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Abattoir – no rendering	>200 tonnes per year	500
	Abattoirs, knackeries or poultry processing works involving rendering	>200 tonnes per year	1000
ACT guidelines	Abattoirs or slaughterhouses	Other than poultry	500
		Poultry only	300
SA guidelines	Abattoirs, slaughterhouses or poultry processing works –other than poultry	Other than poultry 100 to 1,000 tonnes per year	500
		Other than poultry >1,000 tonnes per year	1,000
		Poultry only 200 to 1,000 tonnes per year	300
		>1,000 tonnes per year	1,000
		With rendering plant	1,000
WA guidelines	Killing of animals for human consumption or pet food – no rendering	-	500 – 1000 depending on size
	Rendering works	-	**1000 – 1500 depending on wastewater treatment/disposal system, location & size**

Feedlot buffer distances

A number of industry-specific guidelines for feedlots exist at both the state and federal level, depending on the type of animal. As the specific details of this feedlot are unknown, a maximum buffer distance of 5,000 m for dairy feedlots is recommended to be applied to feedlot areas, as per the Victorian guidelines. GHD recommends that this separation distance is re-evaluated once specific values such as the size and location of the industry are known.

4.5.3 Stockfeed pelletisation facility

Buffer categories for the processing/handing of grain exist in the Victorian and WA guidelines. The Victorian guideline refers to the *'receiving, storing, fumigating, bagging, transporting and loading grain or stock feed'* and requires a buffer distance of 250 m for throughput amounts greater than 20,000 tonnes per year. The WA guideline refers to the *'manufacture of animal feed from grain and other food products'* and requires a buffer distance of 500 m. As the WA guideline refers more specifically to animal feed manufacturing and is a larger distance (i.e. more worst-case) than the Victorian buffer, this 500 m buffer is recommended to be applied to the site.

4.5.4 Drive it NQ

Two guidelines exist with regards to motor sport racing venues as follows:

- SA guidelines
- Queensland Government, Providing Opportunities for Off-Road Motorcycling , A Guide for Local Governments (2012)

The former of the two documents states that an individual assessment for the motor racing/testing venue is required and does not detail an indicative buffer distance range. The latter of the two documents states the following with regards to off-road motorcycling:

"The area should be sufficiently large to accommodate off-road motorcycle uses, as well as future redesign or expansion. The site should incorporate buffer areas for the mitigation of noise and dust emissions. As a guide, the required area may vary from approximately 50 to 400 hectares, depending on the type of off-road motorcycle use."

Therefore, based on the above text, it is stated that this buffer area (ranging from approximately 50 to 400 hectares) should be incorporated within the site (i.e. not external to the site as is the usual application of buffer distances).

Moreover, the document also makes reference to vegetated buffers:

- Vegetated buffers of a minimum width of 20 m are to be established between recreational riding trails and existing development on land adjoining the site in order to minimise dust
- "Where motocross tracks are developed in urban areas, vegetated dust buffers of a minimum width of 5 m are established along the common boundary of the motorsport activity facility and adjoining land."

The document also makes reference to the types of species that should present within these buffers. GHD therefore recommends the following buffers for Drive it NQ:

- Minimum 20 m vegetated buffer beyond site boundary
- 50 to 400 ha (368 to 1128 m) internal buffer

It is also noted that Ipswich Planning Scheme includes a motor sports buffer overlay (OV8 Motor Sports Buffer) for the Tivoli Raceway and Ipswich Motorsports Precinct. The purpose of this overlay is to provide a secondary organisational layer in the planning scheme based on special attributes of land that need to be protected, or that may constrain development. A similar overlay could be introduced for Drive it NQ (in addition to the above buffers) to assist in reducing the likelihood of off-site disamenity at existing and proposed sensitive receptors.

4.5.5 Wellard Rural Exports

As stated in Section 4.5.2 a number of industry-specific guidelines for feedlots exist at both the state and federal level, depending on the type of animal.

GHD has adopted the methodology for developing separation distances outlined in the National Guidelines for Beef Cattle Feedlots in Australia as it is the most relevant guideline.

The guideline utilises an S-factor equation method for developing minimum separation distances, as follows:

$$D = \sqrt{N} \times S$$

where:

D = required minimum separation distance (m)
N = feedlot capacity in standard cattle units (SCU)
S = composite site factor

The equation accounts for site-to-site and time-to-time variation through the composite site factor (S). A number of component S-factor values (S1 – S5) are outlined in the document allowing for S to be developed by multiplying the component S-factor values together.. It is noted that guideline states that feedlots are rarely located in areas with an annual rainfall greater than 750 mm which is the case for the site[3]. Secondly, the proposed stocking of 10 m^2/SCU (Ranbury 2017) is well below what the guideline recommends for a feedlot located in an area with greater than 750 mm. Thus, GHD has assumed a buffer of 5,000 m as per dairy feedlots from the Victorian guidelines

4.5.6 Anroca

The buffer distances for nickel processing are outlined within the following guidelines, as shown in Table 5. The proposed throughput of Anroca is unknown and therefore the worst-case buffer distance of 1,000 m is recommended to be applied, as per the SA guidelines.

Table 5 Summary of buffers applicable to nickel processing

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Non-ferrous metal production	< 100 tonnes per year	100
		100 to 2,000 tonnes per year	250
		> 2,000 tonnes per year	500
SA guidelines	**Ferrous and non-ferrous metal melting**	< 500 kg/cycle	500
		> 500 kg/cycle	**1000**
WA guidelines	Metal smelting, refining, melting, casting, fusing,	< 100 tonnes per year	100 – 200

[3] http://www.bom.gov.au/jsp/ncc/cdio/cvg/av?p_stn_num=033307&p_prim_element_index=18&p_display_type=statGraph&period_of_avg=ALL&normals_years=allYearOfData&staticPage=

Guideline	Description	Scale and industry description	Buffer distance (m)
	roasting or processing works	100 to 1,000 tonnes per year	300 – 500
		> 1,000 tonnes per year	Case by case

4.5.7 Grain processing facility

The relevant buffer distances for the grain storage and drying hub are outlined within the following guidelines, as shown in Table 6. The proposed throughput nor size of the grain processing facility is not known and therefore the worst-case buffer distance of 500 m is recommended to be applied, as per WA guidelines.

Table 6 Summary of buffers applicable to grain storage and drying facilities

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Grain and stockfeed mill and handling facility	> 20,000 tonnes per year	250
SA guidelines	Bulk storage and shipping facilities	-	300
WA guidelines	**Grain cleaning (no milling)**	**-**	**300 – 500 (depending on size)**

4.5.8 Gumloo

The buffer distances for food processing (vegetables) are outlined within the following guidelines, as shown in Table 7. Specific details of the processing facility are not known and therefore the worst-case buffer distance of 500 m is recommended to be applied, as per WA guidelines.

Table 7 Summary of buffers applicable to food processing

Guideline	Description	Scale and industry description	Buffer distance (m)
ACT guidelines	Processing agricultural crop material by deep fat frying, roasting or drying through the application of heat	-	150
	Processing any agricultural crop material where waste water is generated and disposed of otherwise than to a sewer or septic tank effluent disposal system	-	150
SA guidelines	Produce processing works, deep fat frying, roasting or drying:	Processing capacity up to but not exceeding 30 kg/hour	150

Guideline	Description	Scale and industry description	Buffer distance (m)
		Processing capacity more than 30 kg/hour	200
	Produce processing works	up to but not exceeding 10 ML/year of wastewater is generated	200
		More than 10 ML/year of wastewater is generated	300
WA guidelines	**Fruit, vegetables or meat is cooked, dried, preserved, bottled, canned or processed**	**For fruit and vegetables**	**200 - 500**

4.5.9 Hughenden Beef

No separation distance for cold storage is specified in any of the guidelines, therefore, no buffer distance has been applied.

4.5.10 Prepared meal food processor

General food production/meal preparation does not typically require a buffer in the above mentioned guidelines, with the exception of the WA guidelines, which outlines the following buffer distances:

- **Food processing:** fruit, vegetables or meat is cooked, dried, preserved, bottled, canned or processed – 200 – 500 m for fruit and vegetables, 500 m for meat
- **Food or beverage products:** manufacture of food and beverage products not categorised – 100 – 300 m, depending on size and type of product

Based on the above separation distances, a worst-case buffer distance of 500 m is recommended to be applied.

4.5.11 Boston Energy and Innovation

The manufacture of lithium-ion batteries is not listed in any of the guidelines and therefore no buffer distance is applicable.

4.5.12 Oz Cain

Biorenewable and bioenergy industries are not listed in any of the guidelines and therefore no buffer distance is applicable.

4.5.13 NQ Bioenergy

As mentioned above, biorenewable and bioenergy industries are not listed in any of the guidelines and therefore no buffer distance is applicable.

4.5.14 Renewable Developments Australia.

As mentioned above, biorenewable and bioenergy industries are not listed in any of the guidelines and therefore no buffer distance is applicable.

4.5.15 Agripower

The buffer distances for fertilizer manufacture are outlined within the following guidelines, as shown in Table 8. The size of the proposed facility is not known and therefore a maximum buffer distance of 2,000 m is recommended to be applied as per the WA guidelines.

Table 8 Summary of buffers applicable to fertilizer manufacture

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Production of inorganic fertilisers	>2,000 tonnes per year	1,000
WA guidelines	**Manufacture of artificial fertilizers**	**-**	**1,000 – 2,000, depending on size**

4.5.16 Lepidico

Lithium processing is not listed in any of the guidelines and therefore no buffer distance is applicable.

4.6 Buffer distances for suggested industry

The suggested industrial premises attracting buffers as identified in Section 3 are listed in Table 20 and are detailed below with a description of the industrial category and relevant buffer distance, if any, for each identified industrial premise.

4.6.1 Food and drink outlet

It has been assumed that the operations of a food and drink outlet would be that of a retail shop, therefore no buffer distance would be applicable. .

4.6.2 Abattoir

As stated in Section 4.5.2, the recommended buffer distance for the abattoir operations within Davco was 1,500 m. This distance has also been adopted for the suggested abattoir industry.

4.6.3 Asphalt plant

The relevant buffer distances for an asphalt plant are outlined within the following guidelines, as shown in Table 9. A maximum buffer distance of 1,000 m is recommended to be applied as per the WA and ACT guidelines.

Table 9 Summary of buffers applicable to an asphalt plant

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Production of asphalt	>100 tonnes per week	500
SA guidelines	Hot mix asphalt preparation	New technology	500
WA guidelines	**Asphalt is mixed and prepared**	**-**	**1,000**
ACT guidelines	**Hot mix asphalt preparation**	**-**	**1,000**

4.6.4 Concrete batching plant

The relevant buffer distances for a concrete batching plant are outlined within the following guidelines, as shown in Table 10. A maximum buffer distance of 500 m is recommended to be applied as per the WA guidelines.

Table 10 Summary of buffers applicable to a concrete batching plant

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Production of concrete	>5,000 tonnes per year	100
SA guidelines	Concrete batching works	-	200
WA guidelines	**Concrete is made (batched) and loaded for transport**	**-**	**300 – 500, depending on size**
ACT guidelines	Concrete batching works	-	100

4.6.5 Boilermaker

A buffer distance category for metal fabrication exists in the WA guidelines. The guideline refers to the fabrication of *'sheet metal, structural metal and iron and steel products – up to 50 000 tonnes per year'* and requires a buffer distance of 500 to 1,000 m, depending on size. A worst-case buffer distance of 1,000 is recommended to be applied.

4.6.6 Metal foundry

The relevant buffer distances for a foundry are outlined within the following guidelines, as shown in Table 11. A maximum buffer distance of 1,000 m is recommended to be applied as per the Victorian, South Australian and Western Australian guidelines, assuming aluminium processing will not be occurring.

Table 11 Summary of buffers applicable to a foundry

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Processing smelt ores or ore concentrates to produce metal, and metal melting in furnaces, including by an electric arc	<1,000,000 tonnes per year	500
		<1,000,000 tonnes per year	**1,000**
	Processing, smelting or melting non-ferrous metals or ores using furnaces, ovens or electrolysis	<100 tonnes per year	100
		100 to 2,000 tonnes per year	250
		>2,000 tonnes per year	500
		Aluminium by electrolysis	2,000
SA guidelines	Ferrous and non-ferrous metal melting (e.g. foundries)	Die casting (no resin sand)	100
		<500 kg/cycle (sand casting)	500

Guideline	Description	Scale and industry description	Buffer distance (m)
		>500 kg/cycle (sand casting)	**1,000**
WA guidelines	Ferrous metals (alloys), non-ferrous, aluminium	-	300 – 500, depending on size
	Non-ferrous, other than aluminium	**-**	**500 – 1,000, depending on metal and size**

4.6.7 Piggery

A number of industry-specific guidelines for agricultural industries exist at both the state and federal level, depending on the type of animal.

Two relevant guidelines for piggeries exist as follows:

- Australian Pork, National Environmental Guidelines for Indoor Piggeries (NEGIP) (2018)
- Queensland Government, Separation guidelines for Queensland piggeries (2001)

GHD has adopted the methodology for developing separation distances outlined in the Queensland Government guideline as it is the most relevant to the suggested industry.

The guideline utilises an S-factor equation method for developing minimum separation distances, as follows:

$$D = N^{0.65} \times S1 \times S2 \times S3 \times S4$$

where:

D = Required minimum separation distance (m)
N = Number of standard pig units (SPU)
S1 = Effluent removal factor
S2 = Receptor type factor
S3 = Terrain factor
S4 = Surface roughness factor

A summary of the values GHD input into the S-factor equation is summarised in Table 12. It is noted that conservative assumptions of the parameters have been made, with justification for each of the selected values provided. From the table it can be seen that the recommended minimum separation distance for the piggery is 2,900 m. GHD recommends that this separation distance is recalculated once specific values such as the size and location of the piggery are known.

Table 12 Piggery S factor equation calculation

Parameter	Description	GHD selected values	Justification
N	Number of standard pig units (SPU)	10,000	A large piggery has been assumed to consist of 10,000 SPU
S1	Effluent removal factor	0.95	Assuming a flushing system is installed and effluent is held for less than 24 hours within building -

Parameter	Description	GHD selected values	Justification
S2	Receptor type factor	7.1	Rural residential development - in which the areas of individual blocks of the subdivision are less than one hectare - – assumption made based on Google Earth Imagery
S3	Terrain factor	1.2	Subject site is typically flat with significant surrounding hills, therefore assuming low relief at > 2 % from site
S4	Surface roughness factor	0.9	Undulating hills was selected as the subject site is typically flat with surrounding hills
D	**Separation distance (m)**	**2,900**	**-**

4.6.8 Poultry production (meat)

The relevant industry specific guideline for meat chicken farms is the Queensland Government, Development of Meat Chicken Farms in Queensland (2016) guideline.

The guideline utilises an S-factor equation method for developing minimum separation distances, as follows:

$$D = N^{0.63} \times S1 \times S2 \times S3$$

where:

D = Required minimum separation distance (m)
N = Maximum number of birds (to be housed on the farm at any one time) divided by 1000
S1 = Sensitive land use factor for estimating the relative odour impact potential of a development.
S2 = Surface roughness factor for estimating the potential changes to odour dispersion due to changes in the land surface.
S4 = Terrain weighting factor for estimating the potential changes to odour dispersion in situations where meteorological conditions may be influenced by local terrain influences.

It is noted that this equation can only applied to farms up to 300,000 birds. For farms greater than 300,000 birds it is recommended that air dispersion modelling is conducted.

A summary of the values GHD input into the S-factor equation is summarised in Table 13 It is noted that conservative assumptions of the parameters have been made, with justification for each of the selected values provided. From the table it can be seen that the recommended minimum separation distance for the chicken farm is 1,217 m. GHD recommends that this separation distance is recalculated once specific values such as the size and location of the broiler farm are known.

Table 13 Poultry production (meat) S factor equation calculation

Parameter	Description	GHD selected values	Justification
N	Maximum number of birds divided by 1000	300	Maximum N value
S1	Sensitive land use factor	30	Sensitive land use located within a rural zone was selected based on Google Earth Imagery

Parameter	Description	GHD selected values	Justification
S2	Surface roughness factor	0.93	Undulating hills was selected as the subject site is typically flat with significant surrounding hills
S3	Terrain weighting factor	1.2	The subject site is located within a valley drainage zone, with elevation to the south and west of the site (i.e. located downslope of hills). A value of 1.2 was selected, assuming a broad valley and the average slope from the centre of valley/gully to confining ridgeline is <2%.
D	**Separation distance (m)**	**1,217**	**-**

4.6.9 Egg production

A number of industry-specific guidelines for agricultural industries exist at both the state and federal level, depending on the type of animal.

GHD has adopted the methodology for developing separation distances outlined in the National Guidelines developed by Australian Eggs, Egg Industry Environmental Guidelines (2018), as it is the most relevant guideline.

The guideline utilises an S-factor equation method for developing minimum separation distances, as follows:

$$D = N^{0.63} \times S1 \times S2 \times S3 \times S4$$

where:

D = Required minimum separation distance (m)
N = Maximum number of birds (to be housed on the farm at any one time) divided by 1000
S1 = Sensitive land use factor for estimating the relative odour impact potential of a development.
S2 = Land roughness factor for estimating the potential changes to odour dispersion due to changes in the roughness of the land surface.
S3 = Terrain weighting factor for estimating the potential changes to odour dispersion in situations where meteorological conditions may be influenced by local terrain influences.
S4= Wind frequency factor (optional) for estimating the relative odour impact due to the frequency of wind direction for wind speeds less than 3 m/s.

It is noted in Section 4.6.8 the meat chicken S-factor equation can only applied to farms up to 300,000 birds. The Egg Industry Environmental Guideline does not specify a maximum N value. Despite not specifying a maximum value, GHD has selected 300,000 birds in order to ensure the S-factor formula approach is valid.

The S4 parameter was omitted from the calculation due to the location of the egg farm is not known, and therefore the proportion of winds resulting in sensitive receptors being downwind of the site is unable to be calculated.

A summary of the values GHD input into the S-factor equation is summarised in Table 14. It is noted that conservative assumptions of the parameters have been made, with justification for each of the selected values provided. From Table 14 it can be seen that the recommended minimum separation distance for the egg farm is 811 m. GHD recommends that this separation

distance is recalculated once specific values such as the size and location of the industry are known.

Table 14 Egg production S factor equation calculation

Parameter	Description	GHD selected values	Justification
N	Maximum number of birds divided by 1000	300	Maximum N value (see above)
S1	Sensitive land use factor	20	Sensitive land use located within a rural zone was selected based on Google Earth Imagery
S2	Land roughness factor	0.93	Undulating hills was selected as the subject site is typically flat with significant surrounding hills
S3	Terrain weighting factor	1.2	The subject site is located within a valley drainage zone, with elevation to the south and west of the site (i.e. located downslope of hills). A value of 1.2 was selected, assuming a broad valley and the average slope from the centre of valley/gully to confining ridgeline is <2%.
S4	Wind frequency factor (optional)	n/a	Omitted (see above).
D	**Separation distance (m)**	**811**	**-**

4.6.10 Waste incineration

The relevant buffer distances for waste incineration are outlined within the following guidelines, as shown in Table 15. A maximum buffer distance of 1,000 m is recommended to be applied as it is the maximum value across numerous guidelines. This buffer distance assumes biomedical, chemical, organic waste, plastic or rubber waste will be incinerated

Table 15 Summary of buffers applicable to waste incineration

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Waste treatment facility for the immobilisation, thermal degradation, chemical conversion, biological oxidisation (aerobic or anaerobic), incineration, gasification or other treatment of solid waste	-	Case by case
SA guidelines	Incineration	Cremation	150
		Solid municipal waste	500
		Destruction of medical wastes	500
		Destruction of chemical wastes	1,000
WA guidelines	Incineration	Waste wood	300

Guideline	Description	Scale and industry description	Buffer distance (m)
		Biomedical, chemical or organic waste	500 – 1,000
		Plastic or rubber waste	1,000
ACT guidelines	Incineration	Refer to SA guidelines	
Northern Territory EPA, Guideline for Disposal of Waste by Incineration	The separation distance is proposed between emission sources and sensitive land uses such as land zoned Residential.	-	500

4.6.11 Manufacture and/or storage of explosives

Australian Standard *AS 2187.1 – 1998: Explosives – Storage, transport and use, Part 1: Storage* outlines a number of separation distances to be met when storing explosives based on the type of explosive (Class 1 or other)[4], the quantity of net explosive quantity (NEQ)[5] stored (kg) and the receptor type. AS 2187.0 – 1998" *Explosives – Storage, transport and use, Part 0: Terminology* outlines the following sensitive receptor types:

- **Vulnerable facility:** "A category of facility that includes but is not restricted to, the following:
  a) Multistorey buildings, e.g. above 4 storeys
  b) Large glass fronted buildings of high population
  c) Health care facilities, childcare facilities, schools
  d) Public buildings or structures of major historical value
  e) Major traffic terminals, e.g. railway stations, airports
  f) Major public utilities, e.g. gas, water, electricity works"
- **Class A: "**Public street, road or thoroughfare, railway navigable waterway, dock, wharf, pier or jetty, marketplace, public recreation and sports ground or other open place where the public is accustomed to assemble, open place of work in another occupancy, river-wall, seawall, reservoir, water main (above ground), radio or television transmitter, main electrical substation, private road which is the principle means of access to a church, chapel, college, school, hospital or factory.**"**
- **Class B:** "Dwelling house, public building. church, chapel, college, school, hospital, theatre, cinema or other building or structure where the public is accustomed to assemble, shop, factory, warehouse, store, building in which any person is employed in any trade or business, depot for the keeping of flammable or dangerous goods, major dam."

The relevant rows and columns of Tables 3.2.3.2 and 3.2.4.3 of *AS 2187.1 – 1998* have been reproduced in Table 16 below. From Table 16 it can be seen that the maximum separation distance varies depending on the storage of NEQ. Given the size of NFQ is unknown GHD has assumed a size of 100,000 kg (Class 1 explosive) with an associated buffer of 2,080 m. This should be re-calculated once further operational details are known.

[4] As defined in *AS 1216-2006: Class labels for dangerous goods*
[5] The mass of explosive material contained in an explosive

Table 16 Separation distances for storage of explosives

NEQ stored (kg)	Separation distance from Class 1 explosives to vulnerable facilities (m)	Separation distance from other than Class 1 explosives to Class A and Class B protected works (m)
50	180	180
500	360	-
1,000	450	185
5,000	760	245
10,000	960	280
20,000	1,220	320
50,000	1,640	375
100,000	2,080	410
200,000	2,600	410
250,000	2,800	410

4.6.12 Mineral processing

The relevant guideline with respect to mineral processing is the Queensland Government, State Planning Policy – state interest guideline, Mining and extractive resources (2016). The guideline outlines the following separation distances for resource/processing areas[6]:

- "1000 metres where the extraction or processing of the extractive resource involves blasting or crushing (namely rock)"
- "200 metres for any other extractive resource not involving blasting or crushing (namely sand, gravel, clay and soil"

The guideline also states that in addition to the separation distances outlined above, a separation distance is also required surrounding the transport route[7].This distance is measured 100 metres from the centre line of the indicated transport route.

A maximum buffer distance of 1,000 m is recommended to be applied as it presents the worst-case scenario. A 100 m buffer distance is also recommended to be applied to the transport route, as required by the guideline.

4.6.13 Oil refinery

The relevant buffer distances for oil refineries are outlined within the following guidelines, as shown in Table 17. A maximum buffer distance of 2,000 m, as per the Victorian guidelines is recommended to be applied.

Table 17 Summary of buffers applicable to oil refineries

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	**Refining oil or gas, producing hydrocarbon fractions or liquefying gas**	**-**	**2,000**

[6] The extent of the extractive resource and any operational areas associated with the extraction and processing of the resource.
[7] The route used to transport extracted resources to market.

Guideline	Description	Scale and industry description	Buffer distance (m)
SA guidelines	Oil refineries	Individual assessment	1,000 (recommended)
WA guidelines	Waste liquid hydrocarbons or chemicals are refined, purified, reformed, separated or processed	-	500 – 1000, depending on size

4.6.14 Rendering plant

The relevant buffer distances for rendering plants are outlined within the following guidelines, as shown in Table 18. A maximum buffer distance of 1,500 m, as per the WA guidelines is recommended to be adopted.

Table 18 Summary of buffers applicable to rendering plants

Guideline	Description	Scale and industry description	Buffer distance (m)
Victorian guidelines	Abattoirs, knackeries or poultry processing works involving rendering	>200 tonnes per year	1,000
SA guidelines	Abattoirs, slaughterhouses or poultry processing works	With rendering plant	1,000
WA guidelines	**Animal matter is processed or extracted for use as fertilizer, stock food or other purposes**	**-**	**1,000 – 1,500, depending on wastewater treatment/disposal system, location and size**

4.6.15 Transport depot

A buffer distance category for transport vehicles depot exists in the WA guidelines. The guideline refers to *'buses, trucks and other heavy vehicles depot'* and requires a buffer distance of 200 m.

4.6.16 Sewage/water treatment plant

Within the above outlined guidelines, a number of differing buffer distances exist for sewage treatment plants. GHD has utilised the Victorian guidance to approximate a buffer distance for the suggested sewage treatment plant. The Victorian guidance outlines the following equation for mechanical/biological wastewater plants:

$$D = 10n^{1/3}$$

Where:

D = separation distance (m)
N = equivalent population

Based on past project experience, it has been assumed that the treatment plant will be a mechanical/biological wastewater plant. It is expected that the plant will comprise majority of industrial waste from the surrounding industries (e.g. abattoirs), with a small portion of domestic waste. Based on this, an equivalent population value of 20,000 has been assumed. Using the above formula, a separation distance of 271 m was calculated. GHD recommends that this separation distance is recalculated once specific values such as the size and location of the industry are known.

4.6.17 Agricultural product processing

The relevant buffer distances for the processing of agricultural products are outlined within the following guidelines, as shown in Table 19. A maximum buffer distance of 500 m, as per the WA guidelines is recommended, assuming a large throughput of fruit and/or vegetables is processed or meat is processed.

Table 19 Summary of buffers applicable to the processing of agricultural product

Guideline	Description	Scale and industry description	Buffer distance (m)
SA guidelines	Produce processing works - deep fat frying, roasting or drying	<30 kg/hour processing capacity	150
		>30 kg/hour processing capacity	200
WA guidelines	**Fruit, vegetables or meat is cooked, dried, preserved, bottled, canned or processed**	**Fruit and vegetables**	**200 – 500**
		Meat	**500**

4.7 Buffer and Risk Summary

From Table 20 it can be seen that a total of eight industries were classified as 'high impact' as follows:

Proposed Industries

- Davco
- Wellard Rural Exports
- Agripower

Suggested Industries

- Abbatoir
- Piggery
- Manufacture and/or storage of explosives
- Oil refinery
- Rendering plant

Table 20 Buffers for identified industries

Industry	Operations	Proposed buffer distance (m)	Relevant guidance	Buffer impact class	Assumptions
Existing industries					
Hy-Tec	Quarry	1000 from quarry area, 500 from processing area	WA guidelines ACT guidelines	Medium impact	Hard rock material is quarried
Donnington	Airstrip	100	WA guidelines	Low impact	Off-site emissions from a major road is equivalent to Donnington airstrip
Proposed industries					
Davco	Abattoir and feedlot	1,500 from abattoir area 5,000 from feedlot area	WA guidelines Victorian guidelines	High impact	Rendering works occurring, dairy feedlot
Not specified	Stockfeed pelletisation facility	500	WA guidelines	Low impact	-
Drive It NQ	Motorsport and driver training facility	20 m vegetated buffer	Queensland Government, Providing Opportunities for Off-Road Motorcycling , A Guide for Local Governments	Low impact	-
Wellard Rural Exports	Integrated live export facility	5,000	Meat & Livestock Australia, National Guidelines for Beef Cattle Feedlots in Australia (Victorian Guidelines)	High impact	
Anroca	Nickel processing	1,000	SA guidelines	Medium impact	> 500 kg/cycle
Not specified	Grain storage and drying	500	WA guidelines	Low impact	-
Gumloo	Vegetable Processors	500	WA guidelines	Low impact	-
Not specified	Prepared meal food processor	500	WA guidelines	Low impact	

Industry	Operations	Proposed buffer distance (m)	Relevant guidance	Buffer impact class	Assumptions
Agripower	Fertilizer manufacture	2,000	WA guidelines	High impact	-
Suggested industries					
-	Food and drink outlet	-	-	-	-
	Abattoir	1,500	WA guidelines	High impact	Rendering works occurring
-	Asphalt plant	1,000	WA and ACT guidelines	Medium impact	-
-	Concrete batching plant	500	WA guidelines	Low impact	-
-	Boilermaker	1,000	WA guidelines	Medium impact	-
-	Metal foundry	1,000	Victorian, SA, WA guidelines	Medium impact	Electrolysis of aluminium will not occur
-	Piggery	2,900	Queensland Government, Separation guidelines for Queensland piggeries	High impact	See Table 12
-	Poultry production (meat)	1,217	Queensland Government, Development of Meat Chicken Farms in Queensland	Medium impact	See Table 13
-	Egg production	811	Australian Eggs, Egg Industry Environmental Guidelines (2018	Medium impact	See Table 14
-	Waste incineration	1,000	Various	Medium impact	Biomedical, chemical, organic waste, plastic or rubber waste will be incinerated
	Manufacture and/or storage of explosives	2,080	AS 2187.1 – 1998: Explosives – Storage,	High impact	Distance between 100,000 kg of stored NEQ and a

Industry	Operations	Proposed buffer distance (m)	Relevant guidance	Buffer impact class	Assumptions
			transport and use, Part 1: Storage		vulnerable facility, of a Class 1 explosive.
-	Mineral processing	1,000 from resource/processing areas 100 from transport route	Queensland Government, State Planning Policy – state interest guideline, Mining and extractive resources	Medium impact	The extraction or processing involves blasting or crushing
-	Oil refinery	2,000	Victorian guidelines	High impact	-
-	Rendering plant	1,500	WA guidelines	High impact	-
-	Transport depot	200	WA guidelines	Low impact	-
-	Sewage/water treatment plant	271	Victorian guidelines	Low impact	The treatment plant will be a mechanical/biological wastewater plant servicing an equivalent population of 20,000.
-	Agricultural product processing	500	WA guidelines	Low impact	A large throughput of fruit and/or vegetables is processed or meat is processed.

4.8 Site specific variation to the default buffer

The Victorian and ACT guidelines allows for site-specific variation to the default buffer distance for a given industry and identify a number of criteria to consider. Both guidelines identify meteorology or topography as the basis for site-specific variation to the buffer provided the "existence of exceptional topographic, meteorological or other circumstances that will affect the emission or dispersion of residual emissions".

Based on the information available to GHD, the only site-specific criteria available to be applied to the industries is meteorology. Therefore, local meteorology has been used to develop directionally dependent buffers. This is discussed further in Sections 0 and 8.

5. Emissions inventory

It is the nature of industrial premises that air emissions may occur during both routine and upset conditions, even with good pollution control technology and practice. The type and frequency of emissions emitted from industrial land uses has the potential to impact the surrounding land uses. Understanding the nature and impact of emissions from the individual sources can be a valuable tool in informing and supporting strategic land use planning decisions. Similar to the buffer risk rating, GHD has developed an emissions risk rating based on the types of pollutants emitted and the potential impact on human health and the surrounding environment.

5.1 Emission risk rating

For each of the industries identified in Section 3, GHD has identified the potential emissions. The emission type has then been classified as high, medium or low impact. The risk rating has been based on the air quality indicators, as outlined in the EPA Victoria, State Environment Protection Policy (Air Quality Management) (SEPP (AQM)) document. The SEPP (AQM) outlines four classes of air quality indicators, as follows:

- *"**Class 1 indicators**: common or widely distributed air pollutants which are established as environmental indicators in the State environment protection policy (Ambient Air Quality) and may threaten the beneficial uses of both local and regional air environments"*
- ***"Class 2 indicators:** hazardous substances that may threaten the beneficial uses of the air environment by virtue of their toxicity, bio-accumulation or odorous characteristics"*
- *"**Class 3 indicators**: extremely hazardous substances that are carcinogenic, mutagenic, teratogenic, highly toxic or highly persistent, and which may threaten the beneficial uses of the air environment"*
- ***"Unclassified indicators**: indicators of the beneficial uses of local amenity and aesthetic enjoyment, namely odour and total suspended particles (nuisance dust)."*

Emissions that are classified as Class 3 indicators, have been assigned a high impact rating, whilst Class 1 and Class 2 indicators have been classified as medium impact. Emissions that are not Class 1, 2 or 3 indicators (i.e. unclassified indicators) have been classified as low impact. For industries where multiple pollutants consisting of differing class indicators were identified, the highest class indicator has been used to develop the risk rating (i.e. if an industry consists of both Class 3 and Class 2 indicators, the risk rating has been developed based off the Class 3 indicator). A full list of substances and their classification is provided in the SEPP (AQM). Table 21 displays the type of possible emissions and the emission risk rating for each of the industries outlined in Section 3. From Table 21 it can be seen that a total of six industries were classified as 'high impact', as follows:

Proposed Industries

- Anroca

Suggested Industries

- Boilermaker
- Metal foundry
- Asphalt Plant
- Waste incineration
- Oil refinery

Table 21 Emission risk rating

Industry/operations	Potential emissions	Emission risk rating
Existing industry		
Hy-Tec/Adelaide Brighton	PM_{10} ,$PM_{2.5,}$ TSP	Medium impact
Donnington	Carbon monoxide (CO), particulate matter (PM), oxides of nitrogen (NOx), sulphur dioxide (SO_2), volatile organic compounds (VOCs), lead	Medium impact
Sun Metals	-	-
Proposed industry		
Adani	-	-
Davco	Dust, odour	Medium impact
Stockfeed pelletisation facility	Dust, odour	Medium impact
Drive it NQ	Dust, NO_2, CO, CO_2, hydrocarbons	Medium impact
Wellard Rural Exports	Odour, dust	Medium impact
Anroca	Dust, SO2, SO3,NOx,, Co, Ni, Cd, Hg.	High impact
Grain processor	Dust, odour	Medium impact
Gumloo	Odour	Low impact
Hughenden Beef	-	-
Prepared meal food processor	Odour	Low impact
Boston Energy and Innovation	CO, NOx, PM-	Medium impact
Oz Cain	CO, NOx, PM	Medium impact
NQ Bioenergy	CO, NOx, PM	Medium impact
Renewable Developments Australia	CO, NOx, PM	Medium impact
Agripower	NOx, SO_2, CO, hydrocarbons, dust, ammonia, hydrogen fluoride	Medium impact
Lepidico	PM_{10}, CO, SO_2, NOx, lithium hydroxide, aluminosilicate, sodium sulphate, mercury	Medium impact
Suggested industry		
Food and drink outlet	-	-
Abattoir	Dust, odour	Medium impact
Asphalt plant	PM, odour, NOx, VOCs, PAHs, benzene	High impact
Concrete batching plant	$PM_{2.5}$, PM_{10}	Medium impact

Industry/operations	Potential emissions	Emission risk rating
Boilermaker	PM, CO, VOCs, Polycyclic aromatic hydrocarbons (PAHs), SO_2, NOx, Fluoride	High impact
Metal foundry	Trace metals, PM, CO, VOCs, PAHs, SO_2, NOx, fluoride compounds	High impact
Piggery	Odour	Low impact
Poultry production (meat)	Odour	Low impact
Egg production	Odour	Low impact
Waste incineration	CO, fluoride compounds, NOx, PM, PAHs, SO_2, hydrochloric acid, VOCs	High impact
Manufacture and/or storage of explosives	SO_2, CO, PM, NOx, ammonia, nitric acid, VOCs, sulphuric acid	Medium impact
Mineral processing	Dust	Medium impact
Oil refinery	PAHs, CO, SO_2, NOx, VOCs, PM	High impact
Rendering plant	Odour, PM, VOCs, formaldehyde, acetic acid	Medium impact
Transport depot	NOx, SOx, CO PM	Medium impact
Sewage/water treatment plant	Odour	Low impact
Agricultural product processing	Odour, VOCs	Medium impact

6. Risk assessment

An overall risk rating for each of the industries outlined in Section 3 was determined based on the buffer and emission based risk ratings. The overall risk rating was taken to be the worst-case of the two, (i.e. if an industry has a low impact buffer risk rating and a medium impact emission risk rating, the overall risk rating would be medium impact).

Table 22 presents the overall risk rating for each industry and also provides a summary of the buffer and emission-based risk rating. From Table 22 it can be seen that a total of

- 13 industries were classified as high impact
- 16 industries classified as medium impact
- 4 industries classified as low impact
- 3 industries classified as no impact

Table 22 Overall risk rating

Industry/operations	Emission risk rating	Buffer risk rating	Overall risk rating
Existing industry			
Hy-Tec/Adelaide Brighton	Medium impact	Medium impact	**Medium impact**
Donnington	Medium impact	Low impact	**Medium impact**
Sun Metals	-	-	**-**
Proposed industry			
Adani	-	-	**-**
Davco	Medium impact	High impact	**High impact**
Stockfeed pelletisation facility	Medium impact	Low impact	**Medium impact**
Drive it NQ	Medium impact	Low impact	**Medium impact**
Wellard Rural Exports	Medium impact	High impact	**High impact**
Anroca	High impact	Medium impact	**High impact**
Grain processor	Medium impact	Low impact	**Medium impact**
Gumloo	Low impact	Low impact	**Low impact**
Hughenden Beef	-	-	**-**
Prepared meal food processor	Low impact	Low impact	**Low impact**
Boston Energy and Innovation	Medium impact	-	**Medium impact**
Oz Cain	Medium impact	-	**Medium impact**
NQ Bioenergy	Medium impact	-	**Medium impact**
Renewable Developments Australia	Medium impact	-	**Medium impact**

Industry/operations	Emission risk rating	Buffer risk rating	Overall risk rating
Agripower	Medium impact	High impact	**High impact**
Lepidico	Medium impact	-	**Medium impact**
Suggested industry			
Food and drink outlet	-	Low impact	**Low impact**
Abattoir	Medium impact	High impact	**High impact**
Asphalt plant	High impact	Medium impact	**High impact**
Concrete batching plant	Medium impact	Low impact	**Medium impact**
Boilermaker	High impact	Medium impact	**High impact**
Metal foundry	High impact	Medium impact	**High impact**
Piggery	Low impact	High impact	**High impact**
Poultry production (meat)	Low impact	Medium impact	**Medium impact**
Egg production	Low impact	Medium impact	**Medium impact**
Waste incineration	High impact	Medium impact	**High impact**
Manufacture and/or storage of explosives	Medium impact	High impact	**High impact**
Mineral processing	Medium impact	Medium impact	**Medium impact**
Oil refinery	High impact	High impact	**High impact**
Rendering plant	Medium impact	High impact	**High impact**
Transport depot	Medium impact	Low impact	**Medium impact**
Sewage/water treatment plant	Low impact	Low impact	**Low impact**
Agricultural product processing	Medium impact	Low impact	**Medium impact**

7. Meteorology

The local meteorology largely determines the pattern of off-site air quality impact. The characterisation of local wind patterns requires accurate site-representative hourly recordings of wind speed and direction over a period of at least 12 months (one year).

As discussed in the GHD 2019, Air, noise and vibration baseline monitoring report (GHD 2019), prognostic meteorological data was generated in The Air Pollution Model (TAPM), due to the lack of site-representative weather stations surrounding the subject site. This dataset is based on synoptic observations filtered through a Global Circulation Model (GCM2), local terrain and land use information. The GHD 2019 report concluded that based on the similarities between the TAPM generated data and the data collected from the onsite weather station, the TAPM generated data is representative of the site and is suitable to be used in this assessment.

GHD selected the year 2017 as it was the most recent period with a complete record at the time of this assessment.

The effect of wind on dispersion patterns can be examined using the general wind climate and atmospheric stability class distributions. The general wind climate at a site is most readily displayed by means of wind rose plots, giving the incidence of winds from different directions for various wind speed ranges.

The features of particular interest in this assessment are: (i) the prevailing wind directions, (ii) the relative incidence of more stable light wind conditions, and (iii) good dispersion conditions with winds over 5 m/s.

A distinction can be made for fugitive deposited dust entrained in strong winds, as opposed to dust emissions from process sources where the emission rate is independent of local wind conditions. The ‘worst case’ in the former class is wind speeds greater than 5 m/s, while the ‘worst case’ in the latter is light, stable winds.

7.1.1 Long term pattern in wind

The average wind rose for the entire data period is shown in Figure 2 and shows the following features:

- The predominant annual average wind directions are from the south southwest and south directions comprising 31% of all incident winds.
- The incidence of westerly winds (~5%) is slightly les than easterlies occurring ~7% of the time.
- The average wind speed measured was 2.7 m/s.
- The observed wind speed distribution indicates that the largest proportion of high wind speeds (> 5 m/s) are from the north and the east-southeast, while the largest proportion of light winds (<1.5 m/s) are from the west-southwest

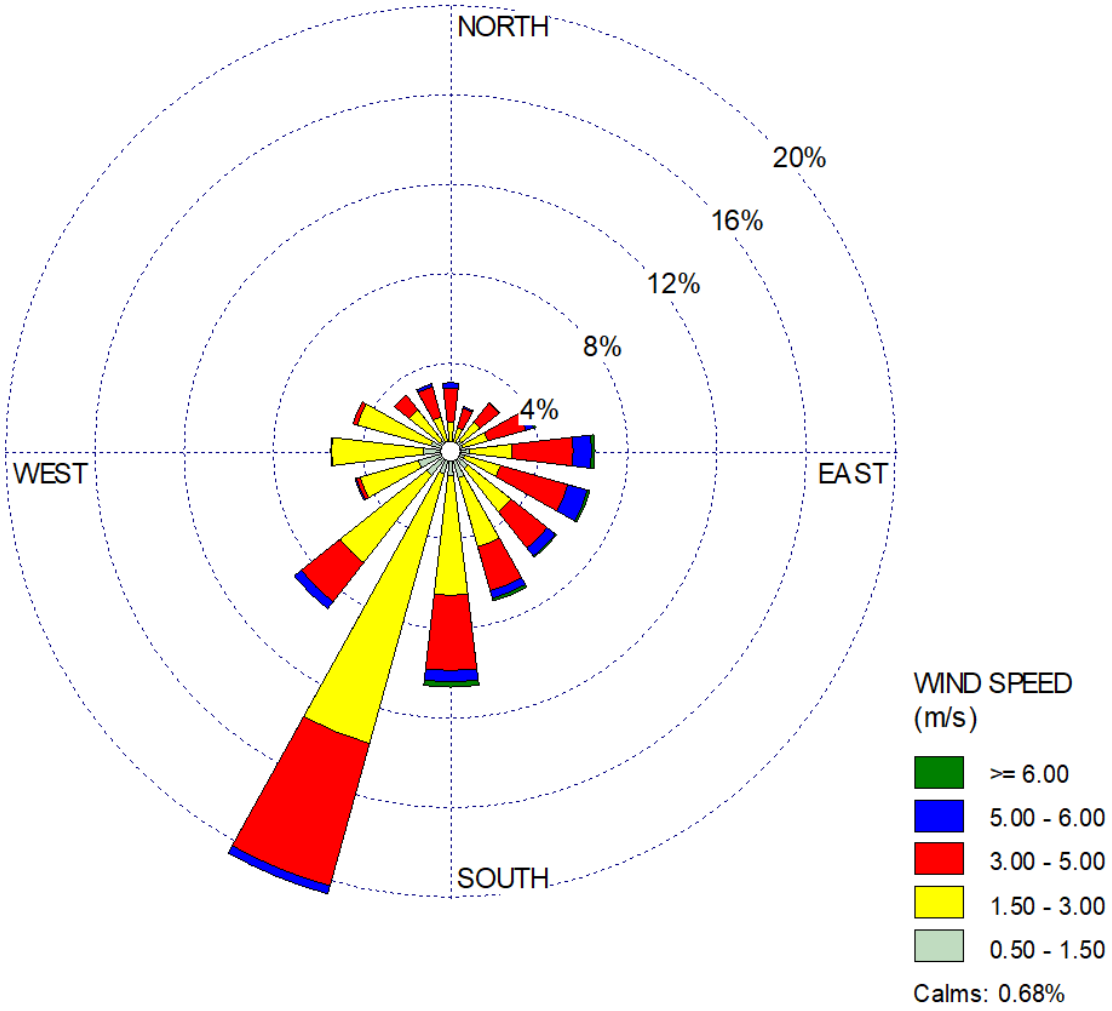


Figure 2 TAPM generated wind rose (2017) at 10 m

8. Directionally dependent buffer

The Victorian and ACT buffer guideline allows for site-specific variation on the basis of topographical or meteorological features which will affect dispersion of industrial residual air emissions. GHD has developed an approach to provide directionally-dependent buffers on the basis of the dispersive ability of the atmosphere, as assessed using atmospheric dispersion modelling (Clarey & Pollock, 2004).

Where site-representative meteorological data is available or prognostic meteorological data (TAPM) is generated, the directions of good and poor dispersion can be identified. Further, if the dataset is configured into the dispersion modelling format (deriving atmospheric stability category) then dispersion modelling can be conducted using a nominal air source emission rate to assess the directional change in extent from a default radial buffer[8].

The directional buffer adapts the default radial buffer (as discussed in Section 4) to take account of the directions of good and poor dispersion – found from the meteorological data representative of local conditions.

In the directions of poor dispersion the buffer is extended and in the directions of good dispersion the buffer is retracted. The effect is to produce the same degree of protection from exposure to impact as the default buffer but shaped by the local meteorology to represent a more realistic site specific buffer in the event of a process upset.

Dispersion modelling was performed using the TAPM meteorological dataset and a nominal 10 m x 10 m area source with a nominal emission rate. The 99.5% contour that provides the same enclosed area as a 5,000 m radius circle (i.e. 78,539,816 m^2) was selected and is presented in Table 23.

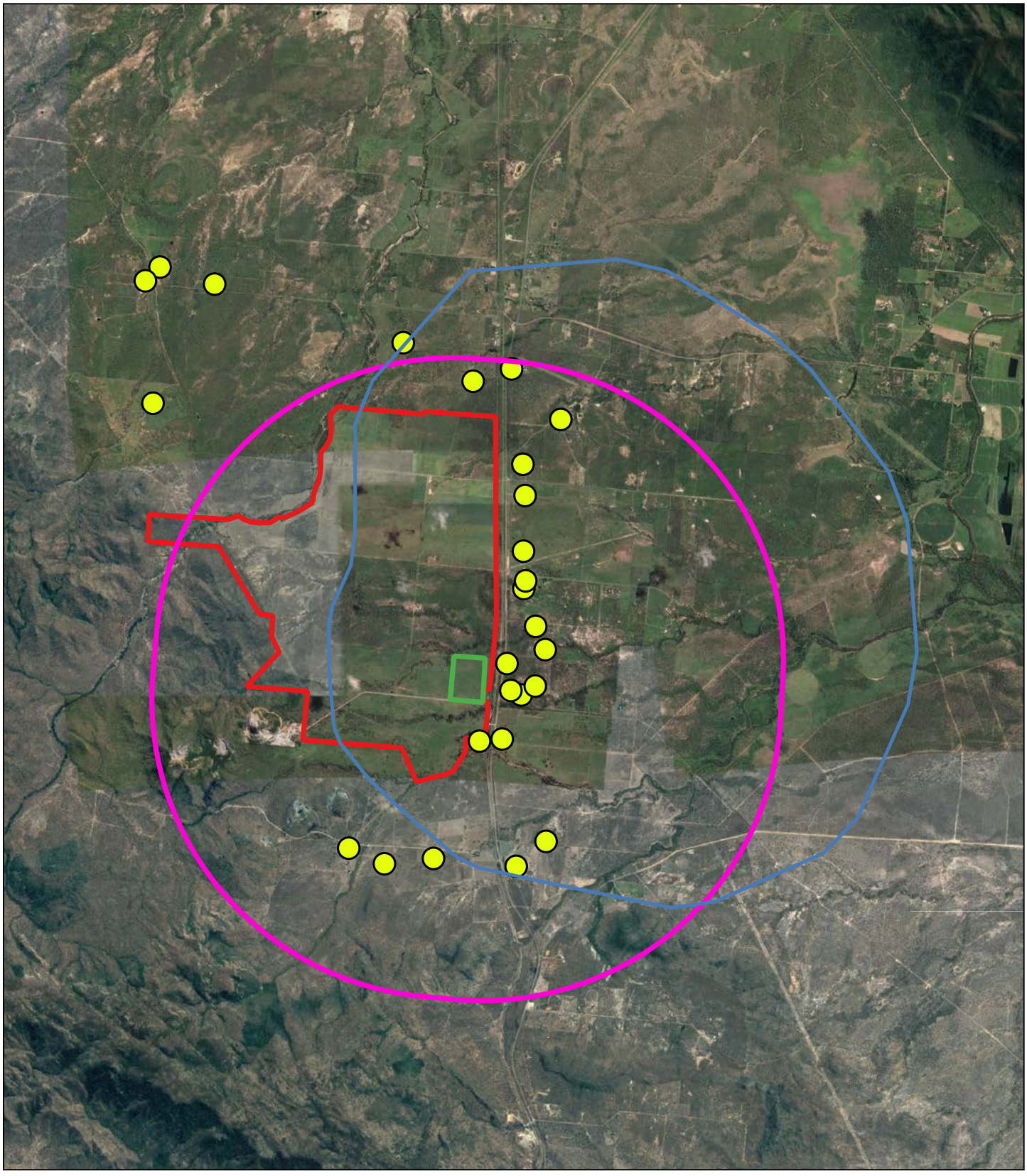
A 5,000 m radius circle was selected as it is the largest buffer distance determined in Section 4. From Table 23, it can be seen that the extent of the contour is greater than the all-direction mean of 5,000 m in the east-northeast sector – out to 7,635 m. Similarly, the extent of the contour to the southwest is significantly less than 5,000 m, down to 1,913 m. The contour effectively gives the departure from the fixed 5,000 m radius that would be required if an equal exposure to disamenity was to be given in the event of an upset/malfunction at any of the potential odour/dust emitting sites.

The angular change in buffer distance is given as a function of direction in Table 23. This information has also been used to demonstrate the effect on the subject site from a worst-case scenario industry (i.e. a 5,000 m directional buffer on an industry located closest to the identified sensitive receptors outlined in Section 2.2), refer to Figure 3. The equivalent default buffer has also been plotted in Figure 3 to show the relative difference between the two buffers.

[8] Clarey P, Pollock T “Integrating Separation Distances with Dispersion Modelling” Enviro 04, 28 Mar – 1 April, Darling harbour, Sydney

Table 23 Directional variation in 5,000 m default buffer in response to local meteorology – TAPM

Direction Sector (Degrees)		Range (m)	Percent (%) of all direction mean range (5,000m)	Direction Sector (Degrees)		Range (m)	Percent (%) of all direction mean range (5,000m)
N	0	6464	129	S	180	2749	55
NNE	22.5	7271	145	SSW	202.5	2125	43
NE	45	7340	147	SW	225	1913	38
ENE	67.5	7635	153	WSW	247.5	2108	42
E	90	7293	146	W	270	2059	41
ESE	112.5	6589	132	WNW	292.5	2260	45
SE	135	4968	99	NW	315	2351	47
SSE	157.5	3298	66	NNW	337.5	4662	93



LEGEND

- Site area
- Sensitive receptors
- Proposed industrial site
- 5000 m default buffer
- 5000 m directional buffer

Paper Size ISO A4

0 400 800 1200 m

N

Map Projection: Mercator Auxillary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxillary

Townsville City Council
Infrastructure, Traffic, Transport & Air Quality
Air, noise and vibration baseline monitoring

5000 m default and directional buffers

Project No. **42-20641**
Revision No. **A**
Date. **11/1/2019**

FIGURE 3

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Data Source: Google Earth Imagery 2018. Created By: SM

8.1.1 Potential constraints posed by directional buffers

Figure 3 shows a 5,000 m worst-case directional buffer applied to the subject site. From Figure 3 it can be seen that the directional buffer extends significantly to the east and northeast (approximately a 50% increase) compared to the default buffer due to local meteorological effects. The directional buffer is significantly reduced to the west (approximately a 60% reduction) compared to the default radial buffer and to a lesser extent in the south.

9. Future land use planning considerations

9.1 Key findings

GHD has conducted an air quality impact assessment for the Lansdown Planning Scheme Major Amendment (PSMA) in relation to the Lansdown Station site located on the Flinders Highway at 132 Bidwilli Road, Calcium, with the following key findings:

- A number of existing, proposed and suggested industries were identified based on the information provided by TCC to GHD.
- The separation distances for each identified industry were evaluated based on buffer distance guidance from other states/territories within Australia and industry specific guidance.
- Based on the designated separation distance, a buffer risk rating (high greater than 1,500 m, medium between 500 m and 1,500 m or low less than 500 m) was determined for each of the identified industries.
- An emission-based risk rating was also developed for each industry based on the potential pollutant type emitted from each industry. This risk rating was based on the four classes of air quality indicators outlined in the Victorian SEPP (AQM).
- An overall risk rating was then calculated for each of the industries, based on the buffer and emission-based risk rating (the worst-case of the two) resulting in the following:
  - 13 industries were classified as high impact
  - 16 industries classified as medium impact
  - 4 industries classified as low impact
  - 3 industries classified as no impact
- Synthesised meteorological data was then used to develop directional buffers to provide an indication of the directions of good and poor dispersion. The influence of local meteorology shows a large reduction of the default buffer towards the west (~60%) and a large increase to the east and northeast (~50%).

9.2 Mitigation measures

It has been assumed that that the development of the site will occur incrementally over time. Therefore, it is important that future development on land surrounding the site is not located in areas that may potentially constrain future industrial activities within the site. A number of mitigation measures in order to reduce this risk is discussed below.

Land use planning considerations

Separating industrial activities from sensitive areas using a setback strategy is commonly adopted and recommended as part of this study. Utilising a setback strategy will aid in achieving the SPP's requirements such that development is located to avoid adverse impacts of environmental emissions.

The nominated buffers for the proposed industries outlined in this report, can be used to inform the setback distances required to assist in reducing the risk to their activities in the future. Based on the risk assessment, this report has highlighted a number of industries which are considered high and medium risk which may have a detrimental impact on the health and amenity of proposed new sensitive uses should they be located adjacent to the site.

It is considered that the failure to establish setbacks for the proposed industries could raise the following two problems:

1. A risk to future sensitive uses being subjected to unacceptable air impacts during either routine or upset events or in certain other circumstances.
2. The encroachment of sensitive uses on the buffer areas of existing industries may result in unachievable or unreasonable requirements on the industries to mitigate the impacts at the source.

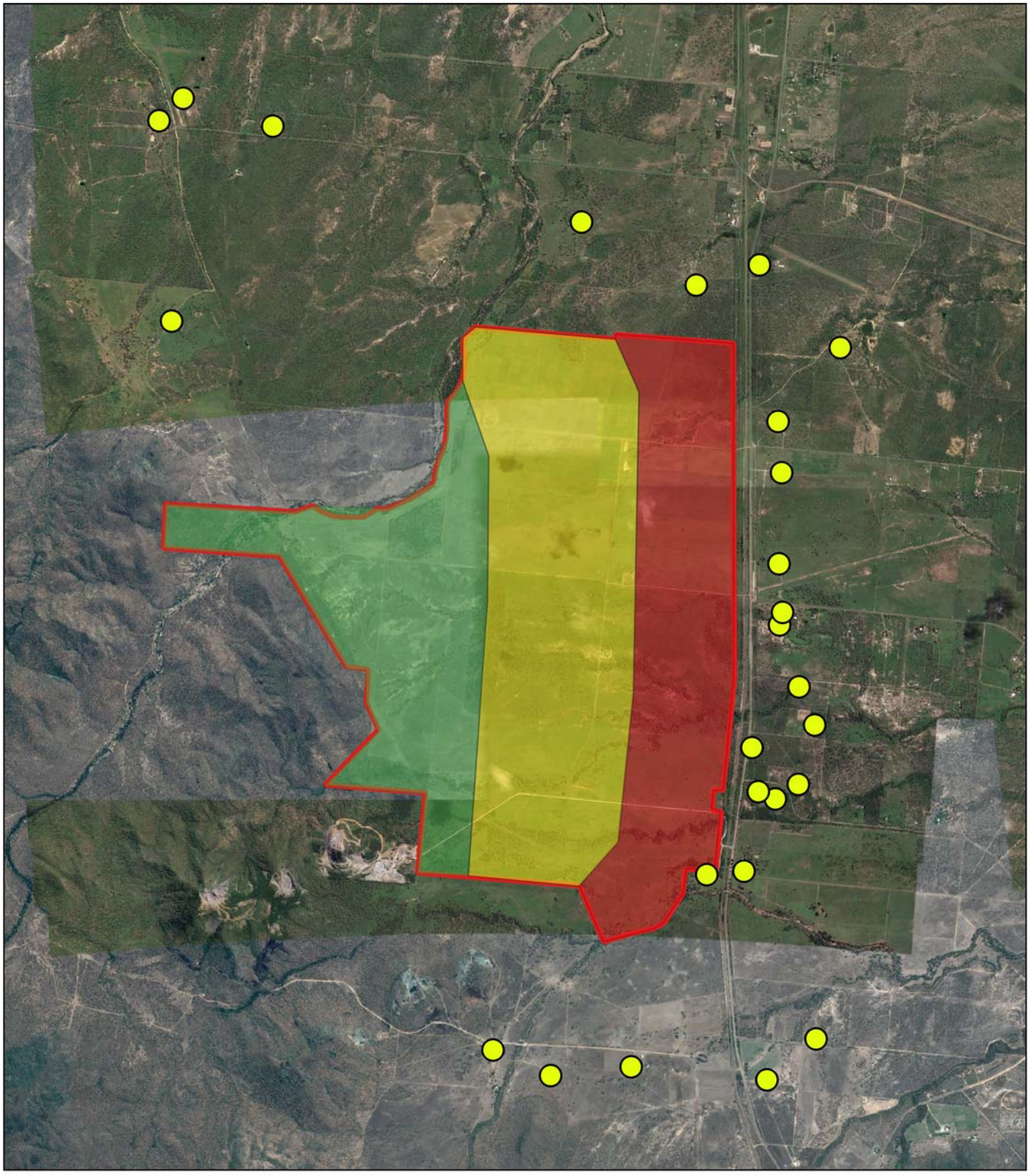
In order to manage the conflicts between land uses, there must be a balance between selecting measures that sufficiently mitigate impacts, and avoiding over regulation and therefore impacting on the ability to achieve other objectives such as urban growth and environmental sustainability.

To assist with land use allocation planning as part of the PSMA the overall risk assessment comprising of both buffer distances (including meteorological influences) and emission types can be used to inform indicative areas requiring differing levels of engineering controls (i.e. high, medium or low) for proposed industrial uses within the Lansdown Station study area. GHD has also used the locations of existing sensitive uses to inform the classification.

The proposed indicative areas requiring different levels of engineering controls for the site is presented in Figure 4.

GHD recommends that industries proposed to be located in the western and southern portion of the site require a low level of engineering control, as this area is located furthest from existing sensitive receptors. Utilisation of medium engineering controls would then surround the low engineering controls area, followed by the area of high level of engineering controls up to the site boundary (closest to the existing sensitive receptors).

It is noted that the proposed indicative areas requiring different levels of engineering controls does not identify any areas within the site that are constrained from development due to specific details such as the size and exact location of the proposed industries not being known. GHD recommends that TCC utilise the findings of this assessment when making decisions regarding the location of new industries on a case by case basis. For example, the high level of engineering controls area is located on the eastern portion of the site (as shown in Figure 4), so if an industry with a 500 m buffer or greater was to be located on the immediate edge of the site, within 500 m of an existing sensitive receptor, this would result in a potential constraint which would require further investigation, in accordance with the SPP, to assess the impacts to air quality and potentially a high level of engineering control prior to TCC making a decision on the individual application.



LEGEND

- Site area
- Sensitive receptors
- Low level of engineering controls required
- Medium level of engineering controls required
- High level of engineering controls required

Paper Size ISO A4

0 400 800 1200 m

N

Map Projection: Mercator Auxillary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxillary

GHD

Townsville City Council
Infrastructure, Traffic, Transport & Air Quality
Air, noise and vibration baseline monitoring

Indicative levels of engineering controls

Project No. **42-20641**
Revision No. **B**
Date. **23/04/2019**

FIGURE 4

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Data Source: Google Earth Imagery 2018. Created By: SM

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Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	[redacted]	[redacted]	[redacted]			
0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	02/05/19

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4220641-70777/https://projects.ghd.com/oc/nqoc1/infrastructuretraffi/Delivery/Documents/4220641_Integrated Master Plan Report_REV 01.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	02/05/19
1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	10/05/19

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