Draft Air Quality and Odour Study

Baseline Assessment for the Western Sydney Aerotropolis

Addressee(s):	Aurecon Australasia Pty Ltd on behalf of the Western Sydney Planning Partnership
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EXECUTIVE SUMMARY

Northstar Air Quality Pty Ltd has been commissioned by Aurecon Australasia Pty Ltd on behalf of the Western Sydney Planning Partnership to perform a baseline constraints and land capability analysis, with a focus on air quality and odour, to support precinct planning for the development of the Western Sydney Aerotropolis.

The Aerotropolis relates to land identified in the Western Sydney Aerotropolis Plan which comprises 11 200 hectares surrounding the Western Sydney International (Nancy Bird Walton) Airport site.

The Western Sydney Aerotropolis is part of the wider Metropolitan Cluster which includes Greater Penrith, Liverpool and Campbelltown-Macarthur, and will play an important role in improving connectivity between these centres. The Stage 1 Land Use and Infrastructure Implementation Plan identified the Aerotropolis Core, Northern Gateway and Wianamatta-South Creek for initial precinct planning.

As planning for the Western Sydney Aerotropolis has progressed, the Western Sydney Aerotropolis Plan has identified that, in addition to the above precincts, the Agribusiness, Badgerys Creek and Mamre Road Precincts are suitable to be brought forward and be planned as initial precincts. Planning for Mamre Road is being led by the Department of Planning, Industry & Environment and therefore does not form part of the detailed planning of initial precincts to be undertaken as a part of this project.

For the purpose of precinct planning, the initial precincts have been sorted into three groupings:

- Northern Gateway;
- Agribusiness; and
- Aerotropolis Core, Badgerys Creek and adjoining areas of Wianamatta-South Creek.

The Air Quality and Odour Study is delivered in two stages, with the requirement and scope of Stage 2 being informed by the findings of Stage 1. The purpose of this report (Stage 1) is to identify sources of air pollutants and odour in the study area, understand the potential for those sources to impact the development of land and provide management strategies for the management of those potential constraints. This scope has been performed using a risk assessment methodology based upon ISO 31000, which provides principles, a framework and a process for managing risk.

In this study, 'risk' has been evaluated as the product of scales applied to 'sensitivity' and to 'magnitude'. For air quality and odour studies, that approach is appropriate given the potential significance of impacts of air pollutants and odour may vary depending on the nature and 'sensitivity' of the receiving environment.

'Sensitivity' has been defined on a simplified 4-point scale using land use data derived from the relevant Local Environmental Plans and land use derived from the Western Sydney Aerotropolis Plan.

Activities with the potential to generate emissions to atmosphere have been identified through various data sources including those published by the Australian Government, NSW Environment Protection Authority, Department of Planning, Industry & Environment, Transport for NSW, and supported by site surveying.

The potential 'magnitude' of emissions of air pollutants and odour has been defined on a simplified 4-point scale using published separation distance thresholds ("buffer distances") and NSW EPA Level 1 odour assessment procedures.

The resultant values for 'sensitivity' and 'magnitude' have been mapped within a Geographical Information System and overlaid to generate a product evaluation of 'risk'.

The maps for 'sensitivity', 'magnitude' and 'risk' are presented in the report for the study area. Sensitivity is presented as (i) existing baseline (existing and approved land uses) and (ii) future baseline, as determined from the draft precinct plans. To facilitate discussion, magnitude is additionally disaggregated by activity type (agriculture, extractive industries, waste management, commercial & industrial, and infrastructure).

Risk maps are presented for the (i) existing baseline (existing and approved land uses) and (ii) future baseline over the study area.

Key Findings

The risk assessment illustrates a number of conclusions including that land associated with the future baseline scenario are predominantly assessed as being of 'medium risk' at all precincts, including:

- Northern Gateway is assessed as being of medium air quality and odour risk at 94 % of land;
- Agribusiness is assessed as being of medium air quality and odour risk at 68 % of land;
- Aerotropolis Core, Badgerys Creek and adjoining areas of Wianamatta-South Creek is assessed as being of medium air quality and odour risk at 96 % of land.

The methodology specifies that land assessed as being at 'medium risk' should be managed to reduce risk as low as practicable through changes to impact magnitude and/or sensitivity.

The assessment also identifies that a not insignificant proportion of land at the Northern Gateway, Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek precincts are assessed as a 'high risk', including:

- Northern Gateway is assessed as being of high air quality and odour risk at 6 % of land;
- Agribusiness is assessed as being of high air quality and odour risk at 31 % of land;
- Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek is assessed as being of medium air quality and odour risk at 2 % of land.

The methodology specifies that land assessed as being at 'high risk' requires management, through changes to impact magnitude and sensitivity

The assessment identifies limitations associated with the baseline assessment methodology that may be addressed as the precinct plans are refined and developed.

Recommendations

The report identifies a number of specific recommendations to manage the evaluated risk including:

- Recommendation 1: Updating the baseline study as the precinct plans are refined. This recommendation is applicable to all precincts.

- Recommendation 2: Updating the risk assessment as the land use in the precinct plans are developed. This recommendation is applicable to all precincts.
- Recommendation 3: Augmenting the baseline study with further assessment to better reflect the potential impacts of intensive poultry farming operations, with critical farms identified (as a priority). This recommendation is applicable to all Precincts.
- Recommendation 4: Augmenting the baseline study with further assessment to better reflect the potential impacts of a number of identified waste management activities. This affects land in the Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek precinct, and also a small section to the south-east in the Northern Gateway precinct.

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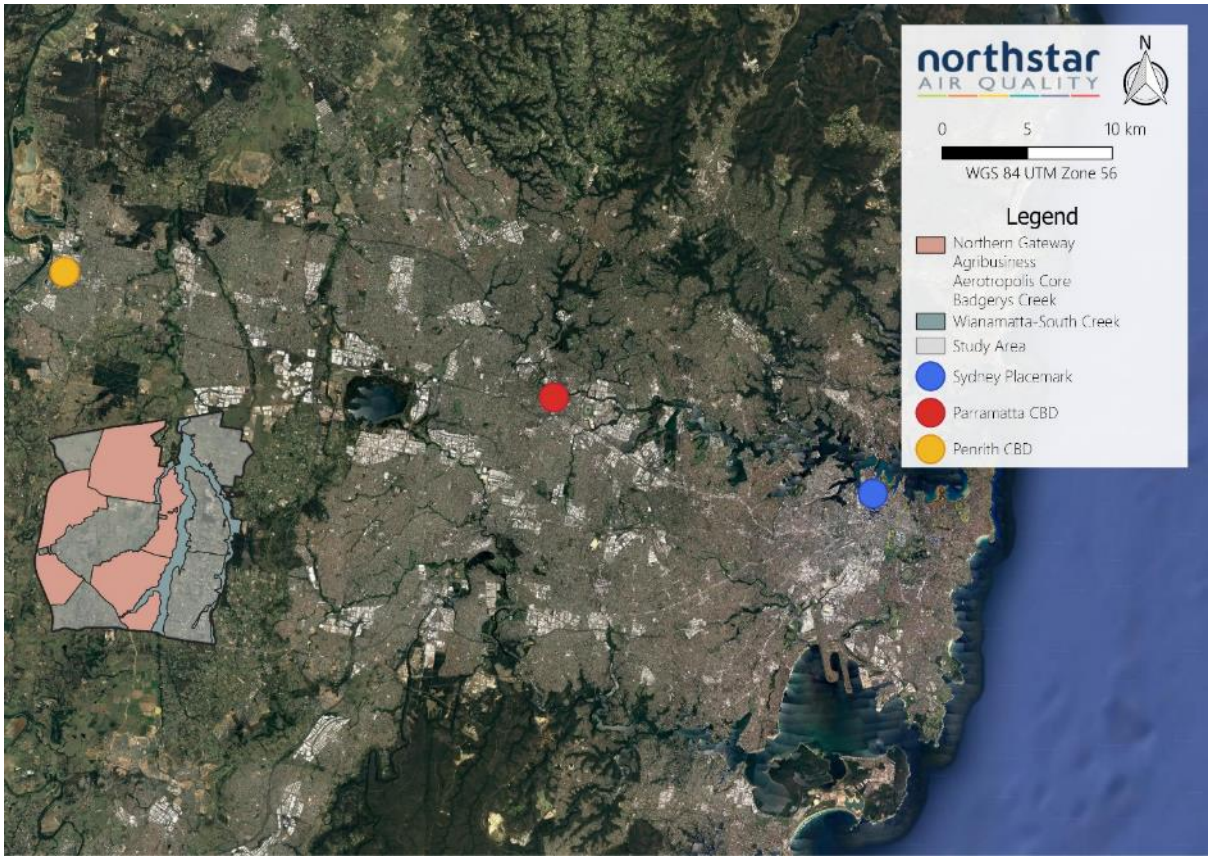
1 INTRODUCTION

Northstar Air Quality Pty Ltd (Northstar) has been commissioned by Aurecon Australasia Pty Ltd on behalf of the Western Sydney Planning Partnership to perform a baseline constraints and land capability analysis, with a focus on air quality and odour, to support precinct planning for the development of the Western Sydney Aerotropolis (Aerotropolis).

1.1 Study Area

The Aerotropolis (study area) relates to land identified in the Western Sydney Aerotropolis Plan (WSAP) which comprises 11 200 hectares (ha) surrounding the Western Sydney International (Nancy-Bird Walton) Airport (Airport) (refer to **Figure 1**).

Figure 1 The Aerotropolis study area location



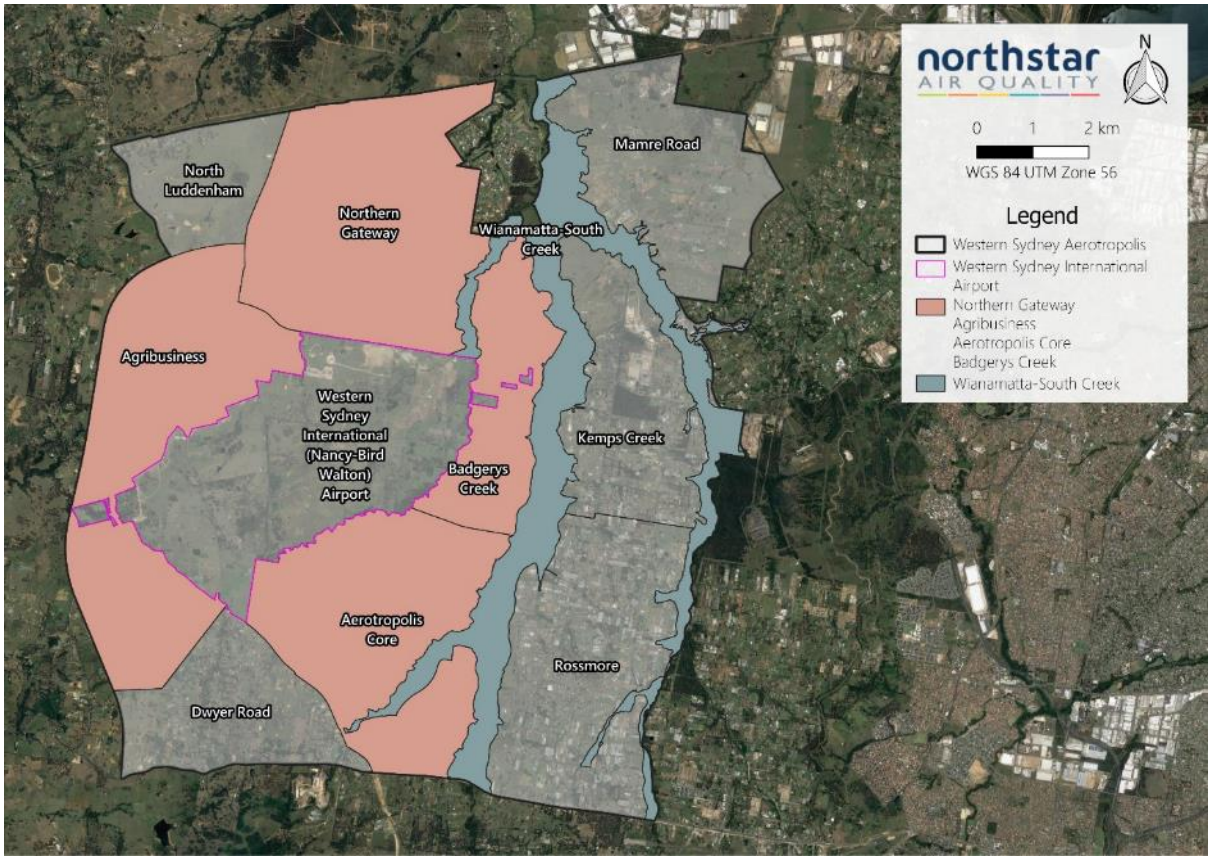
Source: Northstar Air Quality Pty Ltd

The Aerotropolis is part of the wider Metropolitan Cluster which includes Greater Penrith, Liverpool and Campbelltown-Macarthur, providing connectivity between the Aerotropolis and these centres. The Stage 1 Land Use and Infrastructure Implementation Plan (LUIIP) identified the Aerotropolis Core, Northern Gateway and Wianamatta-South Creek for initial precinct planning.

As planning for the Aerotropolis progressed, the WSAP has identified that, in addition to the above precincts, the Agribusiness, Badgerys Creek, and Mamre Road Precincts are suitable to be brought forward and be planned as initial precincts. Planning for Mamre Road is being led by the DPIE and therefore does not form part of the detailed planning of initial precincts to be undertaken as a part of this project.

These are illustrated in **Figure 2**.

Figure 2 Precinct groups



Source: Northstar Air Quality Pty Ltd

For the purpose of detailed precinct planning, the initial precincts have been sorted into three groupings:

- Northern Gateway;
- Agribusiness; and.
- Aerotropolis Core, Badgerys Creek and adjoining areas of Wianamatta-South Creek (assessed as a single contiguous area in this study).

1.2 Scope of Air Quality and Odour Study

The Air Quality and Odour Study is delivered in two stages, with the requirement and scope of the second stage being informed by the findings of the first. A description of the scope of the Stage 1 and (anticipated) Stage 2 air quality and odour study is provided in the following sections.

1.2.1 Stage 1

The requirements of the Stage 1 air quality and odour study (the baseline assessment) are as follows:

- Identify source(s) of air pollutants and odour on or in the vicinity of the subject land that may impact future development, including from any ongoing agricultural activities. These agricultural activities could be within or outside the Aerotropolis depending on how far the impacts extend;
- Develop an understanding of the nature of any air pollutant and odour producing activities identified;
- Consider the implications of any existing air pollutants and odours that may inform the staging of development;
- Complete a Level 1 Odour Impact Assessment as outlined in the former NSW Department of Environment and Conservation's *Technical Framework: Assessment and management of odour from stationary sources in NSW* (2006) and its *Technical Notes*. This assessment should identify the separation distance which would nominally be required between the odour producing activities and urban development (refer to the Technical Notes in the Policy). Separation distances associated with other activities with the potential for air emissions other than odour have also been considered;
- Recommend management strategies to maximise development opportunities both under the existing air pollutant and odour situation and into the future;
- Make recommendations for controlling impacts from air pollutant and odour generating activities. This includes adequate buffers or transition zones between areas identified for urban development (as identified in the WSAP) and sources of air pollutant and odour impacts;
- Prepare a report that outlines the findings of the assessment, including maps identifying areas where urban development (as generally identified in the WSAP) would encroach into the 'separation distance' required from any air pollutant and odour producing activities, and make recommendations for any Level 2 and/or 3 Assessments if required; and,
- Make specific recommendations to mitigate air pollutants and odour from development on areas identified for urban development or open space in the WSAP. The purpose of these recommendations to inform any acceptable solutions to be included in the Phase 2 Western Sydney Aerotropolis Development Control Plan (DCP) and/or inclusion in State Environmental Planning Policy (SEPP) maps.

For clarity, this report specifically considers the requirements of **Stage 1** only, comprising the requirements as outlined above).

1.2.2 Stage 2

If the work carried out in Stage 1 in the Air Quality and Odour Study – Baseline Assessment finds that further assessment is required, the consultant is to undertake a Level 2 and/or Level 3 Odour Assessment as outlined in the NSW Department of Environment and Conservation's *Technical Framework: Assessment and management of odour from stationary sources* (2006) and its *Technical Notes.*

The Stage 2 Air Quality and Odour Study report will:

- incorporate the results of the modelling and sets out any limitations to the data;
- highlights specific strategies for managing air pollutant odour impacts (including any appropriate management or structural changes to the odour generating operation);
- predicts air pollutant and odour impacts on the future development of the site in light of the management recommendations; and,
- make specific recommendations for controlling air pollutant and odour impact from development on proposed residential development and associated land uses including open space. These recommendations shall be in the form of development control provisions suitable for inclusion in a development control plan and / or indicative layout plan.

This report specifically considers the requirements of Stage 1 (see **Section 1.2.1**).

1.3 Legislation and Regulation

The purpose of this study is to identify existing land uses and their proximity to existing (and proposed) activities that have the potential to give rise to emissions to air. Through this process, opportunities and constraints within the WSAP can be identified.

An objective of the WSAP is to ensure a sustainable, low carbon Aerotropolis that embeds the circular economy, and therefore legislation relevant to this study includes the *Protection of the Environment Operations Act* (1997) (POEO Act) and the Protection of the Environment Operations (Clean Air) Regulation (2010) (under the *POEO Act*).

1.4 Data Sources

The study is reliant on the underlying sources of data which have been used to determine the potential constraints associated with existing and proposed land uses, when considering surrounding sources of air pollution and odour.

Minor discrepancies have been identified between the areas of the individual precincts provided, and the underlying land uses within those precincts for the future preferred scenario. These discrepancies are not likely to alter the findings of the assessment, but it is noted that the assessment presented here has adopted those provided data *prima facie*.

The sources of data adopted in the performance of this study include:

Table 1 Data sources used in the study

Data	Data source
Precinct boundaries	• GIS files provided by email to Northstar via Aurecon on 30 September 2020 • NSW Government, *Western Sydney Aerotropolis Plan*, September 2020 (NSW Government, 2020)
Land sensitivity	Existing land use data obtained in GIS format from https://www.planningportal.nsw.gov.au/opendata/dataset/environment-planning-instrument-local-environmental-plan-land-zoning specifically referencing: • Liverpool Local Environmental Plan (2008) • Penrith Local Environmental Plan (2010)
	Future preferred scenario provided by email in GIS format to Northstar via Aurecon on 30 September 2020
Magnitude	Based on data obtained from • DPIE NSW Planning Portal – Major Projects[1] • NSW RMS - Infrastructure Projects[2] • Australian Government DAWE National Pollutant Inventory[3]; • NSW Environment Protection Licence register[4]; • Desk-top surveying, including use of Google Earth[5] and Six Maps[6]; • Northstar Air Quality site surveying (see **Section 3.3.1**).
Risk	A product of Sensitivity and Magnitude as described in **Section 3.1.3**

[1] https://www.planningportal.nsw.gov.au/major-projects

[2] https://www.rms.nsw.gov.au/projects/index.html

[3] www.npi.gov.au

[4] https://apps.epa.nsw.gov.au/prpoeoapp/

[5] https://www.google.com/earth/

[6] https://maps.six.nsw.gov.au/

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2 EXISTING CONDITIONS

The information below provides a general description of the existing (background) conditions across the Aerotropolis study area. This information is not used in any significant way in the risk assessment process and is therefore provided for information purposes only.

2.1 Background Air Quality

The prevailing background (sometimes called 'baseline') air quality condition in the study area has been determined through review of air quality data collected by the DPIE at the Bringelly air quality monitoring station (AQMS). The AQMS is located on Badgerys Creek Road, within the study area, and provides a good approximation of air quality conditions across the study site. The air quality data collected at this site can be considered to be representative of conditions away from significant sources of emissions.

Data for nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and particulate matter (PM_{10} and $PM_{2.5}$) are presented in **Figure 3**, **Figure 4**, **Figure 5** and **Figure 6**, respectively for the period 2015 to 2019 inclusive.

Concentrations of NO_2 and SO_2 are well below the relevant 1-hour criteria at Bringelly AQMS. Maximum 1-hour concentrations in the period 2015 to 2019 were 30 % of the NO_2 criterion and 14 % of the SO_2 criterion. Exceedances of the longer term (annual average) criteria for these pollutants have not been measured at this AQMS.

Concentrations of particulate matter (PM_{10} and $PM_{2.5}$) have been measured to be in exceedance of the relevant 24-hour criteria at the Bringelly AQMS in the period 2015 to 2019, with some exceedances being significant. Exceedances are generally a result of regional dust storms, or bushfires, and the impact of the 2019 bushfire emergency is clearly seen in the monitoring record. Concentrations of particulate matter measured at the Bringelly AQMS are not atypical of the local area or wider Sydney region.

Given the fact that the study area is prone to the effects of bushfires and hazard reduction burns, consideration at the detailed design stage should include measures to reduce smoke exposure in buildings and public spaces.

Figure 3 Long-term 1-hour average NO_2 concentrations – Bringelly AQMS – 2015 to 2019

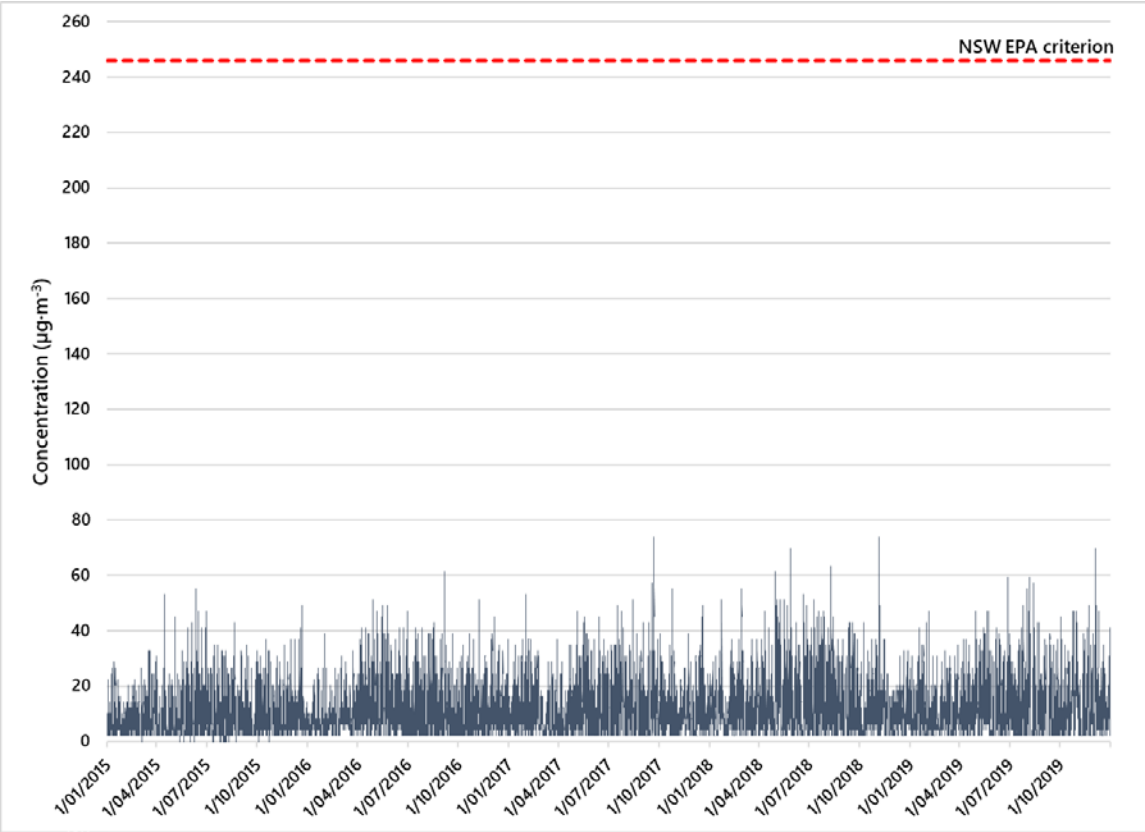


Figure 4 Long-term 1-hour average SO_2 concentrations – Bringelly AQMS – 2015 to 2019

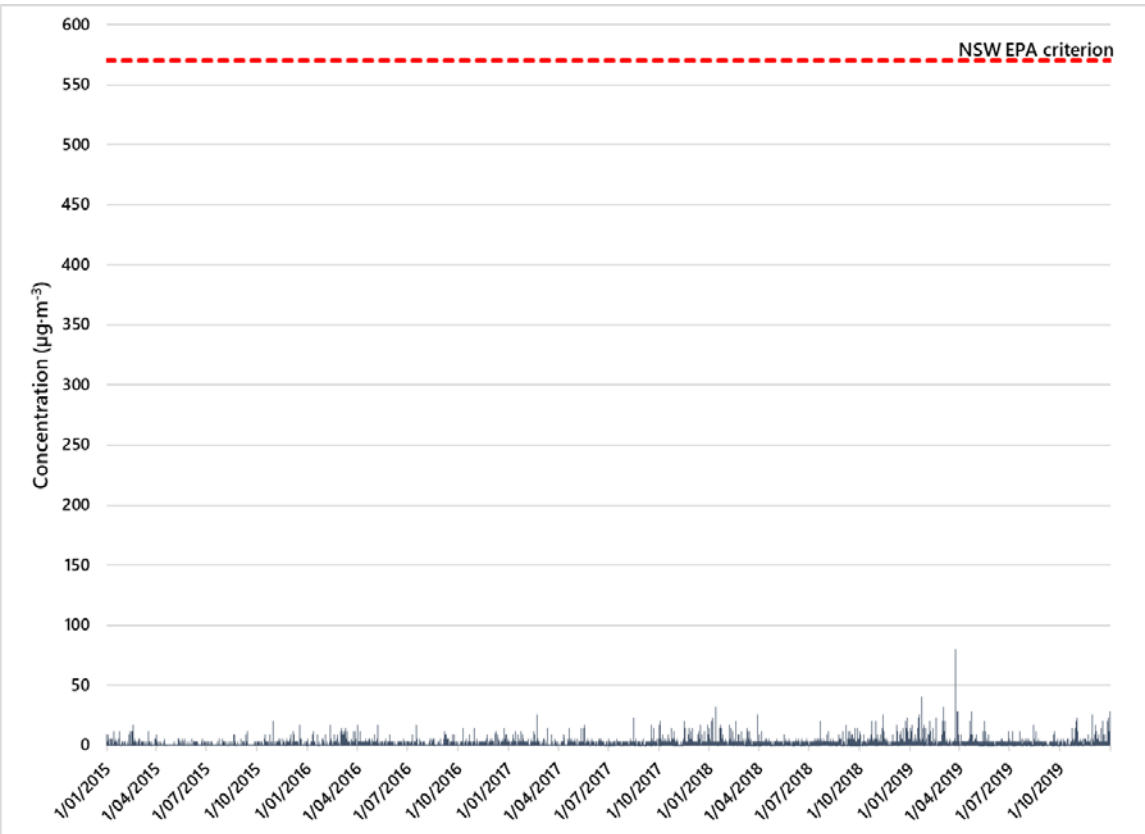


Figure 5 Long-term 24-hour average PM_{10} concentrations – Bringelly AQMS – 2015 to 2019

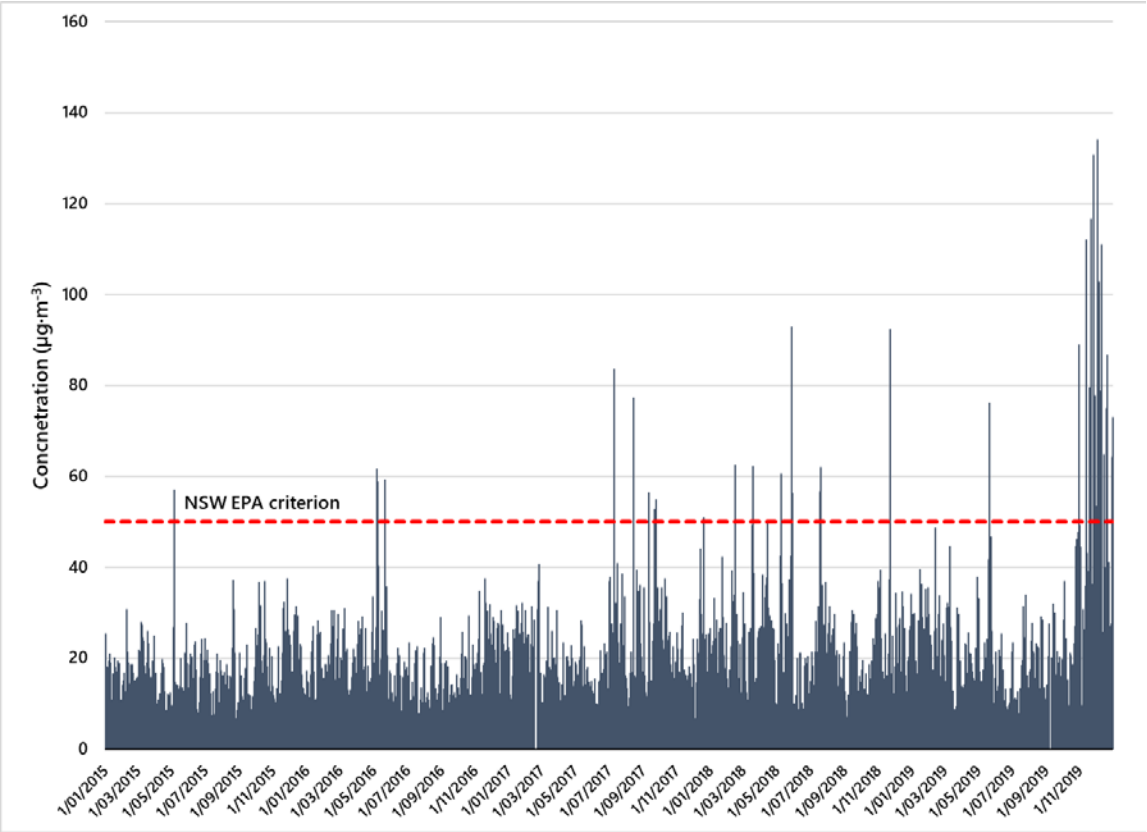
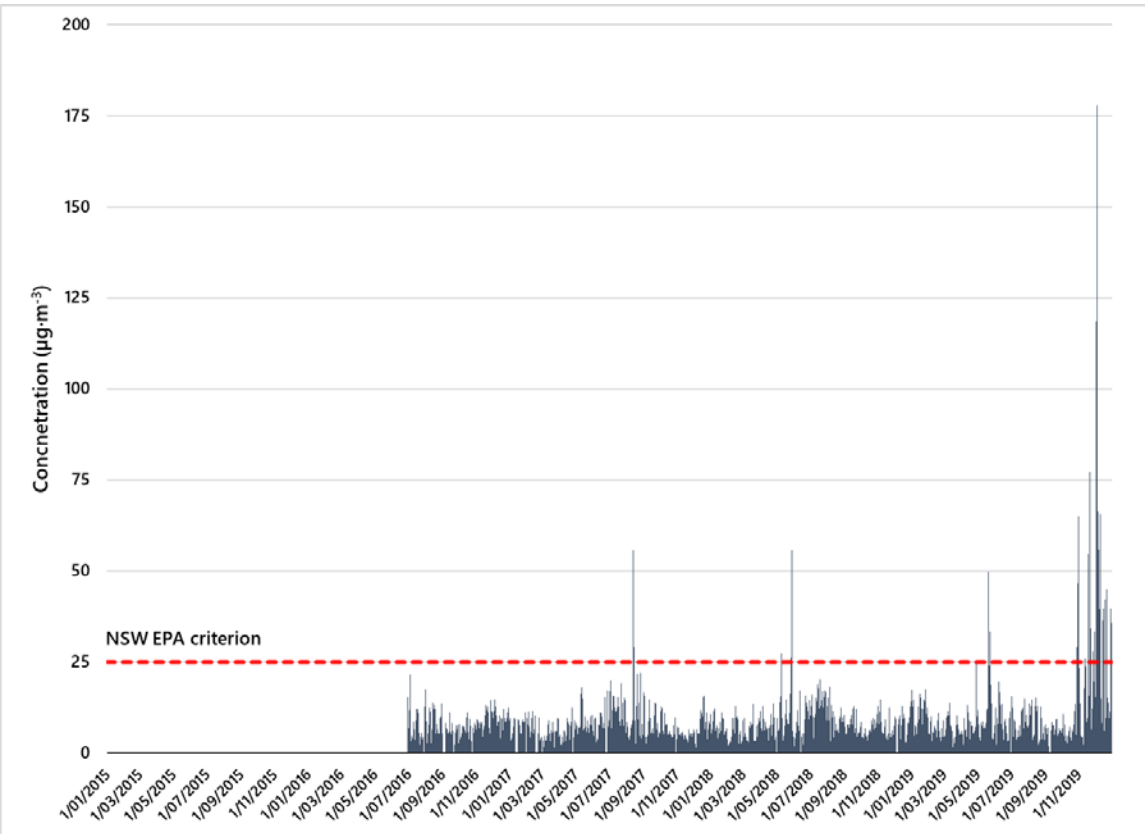


Figure 6 Long-term 24-hour average $PM_{2.5}$ concentrations – Bringelly AQMS – 2015 to 2019

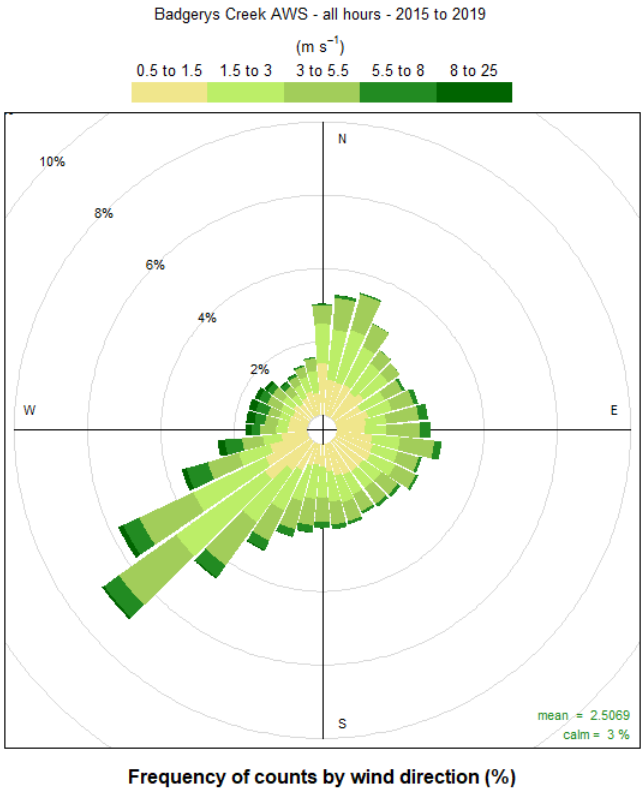


2.2 Meteorology

General meteorological conditions for the study area have been derived from data collected by the Bureau of Meteorology (BoM) at the Automatic Weather Station (AWS) at Badgerys Creek (ID 67108), which is located within the boundary of the study area.

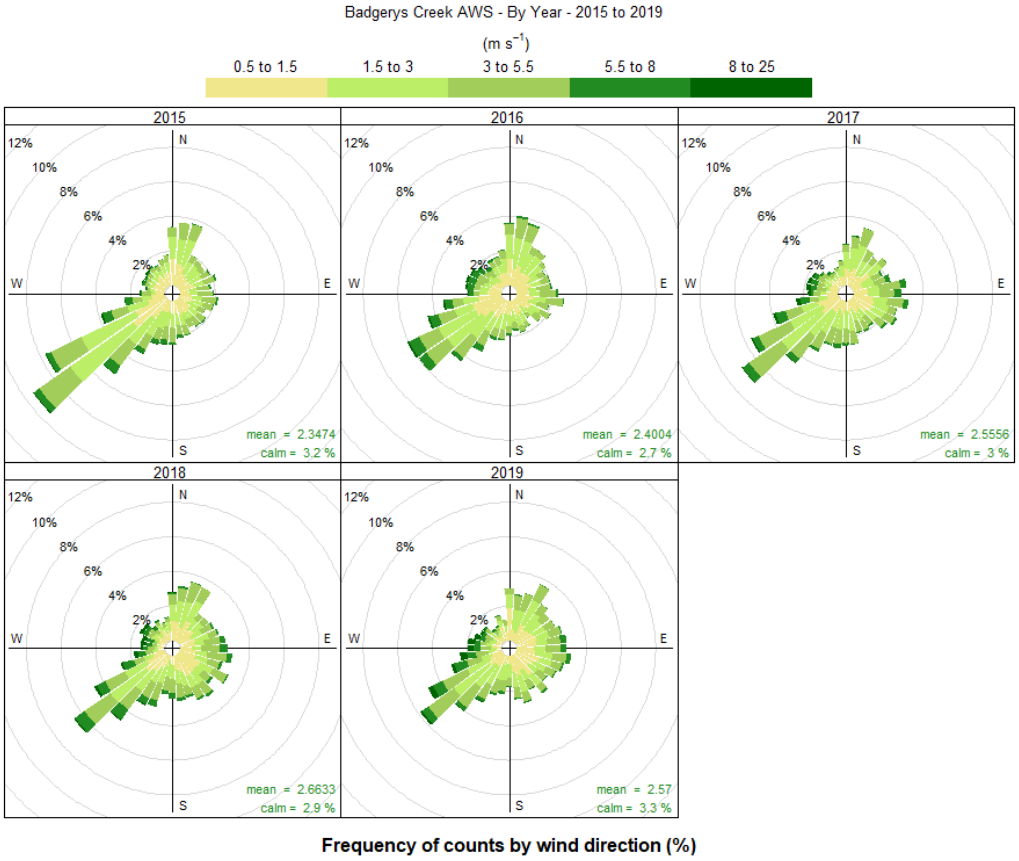
The prevailing wind conditions at Badgerys Creek AWS over the period from 2015 to 2019 are presented in **Figure 7**. **Figure 8** additionally presents the annual wind roses for the years 2015 to 2019 sequentially for information purposes only.

Figure 7 Long-term wind rose – Badgerys Creek AWS – 2015 to 2019



Source: Northstar Air Quality Pty Ltd

Figure 8 Annual wind roses – Badgerys Creek AWS – 2015 to 2019



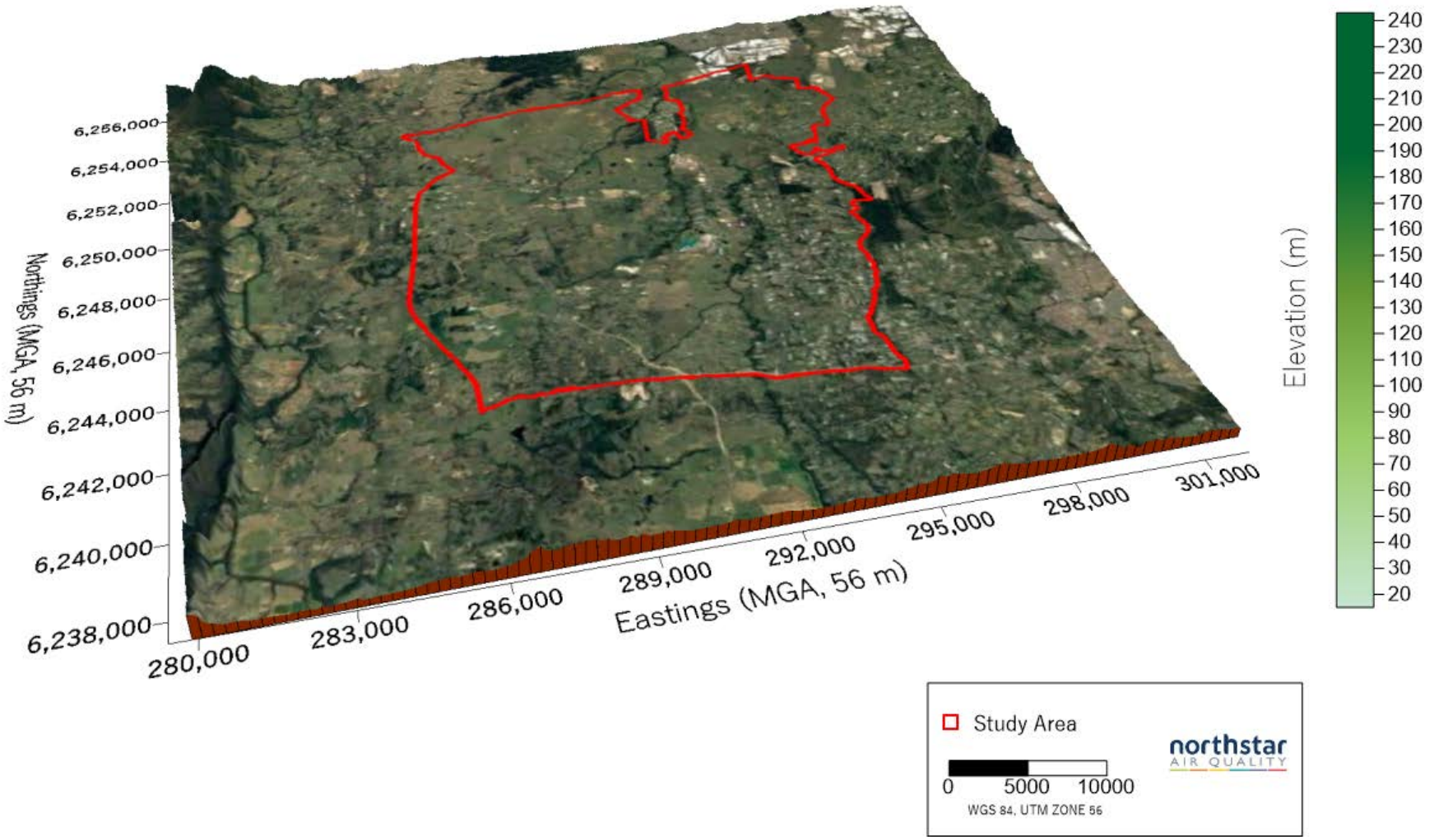
Source: Northstar Air Quality Pty Ltd

2.3 Topography

The topography of the study area is illustrated in **Figure 9**.

The relief across the study area is generally flat, as may be expected for the site of an airfield. The height across the study area ranges from approximately 30 m Australian Height Datum (AHD) to 110 m AHD.

Figure 9 Existing conditions – topography



Source: Northstar Air Quality Pty Ltd

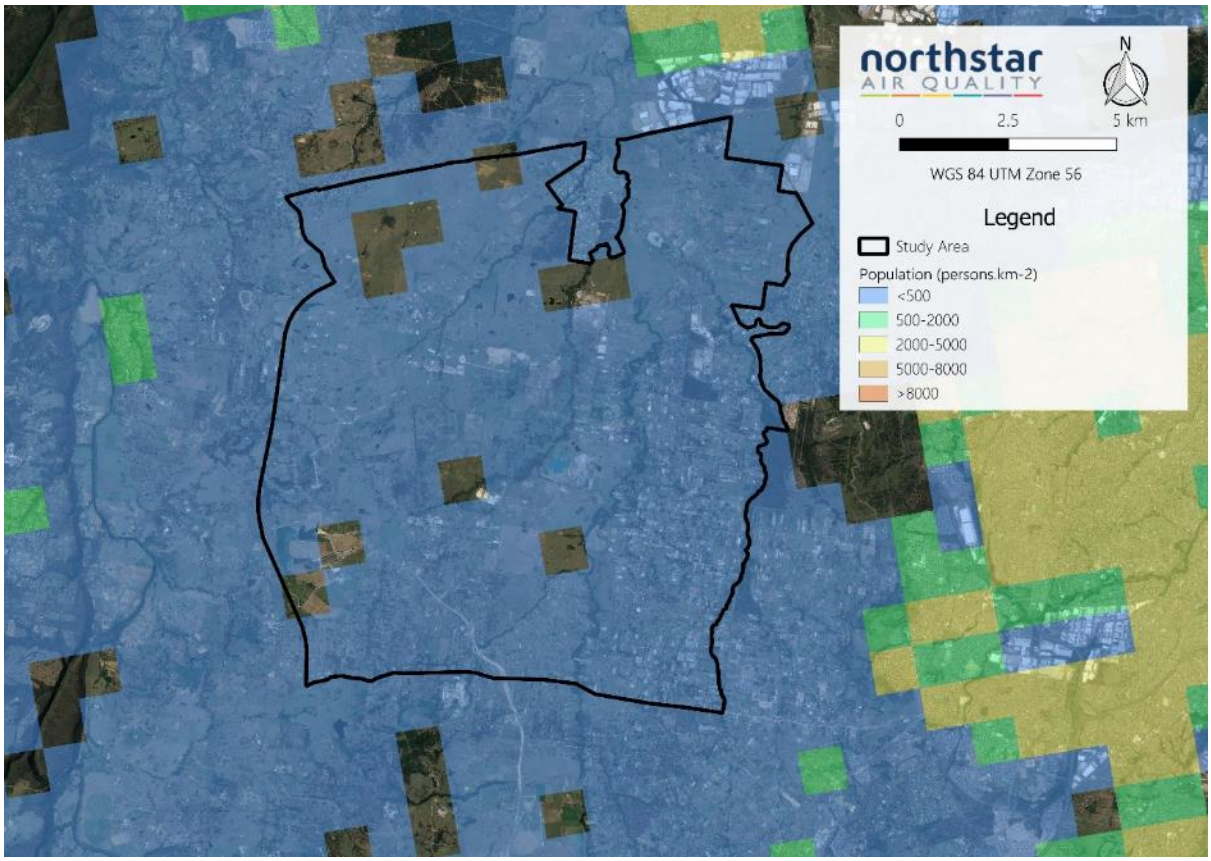
2.4 Population

Population density data based on the 2016 census have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre (km^2) grid, covering mainland Australia (ABS, 2017). For clarity, the ABS use the following categories to analyse population density (persons·km^{-2}):

- Very high >8,000
- High >5,000
- Medium >2,000
- Low >500
- Very low <500
- No population 0

Using ABS data in the GIS, the population density of the study area is presented in **Figure 10**. Existing population density across the study area is very low (<500 persons·km^{-2}).

Figure 10 Existing conditions – population density

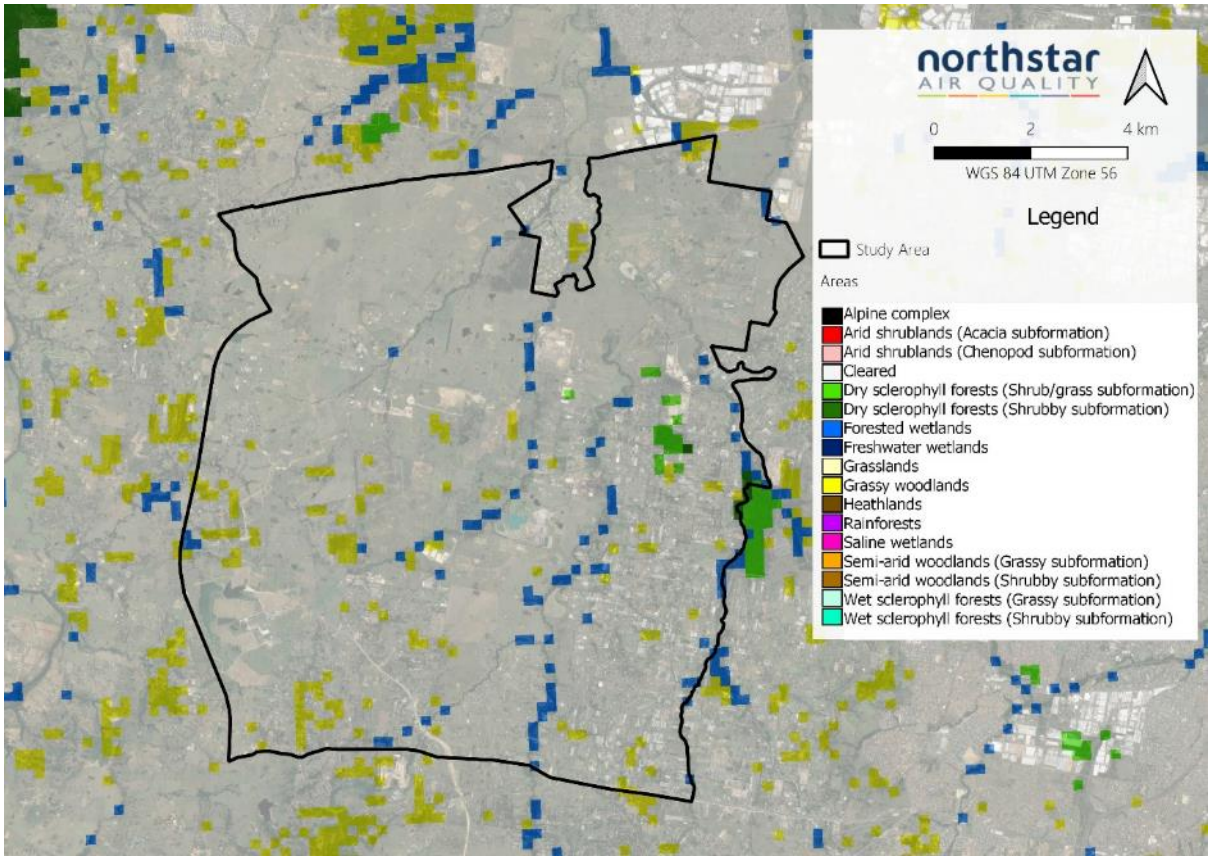


Source: Northstar Air Quality Pty Ltd

2.5 Vegetation

Vegetative ground cover is not typically considered in air quality studies but can affect near-ground wind speeds and turbulence, which are factors that can change risks of air pollutant exposure under certain circumstances. Vegetation type is an input for the Level 1 odour assessment procedure for poultry farms (see **Section 3.3.2**) and therefore the vegetation type covering the study area is provided in **Figure 11** below, as determined from (DPIE, 2012). The majority of the land across the study area is categorised as cleared land, with small areas of grassy woodlands, freshwater wetlands, and smaller areas of shrubby subformation forested areas.

Figure 11 Existing conditions – vegetation



Source: Northstar Air Quality Pty Ltd (DPIE, 2017)

3 METHODOLOGY

This baseline air quality and odour risk assessment has been performed using a risk assessment procedure, in accordance with the general requirements of ISO 31000 (International Organization for Standardisation (ISO) 31000:2018 'Risk management – Guidelines') and incorporating a methodology adopted from former NSW Department of Environment and Conservation's *Technical Framework: Assessment and management of odour from stationary sources in NSW* (DEC, 2006) and its associated *Technical Notes* (DEC, 2006).

For the purposes of this study, risk is evaluated as $\boldsymbol{risk = sensitivity \times impact\ magnitude}$.

These terms are defined in the following sections, which also provide clarification on how this report has applied observed conditions of baseline sensitivity and impact magnitude to those definitions.

3.1 Definitions

3.1.1 Sensitivity

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with a scale from 'very high' to 'low', as defined in **Table 2**. Given that the definitions may be applied to air quality and odour pollutants with respective exposure times ranging from 3-seconds, 1-hour to 24-hour, and annual average exposure standards, the definitions need to be broad enough to be adaptable to a range of pollutants and the time over which a member of the community may reasonably be expected to be present at those locations. For example, it is reasonable to assume a member of the community would be at a place of residence for a 24-hour period, but not so at a place of employment, at which a person may be assumed to be located for around 8-hours over a typical working day.

The definition applied may also need to consider the level of amenity that may be reasonably expected at those locations, for example, the level of amenity at a place of residence would be higher than on agricultural land or at an industrial park.

The sensitivity of receptors has been applied with cognisance of the above factors and includes an element of interpretation and balance.

Table 2 Methodology - sensitivity of receptors

Sensitivity		Descriptions
4	Very high	• Receptors are highly sensitive to changes in the air quality / odour environment. • Areas may be typified by extended (day-long) exposure times and/or an expectation of high amenity values. • Typical examples may include residential areas, health care facilities, retirement homes
3	High	• Receptors have a high sensitivity to changes in the air quality / odour environment. • Areas may be typified by working-day exposure times and/or an expectation of high amenity values. • Typical examples may include commercial zones, recreation facilities, schools, high-end office space (banking etc).
2	Medium	• Receptors have a medium sensitivity to changes in the air quality / odour environment. • Areas may be typified by up to working-day exposure times and an expectation of reasonable amenity values commensurate with the land-uses. • Typical examples may include agricultural and environmental conservation spaces, industrial zones.
1	Low	• Receptors have a low sensitivity to changes in the air quality / odour environment. • Areas may be typified by short-term exposure times and a low expectation of amenity values. • Typical examples may include infrastructure land uses, open and undeveloped land.

In this study, sensitivity has been assessed using the following resources:

- Liverpool Local Environmental Plan (2008);
- Penrith Local Environmental Plan (2010); and,
- Current preferred scenarios for the initial Aerotropolis Precincts, as developed in September 2020.

The application of land sensitivity 'classification' to the study area is presented in **Section 4.1**.

Existing land use classifications, as derived from the Liverpool LEP and Penrith LEP have been applied as outlined in **Table 3**. Descriptors of potential future land uses have been extracted from the draft precinct plans (see **Section 4.1** for further details on how these data have been applied).

Table 3 Methodology – application of sensitivity

Sensitivity		Descriptions	
		Existing land use	Future land use
4	Very high	Land uses assessed include: • R2: Low density residential • R5: Large lot residential • RU5: Village	Land uses assessed include: • Mixed use • Luddenham Village • Plaza
3	High	Land uses assessed include: • B3: Neighborhood centre • E4: Environmental living • RE1: Public recreation	Land uses assessed include: • Education use • Development land • Specialised centre • Centres
2	Medium	Land uses assessed include: • E2: Environmental conservation • E3 Environmental management • IN1: General industrial • RU1: Primary production • RU2: Rural landscape • RU4: Primary production small lots • RU6: Transition	Land uses assessed include: • Light industrial use • Enterprise use • Productive land • Parks and open spaces • Environmental lands • Flexible employment
1	Low	Land uses assessed include: • SP1: Special activities • SPS2: Infrastructure	Land uses assessed include: • Special use (airport) • Roads and streets

3.1.2 Magnitude

Impact magnitude is a descriptor for the predicted scale of potential impact to the air quality / odour environment. This study is not an impact assessment, and as such 'impact' is in reference to the graduated scale of potential impacts only, to enable the more significant hazards to be identified.

In this study, impact magnitude is evaluated on a scale from ''major' to 'negligible' as defined in **Table 4**.

Table 4 Methodology - impact magnitude

Magnitude		Descriptions
4	Major	Potential impact magnitude may cause statutory objectives / standards to be exceeded. Potential magnitude of impacts may generate nuisance complaints, resulting in regulatory action.
3	Moderate	Potential impact may give rise to a perceivable health and/or amenity impact. Potential magnitude of impacts may generate nuisance complaints, likely to require management but not result in regulatory action.
2	Slight	Potential impact may be tolerated. Potential magnitude of impacts is not likely to generate nuisance complaints.
1	Negligible	Potential impact magnitude is unlikely to cause significant consequences. Potential magnitude of impacts is unlikely to generate nuisance complaints and is likely to only be perceptible within the site boundary.

In this study, impact magnitude has been assessed using the following resources (in no order):

- DPIE NSW Planning Portal – Major Projects[7]
- NSW RMS - Infrastructure Projects[8]
- Australian Government DAWE National Pollutant Inventory[9];
- NSW Environment Protection Licence register[10];
- Desk-top surveying, including use of Google Earth[11] and Six Maps[12];
- Northstar Air Quality site surveying (see **Section 3.3.1**).

The application of magnitude 'classification' to the study area is presented in **Section 4.2**. Magnitude of potential impacts have been applied as outlined in **Table 5**.

[7] https://www.planningportal.nsw.gov.au/major-projects
[8] https://www.rms.nsw.gov.au/projects/index.html
[9] www.npi.gov.au
[10] https://apps.epa.nsw.gov.au/prpoeoapp/
[11] https://www.google.com/earth/
[12] https://maps.six.nsw.gov.au/

For a number of activities, reference has been made to the buffer distances. That value is considered to be sufficiently robust for the purposes of this baseline assessment. Similarly, a surrogate buffer distance has been adopted for road infrastructure developments based upon Department of Planning (NSW DoP, 2008) guidelines.

Table 5 Methodology – application of impact magnitude

Magnitude		Application
4	Major	Distance from activity/source is less than 50 % of the identified separation distance for the respective activity / facility (see **Sections 3.3.2** to **3.3.7**)
3	Moderate	Distance from activity/source is greater than 50 % and less than 75 % of the identified separation distance for the respective activity / facility
2	Slight	Distance from activity/source is greater than 75 % and less than 100 % of the identified separation distance for the respective activity / facility
1	Negligible	Distance from receptors to land use is greater than 100 % of the identified separation distance for the respective activity / facility

3.1.3 Risk

The risk matrix provided in **Table 6** illustrates how the definition of the impact magnitude and sensitivity of receptors interact to produce impact risk (composite risk index). For example, an impact of *slight* magnitude at a *medium* sensitive receptor location would be determined to be of ***medium*** risk (significance).

Table 6 Methodology - odour risk matrix

Sensitivity \ Magnitude		Negligible (1)	Slight (2)	Moderate (3)	Major (4)
		[Defined by Table 4]			
Very High (4)	[Defined by Table 2]	Medium (4)	Medium (8)	High (12)	High (16)
High (3)		Medium (3)	Medium (6)	Medium (9)	High (12)
Medium (2)		Low (2)	Medium (4)	Medium (6)	Medium (8)
Low (1)		Low (1)	Low (2)	Medium (3)	Medium (4)

'Risk' derived through this methodology is presented on a simplified three-point scale:

High	A high risk that requires management, through changes to impact magnitude and sensitivity
Medium	An intermediate risk, and recommendations are to reduce risk as low as practicable through changes to impact magnitude and/or sensitivity
Low	No further management required, although risks should be managed

The relative risk is provided as a dimensionless product of the defined values attributed to receptor sensitivity and impact magnitude.

The determined risk (sometimes termed 'significance') may be used to highlight the relative environmental risk and to highlight the general requirement for the application of controls and mitigation. It is noted that the above approach is designed to provide an overall impact risk and is not intended to represent the defining determination for the requirement for mitigation and control. The determined risk methodology is not designed to exclude impacts with a lower determined significance from receiving mitigation and control treatments, in accordance with the principle of reducing environmental impacts to the maximum extent practicable.

3.2 Assessment of Sensitivity

As outlined above in **Section 3.1.1**, this baseline risk assessment has derived a scale of sensitivity from existing, approved, and proposed land use classifications.

This has been performed to assess land sensitivity for two cases:

- Existing baseline (which includes existing and approved land use classification); and,
- Future baseline (which overlays the former with the draft precinct plans).

It is understood that the future baseline sensitivity assessment may change as the precinct-planning process develops.

The maps illustrating land sensitivity for the (i) existing baseline and (ii) future baseline are illustrated in **Section 4.1**.

3.3 Assessment of Magnitude

The assessment of magnitude in this study has referenced numerous inputs, including:

- Desktop source identification to provide a starting point for the identification of existing potential sources;

- Site surveying, to provide a ground-truthing of the assumptions derived from the desk-top mapping exercise;
- Review of the DPIE major projects website to identify approved developments and developments currently under assessment that may influence this risk-assessment process;
- Review of the Transport for NSW infrastructure projects website to identify proposed and approved roads construction and upgrades;
- Identification of the relevant buffer distances applicable to the identified activities; and,
- Mapping in GIS to provide impact magnitude graduations, as outlined in **Section 3.1.2**.

3.3.1 Source Identification

Through desktop research and site surveying, the existing and approved sources (activities) within the study area have been identified. This has also included any sources outside of the study area but within a notional 500 m distance, so that the potential influence of those activities could be assessed.

Field work was undertaken on site over two days on 24 July and 30 July 2020. This was performed by investigating all accessible roads inside the study area and recording all observations of potential air quality and/or odour sources. Additional information was also recorded for poultry farms to determine the ventilation type used, operational status and number of sheds on the property, if possible. It is important to note that due to limitations associated with the field survey such as restricted access to private property, operational information for a number of poultry sheds was unable to be obtained. For the purposes of this study these sheds have been categorised as fan-ventilated for conservatism (i.e. an assumed larger potential of odour pollution).

The desktop assessment was performed to identify any remaining sources that were unable to be observed on site. A desktop survey was conducted to identify remaining sources and to confirm the locations of sources already recorded. Additional online research included reviewing documents published by DPIE, RMS and the *Protection of the Environment Operations Act* (POEO) public register among other online services.

The DPIE's Major Projects website provides information regarding the current status of state significant development applications (whether under assessment or approved). A number of these projects are located in the proposed project area and are identified as follows:

Approved:

- The Northern Road Upgrade

Proposed:

- The M12 Motorway
- Brandown Resource Recovery Facility

- SUEZ Kemps Creek Advanced Resource Recovery Technology Facility
- Sydney Metro: Western Sydney Airport Line

It should be noted that the Brandown and SUEZ facilities are existing operations that have proposed modifications to their operational activities.

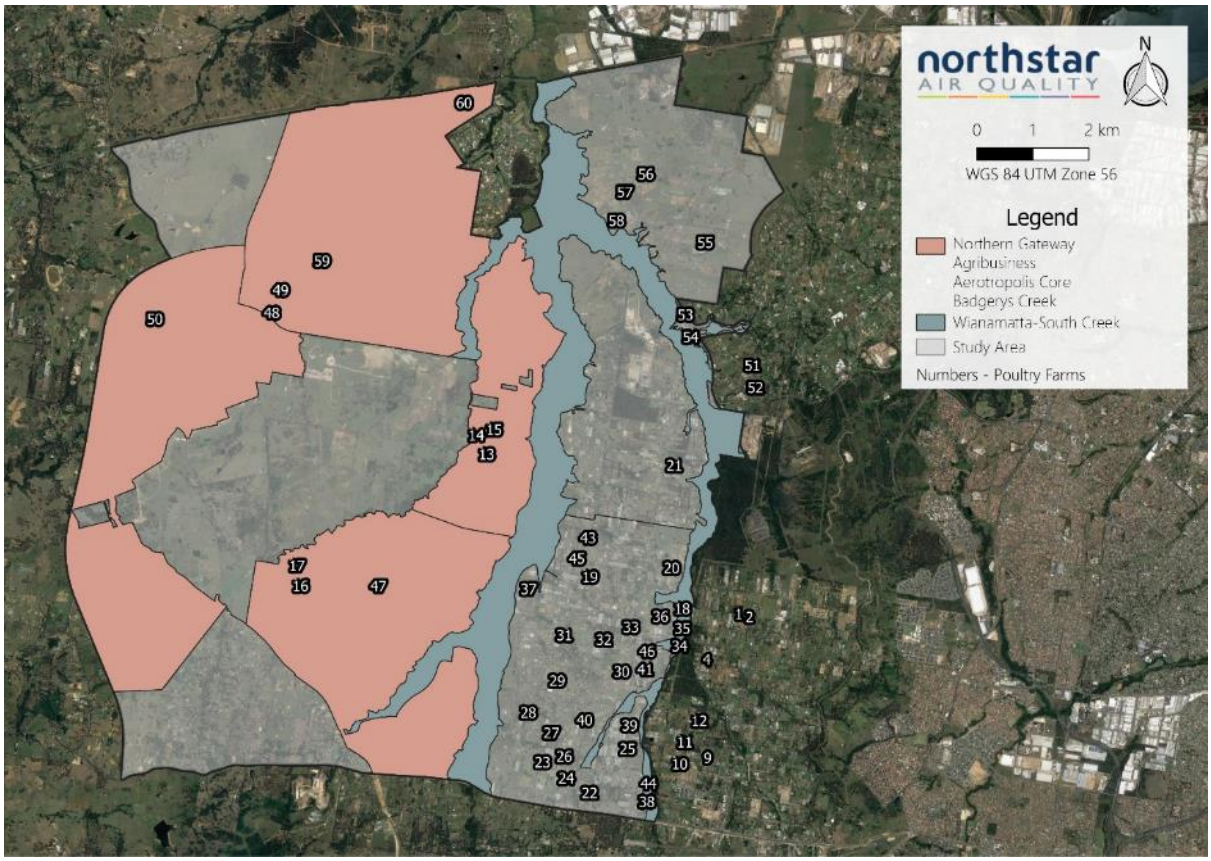
The sources identified in the described surveying processes include a range of commercial and industrial activities, including agriculture, waste management and extractive industries, and infrastructure. The relevant separation distances applied to each identified source group is discussed sequentially in the following subsections, and a detailed summary all sources and their locations have been provided in **Appendix A.**

3.3.2 Assessment of Separation Distances - Agriculture

The identified agricultural land uses with potential to impact upon air quality and odour are limited to poultry farming operations.

The identified locations of all identified poultry farming activities are illustrated in **Figure 12** and detailed in **Appendix A**.

Figure 12 Locations of identified poultry farm activities



Source: Northstar Air Quality Pty Ltd

The procedure for the assessment of required separation distances from poultry farming activities is provided in the document '*Technical framework: Assessment and management of odour from stationary sources in NSW* and its associated *Technical Notes* (DEC, 2006).

The Technical Notes provide a detailed method for the calculation of site-specific separation distances associated with broiler (meat) poultry farms (termed a 'Level 1' assessment). The following provides a description of that method and the source of data used in calculations for the purposes of this study.

Calculation and inputs

$$D = (N)^{0.71} \times S$$

where:

N = Number of standard broiler chicken shed units (SBCSU) (1 SBCSU is equivalent to 22 000 broiler chickens)

D = Separation distance in metres between the closest points of the broiler chicken sheds and the most sensitive receptor or impact location

S = Composite site factor = $S1 \times S2 \times S3 \times S4 \times S5$. Site factors $S1, S2, S3, S4$ and $S5$ relate to shed design, receptor, terrain, vegetation, and wind frequency respectively.

The tabulated outputs of the (DEC, 2006) calculations are presented in **Appendix B**.

Standard broiler chicken shed units

The number of SBSCU for each identified farm was calculated assuming that 22 000 birds would be housed in a shed with dimensions 100 m by 13 m (1 300 m^2, 16.9 chickens·m^2) as per (DEC, 2006). The area of identified sheds in each farm was estimated, and the corresponding number of chickens per farm was calculated with the result divided by 22 000 to determine the SBSCUs per farm.

Shed factor S1

The shed factor S1 depends on how the shed is ventilated and is determined from **Table 7**. If some sheds will have controlled fan ventilation and some have natural ventilation, S1 is proportional to the numbers of each type of shed.

Table 7 Shed factor, S1

Shed type	Value
Controlled fan ventilation without barriers	980
Controlled fan ventilation with barriers	690
Natural ventilation	690

Source: from Table 5.1 of the Technical notes (DEC, 2006)

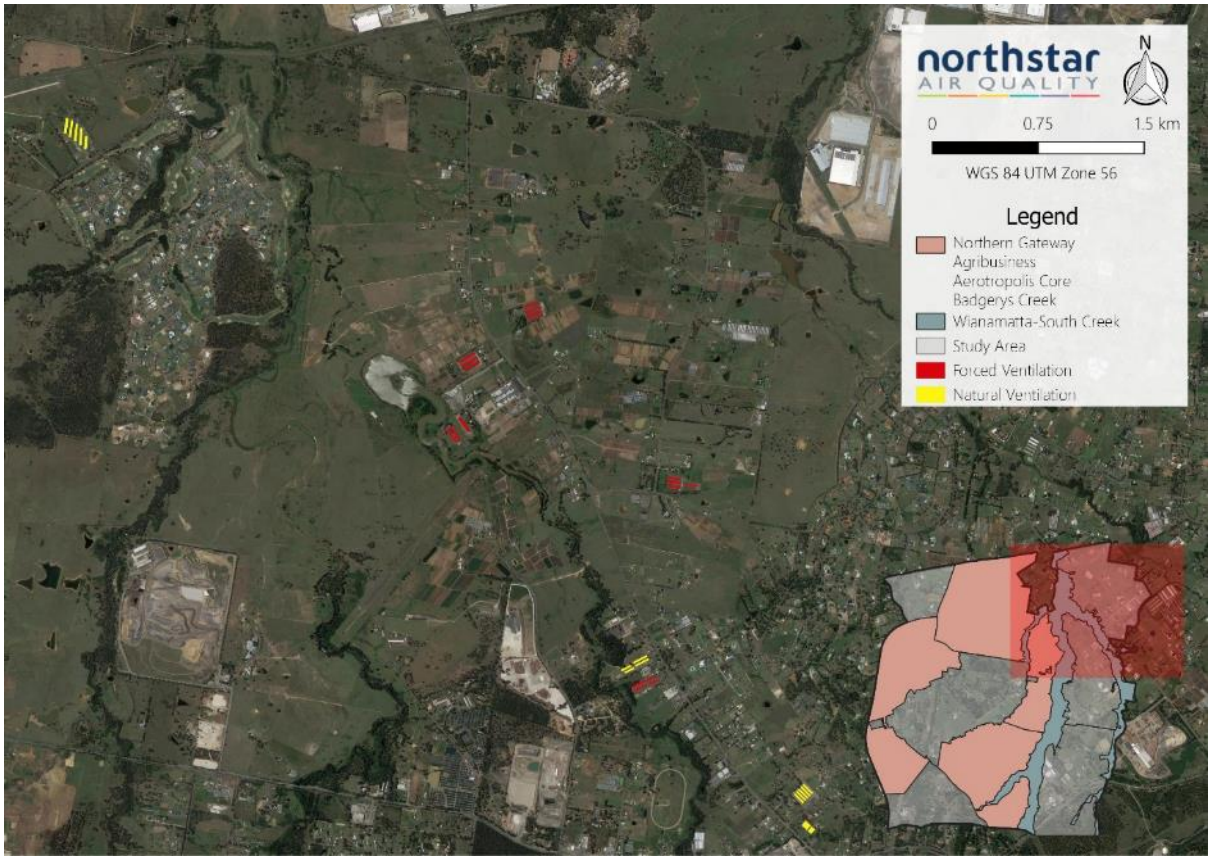
The shed type for each operational broiler farm has been determined through the site survey. Where the shed type could not be determined due to obstructions in view or access, the shed type has been taken to be 'controlled fan ventilation without barriers' to ensure that an appropriately conservative assessment is provided.

A map of the identified operating poultry farms with each shed type noted is presented sequentially by area in **Figure 13** to **Figure 17**.

As illustrated, the majority of poultry sheds are situated in the south-eastern region of the study area and beyond, with the remaining sheds relatively evenly distributed across the other areas. Sheds identified as naturally ventilated are represented by the colour yellow and fan ventilated sheds in red.

A more detailed summary of shed types and locations is provided in **Appendix A**.

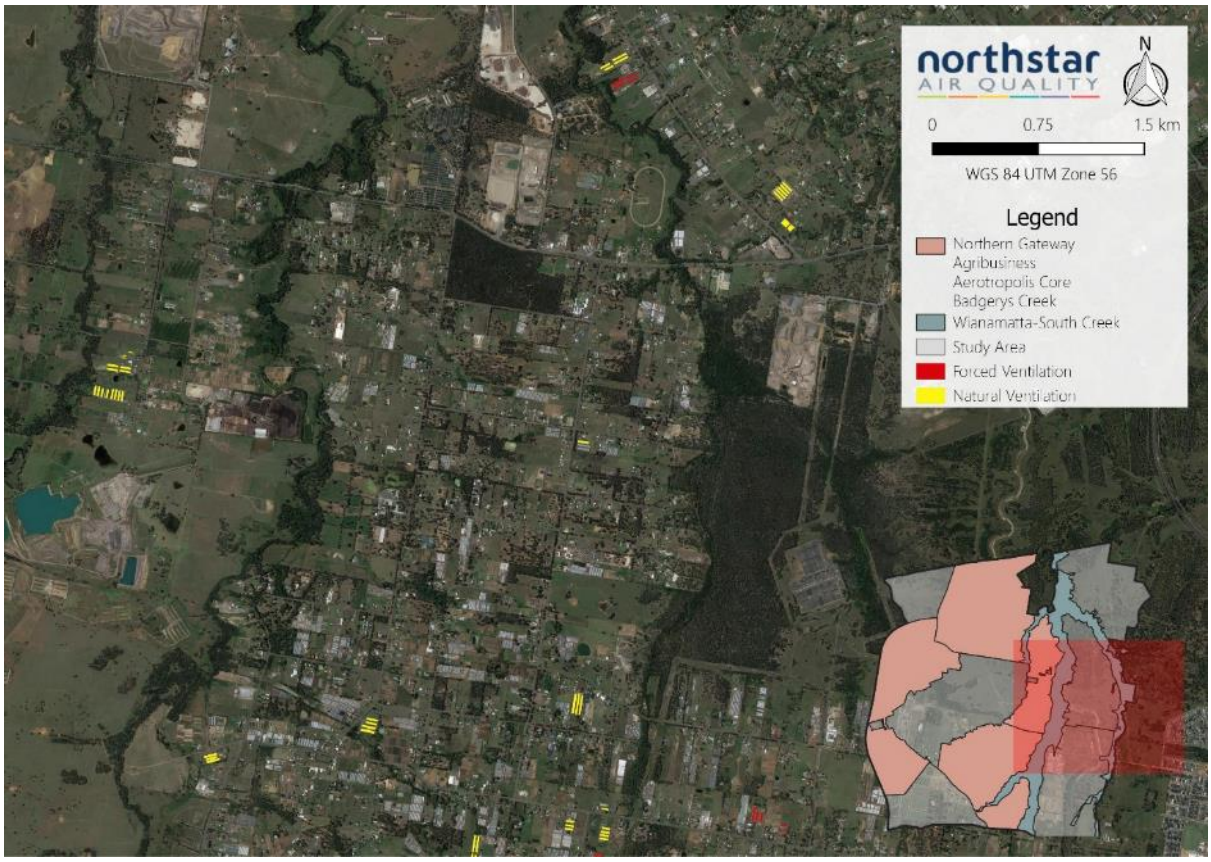
Figure 13 Distribution of adopted shed type (north east)



Source: Northstar Air Quality Pty Ltd

The naturally ventilated sheds seen in the top north-west corner of **Figure 13** are located in the Northern Gateway precinct, whereas the sheds located in the bottom south-east corner are positioned just outside the study area. All other sheds are evenly distributed across the Mamre Road and Wianamatta-South Creek precincts.

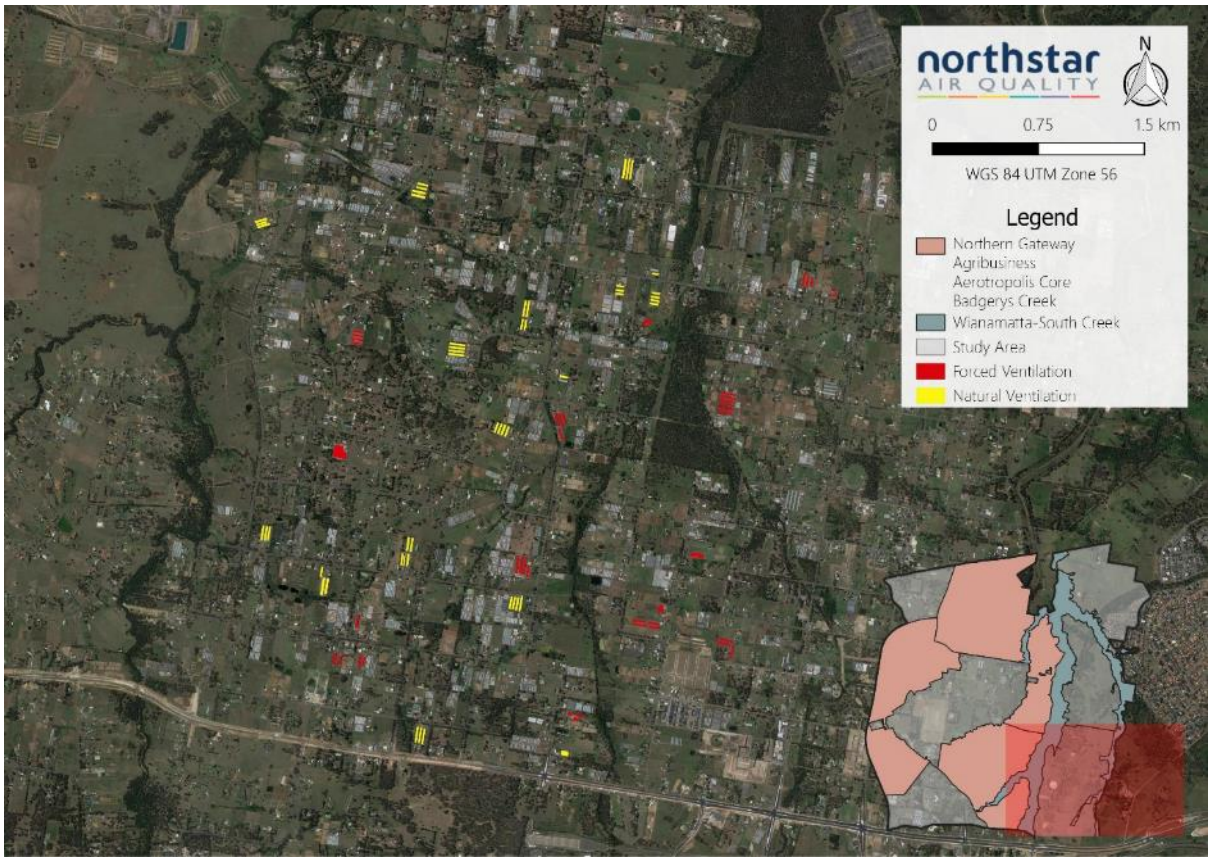
Figure 14 Distribution of adopted shed type (east)



Source: Northstar Air Quality Pty Ltd

Poultry farm sheds seen at the top of **Figure 14** are also illustrated in **Figure 13**. The naturally ventilated sheds located to then east of the map are found in the Badgerys Creek precinct. The fan ventilated sheds displayed towards the bottom right of the map are located outside the study area and all other sheds are positioned in the Rossmore precinct.

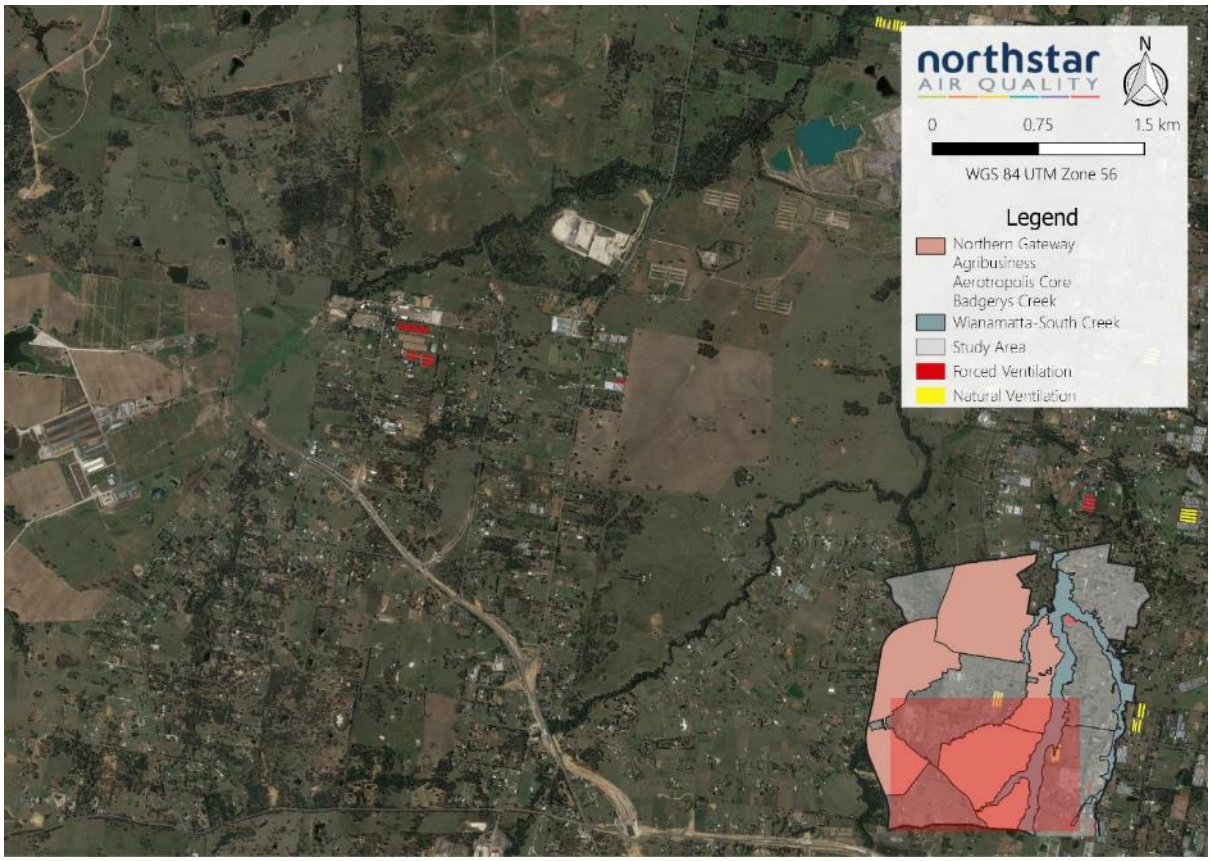
Figure 15 Distribution of adopted shed type (south east)



Source: Northstar Air Quality Pty Ltd

The forced ventilated sheds seen on the eastern portion of **Figure 15** are located outside of the study area. All remaining sheds are found in the Rossmore precinct.

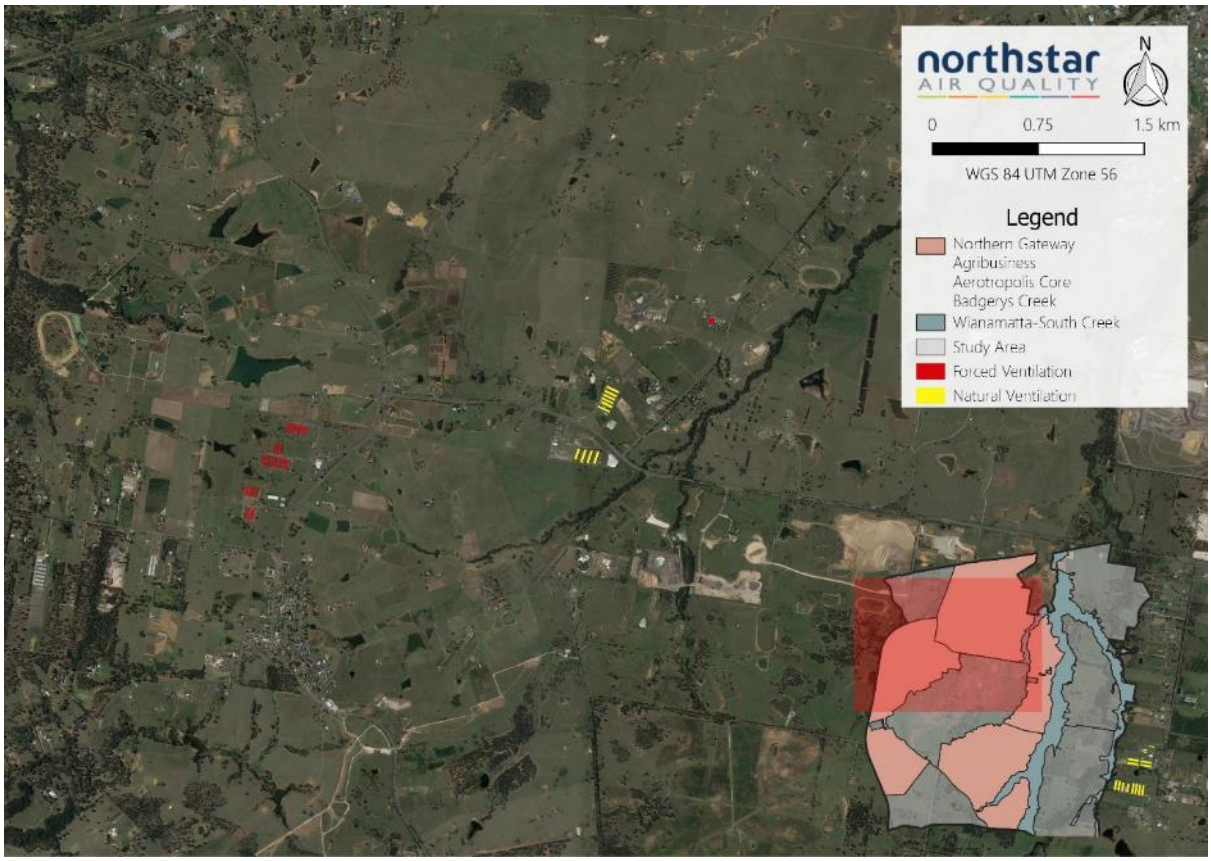
Figure 16 Distribution of adopted shed type (south)



Source: Northstar Air Quality Pty Ltd

The naturally ventilated sheds seen on the eastern portion of **Figure 16** are also illustrated in **Figure 15** and are located in the Rossmore precinct of the study area. The remaining forced ventilated sheds are positioned in the Aerotropolis Core precinct.

Figure 17 Distribution of adopted shed type (north west)



Source: Northstar Air Quality Pty Ltd

The forced ventilated sheds located to the west, as well as the most southerly naturally ventilated sheds displayed in **Figure 17** are located in the Agribusiness precinct of the study area. The remaining poultry farm sheds are found in the Northern Gateway precinct.

Receptor factor S2

The receptor factor S2 varies depending on the likely impact area and is determined from **Table 8**.

For the purposes of this study, the receptor factor would vary depending on the proposed land use (e.g. urban land, commercial areas, environment and recreation, agribusiness, transport corridor). Impacts from broiler farms may also move through multiple land use / receptor types.

For the initial purposes of this baseline assessment, the receptor type adopted is associated with large towns (S2=1.05), being the value which will yield the largest separation distance, and appropriate for the baseline risk assessment.

Table 8 Receptor factor, S2

Receptor type	Value
Large towns, greater than 2 000 persons	1.05
Medium towns, 500 – 2 000 persons	0.75
Medium towns, 125- 500 persons	0.55
Small towns, 30 – 125 persons	0.45
Small towns, 10 – 30 persons	0.35
Single rural residence	0.30
Public area (occasional use)	0.05(A)

Source: from Table 5.2 of the Technical notes (DEC, 2006)

Notes: (A) The value for a public area would apply to areas subject to occasional use. Higher values may be appropriate for public areas use frequently or sensitive in nature, such as frequently used halls and recreation areas. These should be assessed individually (DEC, 2006)

Terrain factor S3

The terrain factor S3 varies according to topography and is determined from **Table 9**.

Table 9 Terrain factor, S3

Terrain	Value
Valley drainage zone	2.0
Low relief	1.2
Flat	1.0
Undulating county between broiler chicken farm and receptor	0.9
High relief or significant hills and valleys between broiler chicken farm and receptor	0.7

Source: from Table 5.3 of the Technical notes (DEC, 2006)

Topography is discussed in **Section 2.3**. For the purposes of this study, topography is assumed to be flat (S3=1).

Vegetation factor S4

The vegetation factor S4 varies according to vegetation density and is determined from **Table 10**. The vegetation density is assessed by the effectiveness with which the vegetation stand will reduce odour by dispersion.

Table 10 Vegetation factor, S4

Terrain	Value
Crops only, no tree cover	1.0
Few trees, long grass	0.9
Wooded country	0.7
Heavy timber	0.6
Heavy forest (both upper and lower storey)	0.5

Source: from Table 5.4 of the Technical notes (DEC, 2006)

The application of the vegetation factor associated with each poultry farm has been determined through site survey, review of aerial imagery and through review of vegetation cover information for a 200 m grid covering the study area (DPIE, 2012) (see **Section 2.5**). This data indicates that currently, none of the criteria associated with any category other than 'crops only, no tree cover' are met given the cleared nature of much of the study area, or the lack of any vegetation with minimum extents in the direction of receptors of 400 m. Given the area is to be developed, the vegetation category of 'crops only, no tree cover' would persist into the future (S4=1).

Wind frequency factor S5

The wind frequency factor S5 is determined from **Table 11**. The wind speed and direction varies annually and diurnally (that is by the season and by the hour of the day). Although there is generally one direction that is the most frequently observed (prevailing wind), the wind direction usually blows from all directions at some time.

The wind can be classed as **high frequency** towards the receptor if the wind is blowing towards the receptor (± 40°) with a frequency of at least 60 % of the time for all hours over a whole year.

The wind can be classed as **low frequency** towards the receptor if the wind is blowing towards the receptor (± 40°) with a frequency of less than 5 % of the time for all hours over a whole year.

Table 11 Wind frequency factor, S5

Wind frequency	Value
High frequency towards receptor (greater than 60 %)	1.5
Normal wind conditions	1.0
Low frequency towards receptor (less than 5 %)	0.7

Source: from Table 5.5 of the Technical notes (DEC, 2006)

Wind conditions surrounding the study area have been characterised through review of meteorological monitoring data collected by the Australian Government Bureau of Meteorology (BoM) at their automatic weather station (AWS) operated at Badgerys Creek (station # 067108). Data are available from the Badgerys Creek AWS from 1995 to present day, although data for the five-year period 2015 to 2019 has been examined for the purposes of this study (see **Section 2.2**).

The review of those data indicates that the prevailing winds at the Badgerys Creek AWS do not meet the criteria for either high or low frequency winds and are therefore categorised at normal (S5=1).

3.3.3 Assessment of Separation Distances - Extractive Industry

Suitable separation distances associated with extractive industries have been determined through review of:

- Separation distance guidelines for air emissions (ACT Government, 2018);
- Evaluation distances for effective air quality and noise management (EPA South Australia, 2016); and,
- Recommended separation distances for industrial residual air emissions (EPA Victoria, 2013).

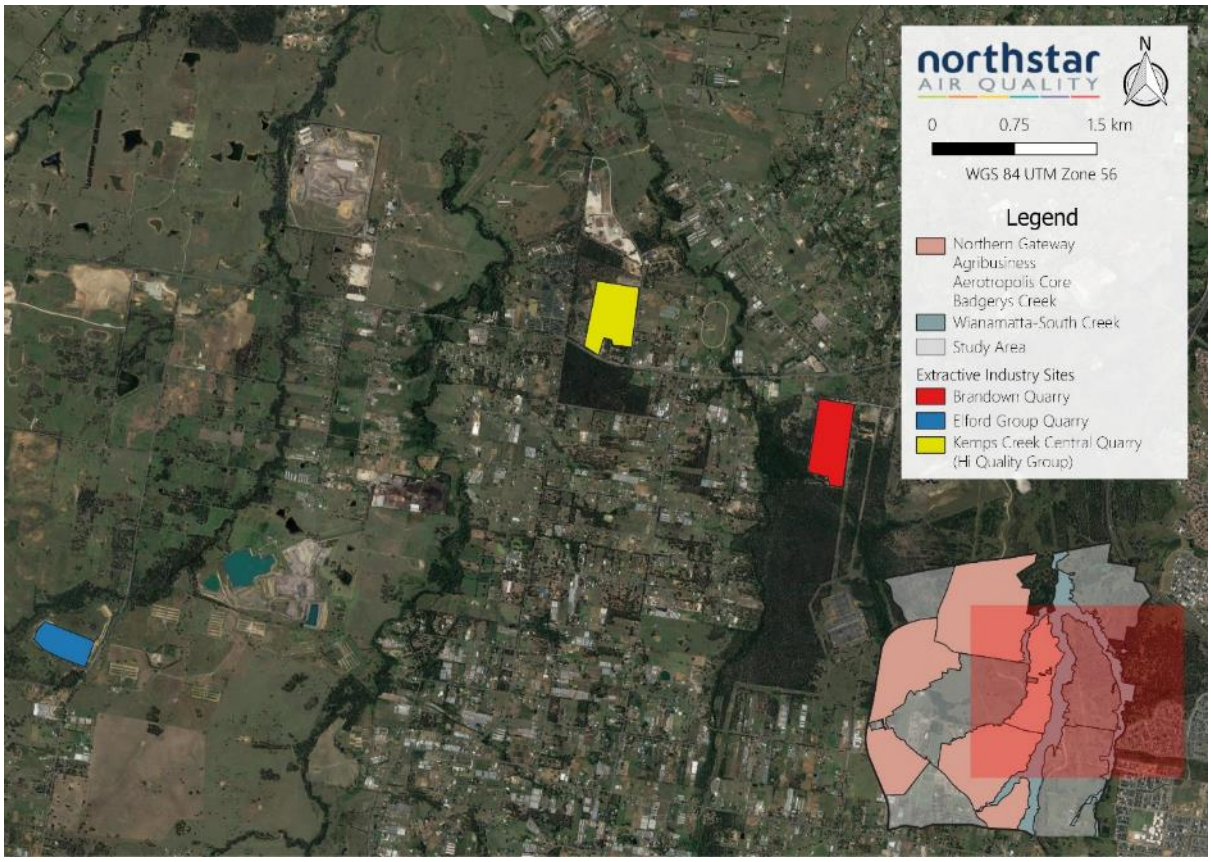
NSW DPIE and EPA do not publish any guidance with respect to separation distances, other than the odour technical framework and notes (DEC, 2006).

The extractive industries identified within and surrounding the study area are quarrying activities located as shown in **Figure 18**, which includes:

- Kemps Creek Central Quarry (Hi Quality Group), 1513 – 1519 Elizabeth Drive;
- Brandown Quarry, 90 Range Road, Kemps Creek; and,
- Elford Group, 320 Badgerys Creek Road, Badgerys Creek.

These are detailed in **Appendix A**.

Figure 18 Locations of extractive activities



Source: Northstar Air Quality Pty Ltd

The locations of extractive activities are displayed above in **Figure 18**. Brandown Quarry (shown in red) is located just outside the study area whereas Kemps Creek Central Quarry (shown in yellow) is positioned in the Kemps Creek precinct. The Elford Group Quarry (shown in blue) seen towards the western extent of the map is located in the Aerotropolis Core precinct.

The separation distances relevant to that activity are presented in **Table 12**. Based on review of the activities being performed, the following separation distances are of relevance.

Table 12 Separation distances for relevant extractive industries

Source	Industry type	Definition	Sub class	Separation distance (m)
(ACT Government, 2018)	Extractive industries	Operations involving extraction, or extraction and processing (by crushing, grinding, milling or separating into different sizes by sieving, air elutriatian or in any other manner), of sand, gravel, stone, shell, shale, clay or soil	With blasting	500
			Without blasting	300

Source	Industry type	Definition	Sub class	Separation distance (m)
(EPA South Australia, 2016)	Extractive industries	The main concerns are noise and dust, which are generated at sites from excavation areas, haul roads, raw feed and product stockpiles, processing and screening plants, blasting, rock crushers, mobile screening plants, crushing, grinding and milling	-	Individual assessment
(EPA Victoria, 2013)	Quarry	Quarrying, crushing, screening, stockpiling and conveying of rock	With blasting	500
			Without blasting	250
			With respirable crystalline silica	500

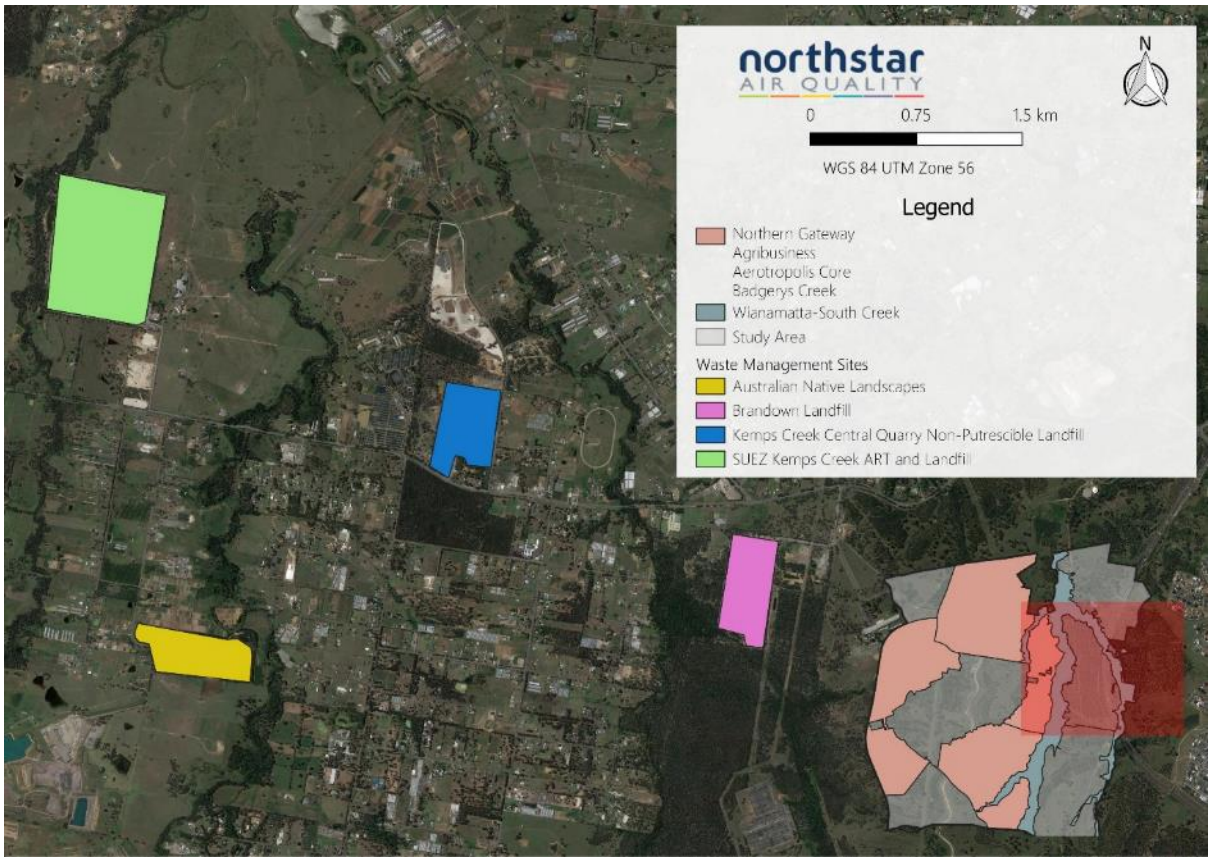
3.3.4 Assessment of Separation Distances - Waste Management

The waste management activities identified within and surrounding the study area are located as shown in **Figure 19**, and include:

- SUEZ Kemps Creek Advanced Resource Recovery Technology Facility, 1725 Elizabeth Drive, Kemps Creek;
- SUEZ Kemps Creek Landfill, 1725 Elizabeth Drive, Kemps Creek;
- Brandown Resource Recovery Facility, 90 Range Road, Kemps Creek;
- Brandown Landfill, 90 Range Road, Kemps Creek;
- Kemps Creek Central Quarry Non-putrescible landfill (Hi Quality Group), 1513 – 1519 Elizabeth Drive; and,
- Australian Native Landscapes, 210 Martin Road, Badgerys Creek.

These are detailed in **Appendix A**.

Figure 19 Locations of identified waste management activities



Source: Northstar Air Quality Pty Ltd

The locations of waste management activities are displayed above in **Figure 19**. Australian Native Landscapes (shown in yellow/mustard) is located on the border of the Badgerys Creek and Wianamatta-South Creek precincts. Both SUEZ activities (shown in red and green) are found in the Badgerys Creek precincts and the Kemps Creek Central Quarry (shown in blue) is located in the Kemps Creek precinct.

The separation distances relevant to those activities are presented in **Table 13**. Based on review of the activities being performed, the following separation distances are of relevance.

Table 13 Separation distances for relevant waste management industries

Source	Industry type	Definition	Sub class	Separation distance (m)
(ACT Government, 2018)	Landfill	Municipal solid waste and commercial and industrial waste landfill activities	-	500
	Materials recovery facility	Collecting, dismantling, treating, processing, storing or recycling used or surplus materials	-	300
	Waste transfer station	Collection, consolidation, temporary storage, sorting or recovering refuse or used materials prior to transfer for disposal or use elsewhere	-	300

Source	Industry type	Definition	Sub class	Separation distance (m)
	Composting works	Compost is produced at a rate of >200 tonnes per year	-	1 000
		Compost is produced at a rate of >20 % <200 tonnes per year	-	300
(EPA South Australia, 2016)	Waste or recycling depots	Landfill	-	500
		Other (e.g. transfer stations, resource recovery facilities)	-	300
	Composting works	> 200 tonnes per year	-	1 000
		> 20 and < 200 tonnes per year	-	300
		< 20 tonnes per year	-	100
(EPA Victoria, 2013)	Green waste compositing facility	Receiving, storing temporarily and transferring putrescible solid and green waste	-	See further guidelines
	Landfill	Landfills used for the discharge or deposit of solid wastes (including solid industrial wastes) onto land, except premises with solely land discharges or deposits, used only for the discharge or deposit of mining wastes, and in accordance with the Extractive Industries Development Act 1995 or the Mineral Resources (Sustainable Development) Act 1990	-	See further guidelines
	Materials recovery and recycling facility	Collecting, dismantling, treating, processing, storing, recycling, or selling used or surplus materials	-	Case by case
	Transfer station	Collecting, consolidating, temporarily storing, sorting or recovering refuse or used materials before transfer for disposal or use elsewhere	-	250
	Green waste composting facility	Receiving, storing temporarily and transferring putrescible solid and green waste	-	See further guidelines

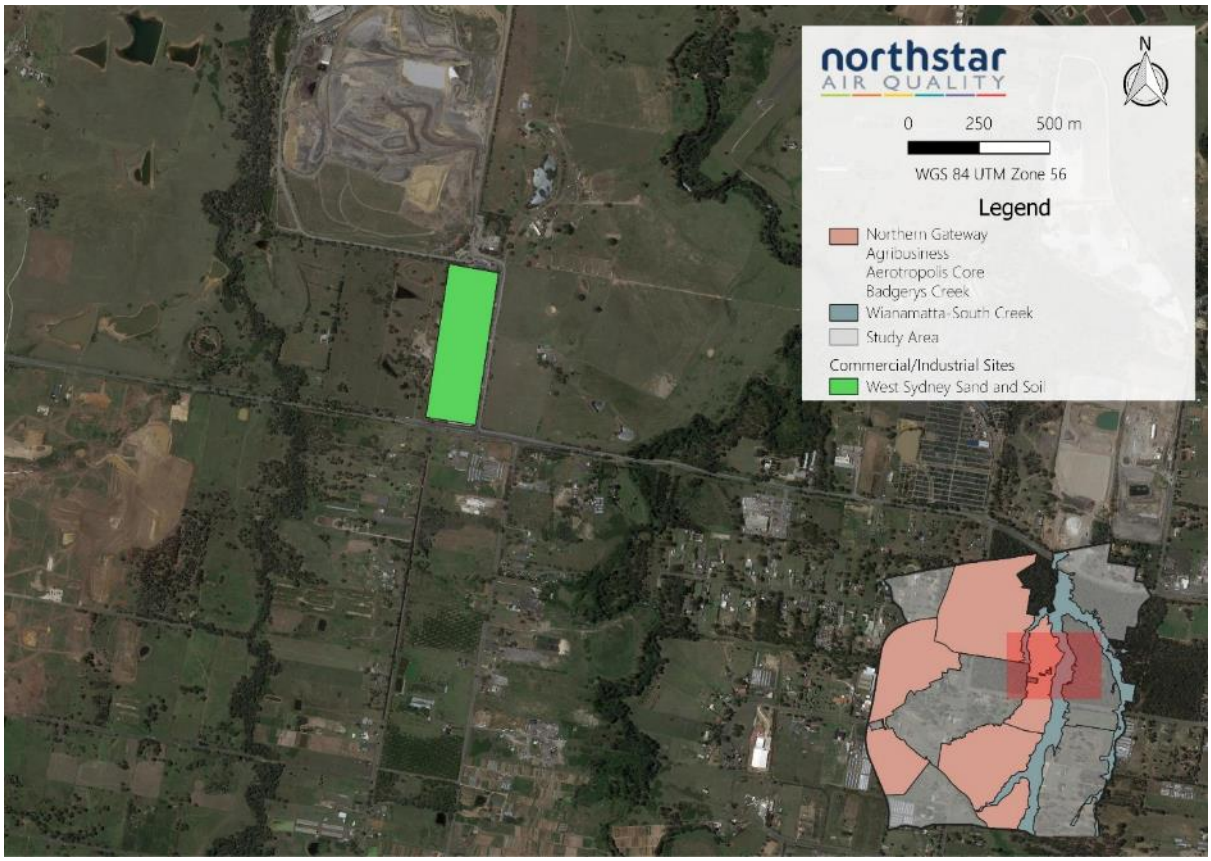
3.3.5 Assessment of Separation Distances - Commercial & Industrial

Other activities which have been identified in the area include:

- Brickworks (PGH Bricks, 2 Greendale Road, Bringelly);
- Concrete Batching Plant (80 Greendale Road, Bringelly); and,
- Landscape supplies (West Sydney Sand and Soil, 1725 Elizabeth Drive, Kemps Creek).

The location of the identified activities are illustrated in **Figure 20** and **Figure 21**. These are detailed in **Appendix A**.

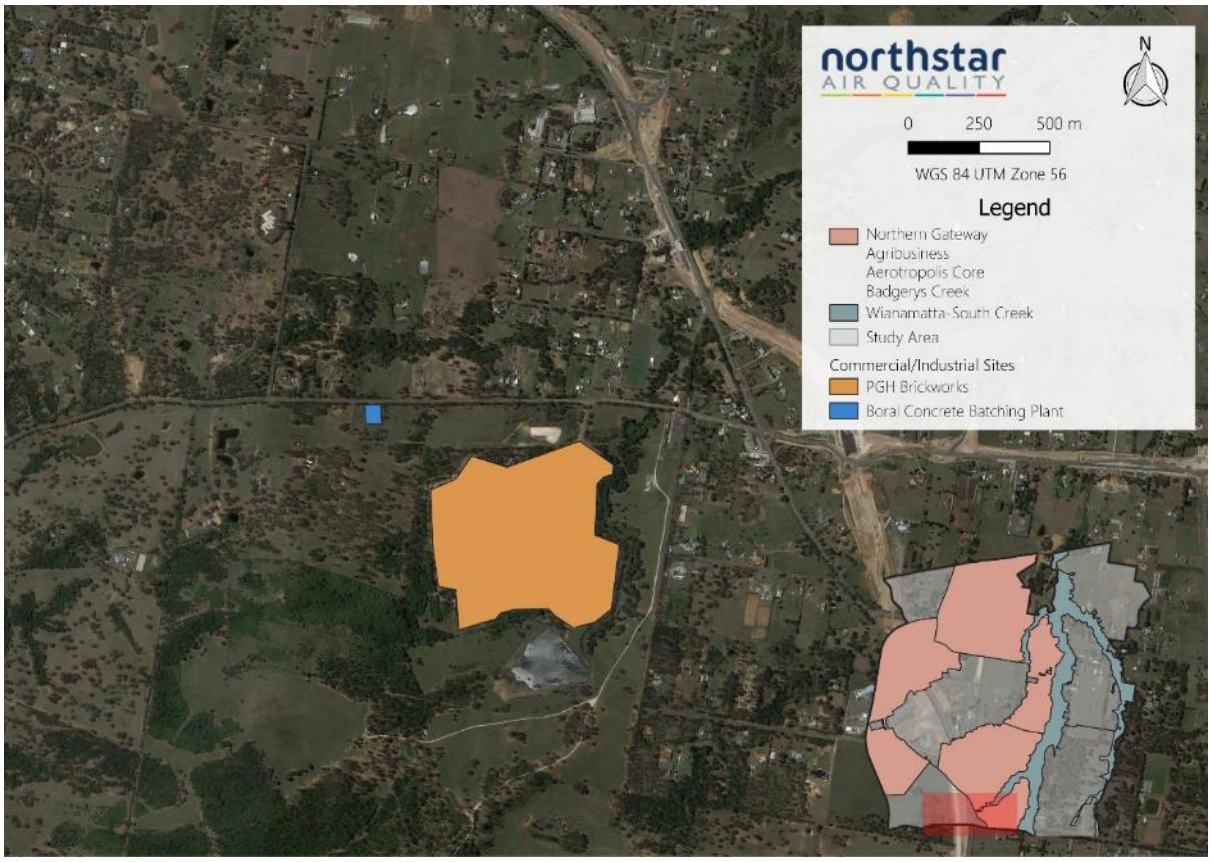
Figure 20 Locations of identified commercial and industrial facilities (north-east)



Source: Northstar Air Quality Pty Ltd

Figure 20 displays the location of West Sydney Sand and Soil (shown in green) which is found in the Badgerys Creek Precinct.

Figure 21 Locations of identified commercial and industrial facilities (south)



Source: Northstar Air Quality Pty Ltd

Figure 21 shows the locations of the PGH Brickworks (shown in brown) and the Boral Concrete Batching Plant (shown in blue) which are both positioned just outside the study area south of the Dwyer Road precinct.

The separation distances relevant to those activities are presented in **Table 14**. Separation distances for landscape supplies operations are assumed to be covered by those for materials recovery and recycling, where materials are stored and sold. Based on review of the activities being performed, the following separation distances are relevant.

Table 14 Separation distances for other relevant industries

Source	Industry type	Definition	Sub class	Separation distance (m)
(ACT Government, 2018)	Ceramic works	Works for the production of ceramics or ceramic products such as bricks, tiles, pipes, pottery goods, refractories or glass that are manufactured or are capable or being manufactured in furnaces or kilns fired by any fuel with a total capacity for the production of products exceeding 100 tonnes per year	-	500

Source	Industry type	Definition	Sub class	Separation distance (m)
	Concrete batching works	Works for the production of concrete or concrete products that are manufactured or capable of being manufactured by mixing cement, sand, rock, aggregate or similar materials with a total capacity for production exceeding 0.5 cubic metres per production cycle.	-	100
(EPA South Australia, 2016)	Ceramic works		-	750
	Concrete batching works		-	200
(EPA Victoria, 2013)	Brick, tile, pipe, and refractory manufacturing	Production of bricks, tiles, pipes, pottery goods or refractories, processed in dryers or kilns	>10 000 tonnes per year	250
	Concrete plant	Production of concrete	>5 000 tonnes per year	100

3.3.6 Assessment of Separation Distances – Infrastructure

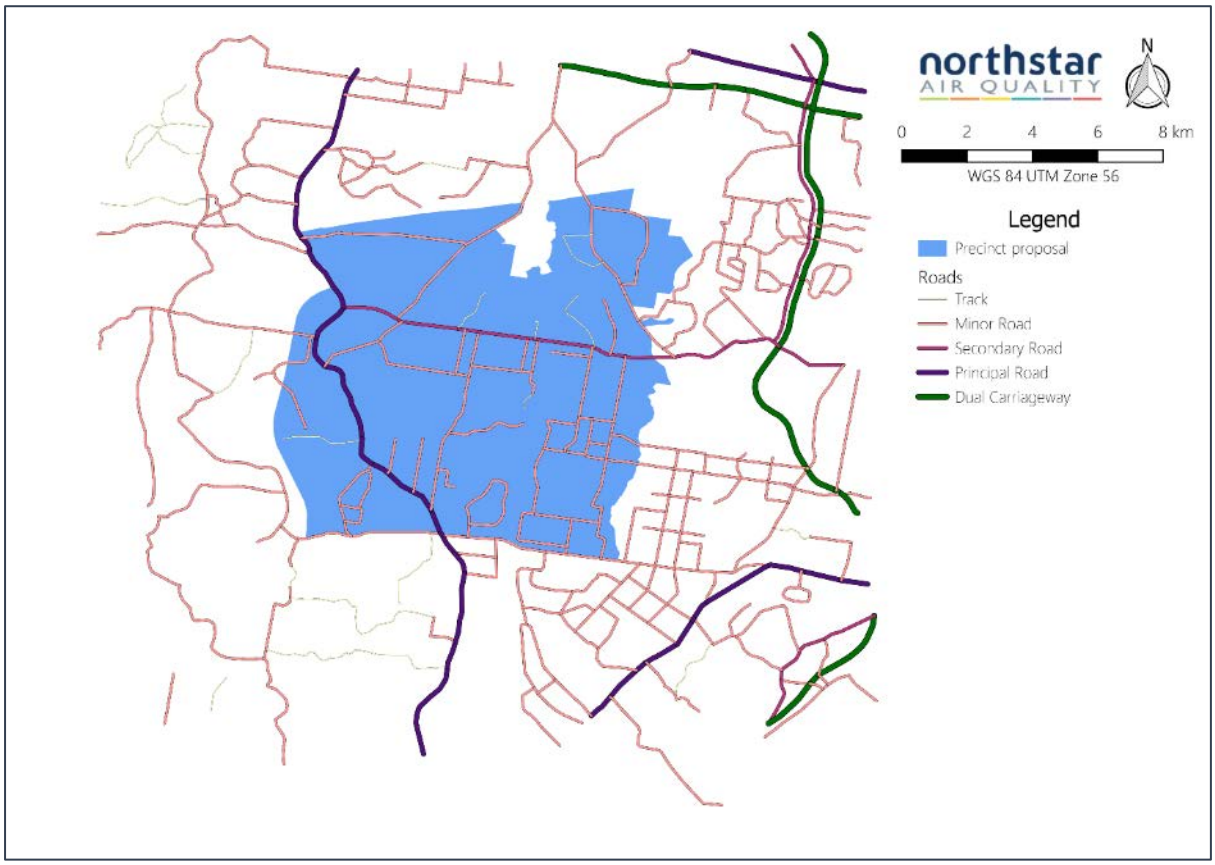
Identified infrastructure activities include:

- Road traffic along motorways and dual carriageways, principal and secondary roads; and,
- The proposed Airport.

Roads

With regard to existing road infrastructure, **Figure 22** below identifies the existing roads identified in the study area.

Figure 22 Identified existing roads in the assessment area



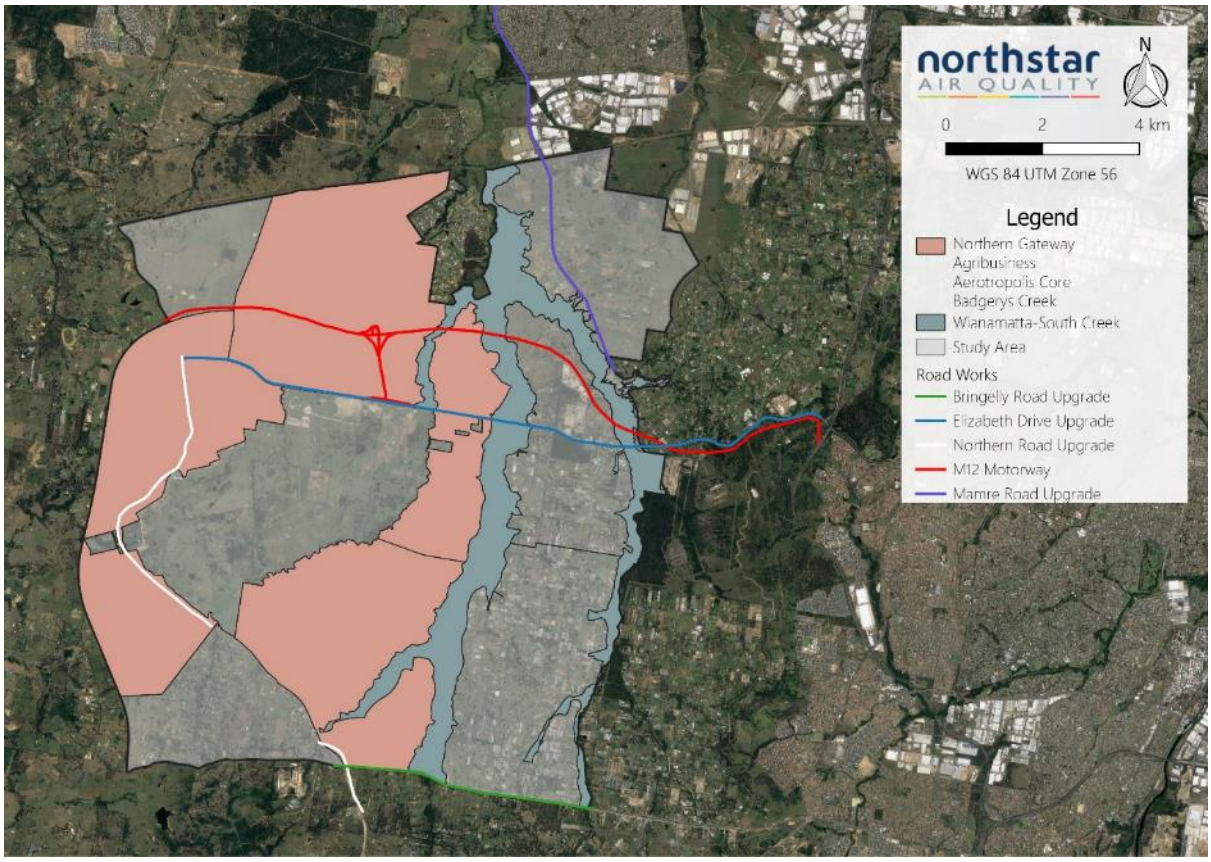
Source: Northstar Air Quality Pty Ltd

The additional approved road infrastructure developments identified include:

- The Northern Road Upgrade;
- M12 Motorway Construction;
- Elizabeth Drive Upgrade;
- Mamre Road Upgrade; and,
- Bringelly Road Upgrade.

These are illustrated in **Figure 23** overleaf.

Figure 23 Identified approved roads in the assessment area



Source: Northstar Air Quality Pty Ltd

As outlined in "*Development near rail corridors and busy roads -Interim Guideline*" (the Roads Guideline) (NSW DoP, 2008) air pollutant concentrations generated from road traffic exhaust emissions tend to decrease with distance from the road (i.e. kerbside). A relative decrease in the pollutant concentrations with respect to the distance from the road is shown in **Figure 24**, which is reproduced from Figure 4.4 of (NSW DoP, 2008).

Figure 24 Percentage of pollutant concentration shown relative to kerbside concentration of 100 %

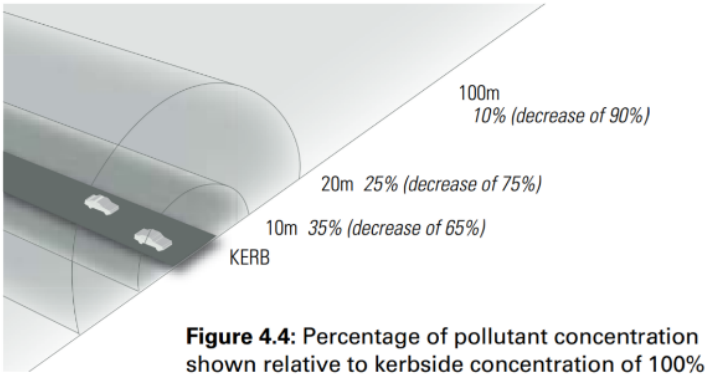


Figure 4.4: Percentage of pollutant concentration shown relative to kerbside concentration of 100%

Source: (NSW DoP, 2008)

For example, under the unfavourable dispersion conditions of temperature inversion and light winds (<1 metre per second) where little mixing occurs in the atmosphere, pollutant concentrations can be expected to reduce by around 65 % of roadside levels in the first 10 m from kerbside, and further pollutant concentration reductions occur as the distance from the road increases. At distances of approximately 100 m from the kerbside, road traffic generated pollutants would be expected to be 10 % of their kerbside concentrations.

It should be recognised that reductions in pollutant concentrations from the kerbside are associated with those generated by the traffic using the road only (i.e. do not account for background contributions). In the case of carbon monoxide (CO) and total oxides of nitrogen (NO_X), given the nature of land uses in which the study area is located, it is reasonable to assume that the significant contribution of emissions impacting upon the study area would be due to road traffic sources, and as such 100 % of the measured concentrations may be assumed to be associated with road traffic sources.

Generally, road-traffic pollutant emissions will tend to background concentrations within 200 m of kerbside, which has been adopted as the buffer for the purposes of this risk assessment.

Western Sydney International (Nancy-Bird Walton) Airport

With regard to the Western Sydney International (Nancy Bird Walton) Airport, separation distances associated with ground based activities (excluding aircraft operations) have been based on the anticipated fuel storage activities which are proposed near the perimeter of the site (see **Figure 25** as reproduced from the Western Sydney Airport EIS, Local Air Quality and Greenhouse Gas Assessment (PEL, 2016)). Further discussion on the potential separation distance associated with operational aircraft movements is provided in **Section 5.4**.

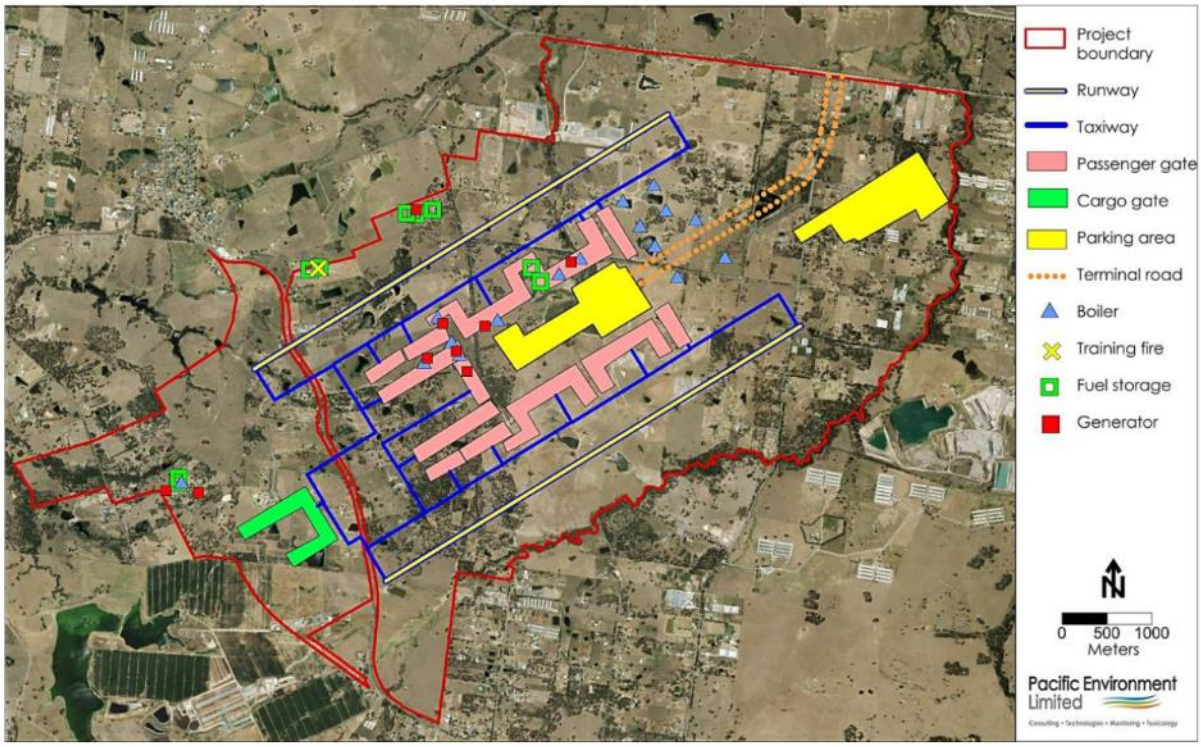
Separation distances associated with petroleum storage are provided in **Table 15**. No separation distances are provided for airports or aerodromes in any of the documentation reviewed and a case-by-case assessment is noted as being required.

Table 15 Separation distances for fuel storage

Source	Industry type	Definition	Sub class	Separation distance (m)
(ACT Government, 2018)	Petroleum storage	Petroleum products are stored in tanks with a total storage capacity exceeding 2 000 cubic metres	-	250
(EPA South Australia, 2016)	Petroleum production, storage or processing works or facilities	Bulk storage	-	Case-by-case with recommended minimum of 500

Source	Industry type	Definition	Sub class	Separation distance (m)
(EPA Victoria, 2013)	Storage of petroleum and hydrocarbon products	Storage of petroleum products or crude oil in tanks	Fixed roof	250

Figure 25 Western Sydney International (Nancy-Bird Walton) Airport – longer term development



Source: (PEL, 2016)

3.3.7 Assessment of Separation Distances – Summary

A summary of the identified separation distances for each identified activity is presented in **Table 16**. For some sites, multiple activities with various separation distances are of relevance. For the purposes of this baseline assessment, the largest separation distance associated with each site is highlighted, with these distances adopted in the assessment of impact magnitude (refer **Section 4.2**).

Table 16 Separation distances - summary

Site	Category	Sub category	Separation distance (m)
Various poultry farming operations	Agriculture	n/a	Variable and calculated as per Section 3.3.2
Kemps Creek Central Quarry/Landfill (Hi Quality Group), 1513 – 1519 Elizabeth Drive	Extractive industry	Quarrying	300 (without blasting)
	Non-putrescible landfill	Landfill	500
Brandown Quarry/RRF/Landfill, 90 Range Road, Kemps Creek	Extractive industry	Quarrying	300 (without blasting)
	Waste management	Materials recovery	300
		Landfill	500
Elford Group, 320 Badgerys Creek Road, Badgerys Creek	Extractive industry	Quarrying	300 (without blasting)
M12 Motorway	Infrastructure	Roads	200
Elizabeth Drive			
Northern Road			
Mamre Road			
Western Sydney International (Nancy Bird Walton) Airport	Infrastructure	Airport	case by case
SUEZ Kemps Creek 1725 Elizabeth Drive, Kemps Creek	Waste management	Materials recovery	300
		Composting	1 000
		Landfill	500
Australian Native Landscapes, 210 Martin Road, Badgerys Creek	Waste management	Composting	1 000
PGH Bricks, 2 Greendale Road, Bringelly	Commercial/industrial	Ceramics manufacture	750
Concrete Batching Plant (80 Greendale Road, Bringelly	Commercial/industrial	Concrete batching	200

Site	Category	Sub category	Separation distance (m)
West Sydney Sand and Soil, 1725 Elizabeth Drive, Kemps Creek	Commercial/industrial	Materials recovery facility	300

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4 RISK ASSESSMENT

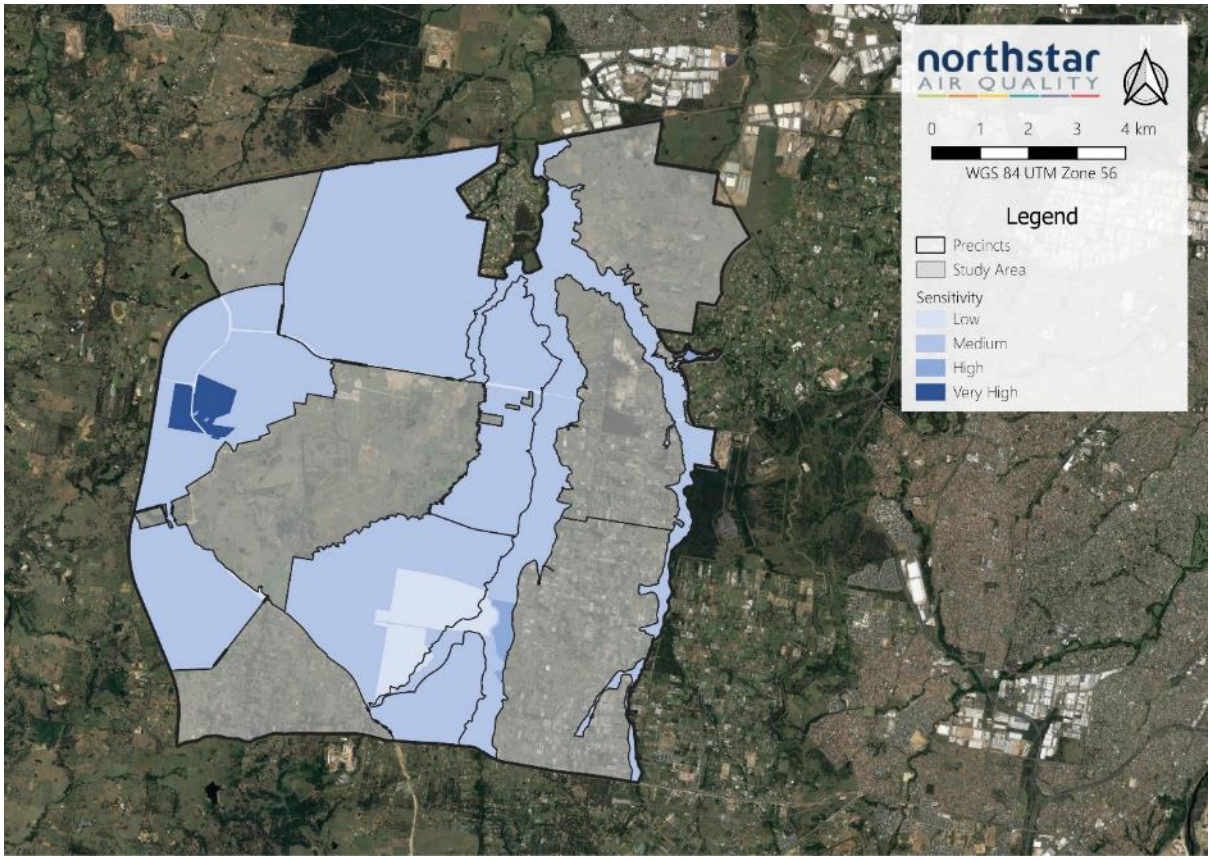
4.1 Sensitivity

The baseline land use sensitivity is assessed in the following section. The methodology is discussed in **Section 3.1.1** and **Section 3.2**. Based upon the presented methodology and inputs, the sensitivity maps for (i) existing baseline and (ii) future baseline are presented in **Section 4.1.1** and **Section 4.1.2** respectively.

4.1.1 Existing Baseline

Figure 26 presents the sensitivity of the relevant land uses under existing conditions with areas associated with each land sensitivity presented in **Table 17**.

Figure 26 Sensitivity – existing baseline



Source: Northstar Air Quality Pty Ltd

Table 17 Distribution of land sensitivity – existing baseline

Precinct	Total area (ha)[B]	Sensitivity							
		Low		Medium		High		Very high	
		Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total
Northern Gateway	1 616	19.7	1%	1 597.4	99%	0.0	0%	0.0	0%
Agribusiness	1 560	33.8	2%	1 400.3	90%	2.0	0%	123.1	8%
Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek [A]	3 349	364.9	11%	2 926.0	87%	55.3	2%	0.0	0%

Note (A) Assessed as a single contiguous area in this study.
(B) Precinct areas derived from (NSW Government, 2020).

4.1.2 Future Baseline

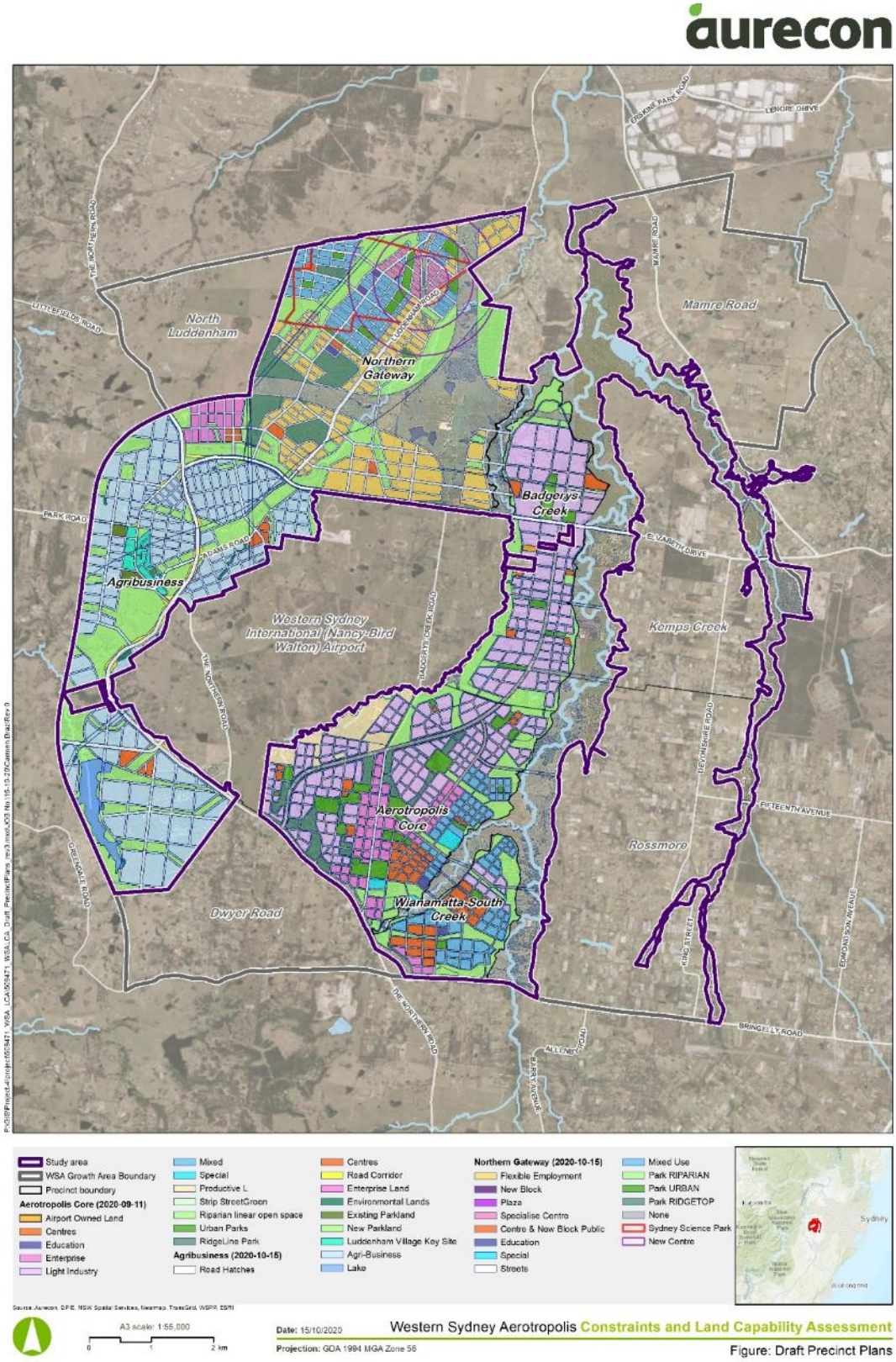
Future baseline is assessed as represented by the draft precinct plans (see **Figure 27**).

Using the methodology presented in **Section 3.2**, land sensitivity has been evaluated as presented in **Figure 28**.

The draft precinct plan shows the Agribusiness precinct is disaggregated by various proposed land uses, and these land uses have been assigned a sensitivity as presented in **Table 2** and **Table 3**.

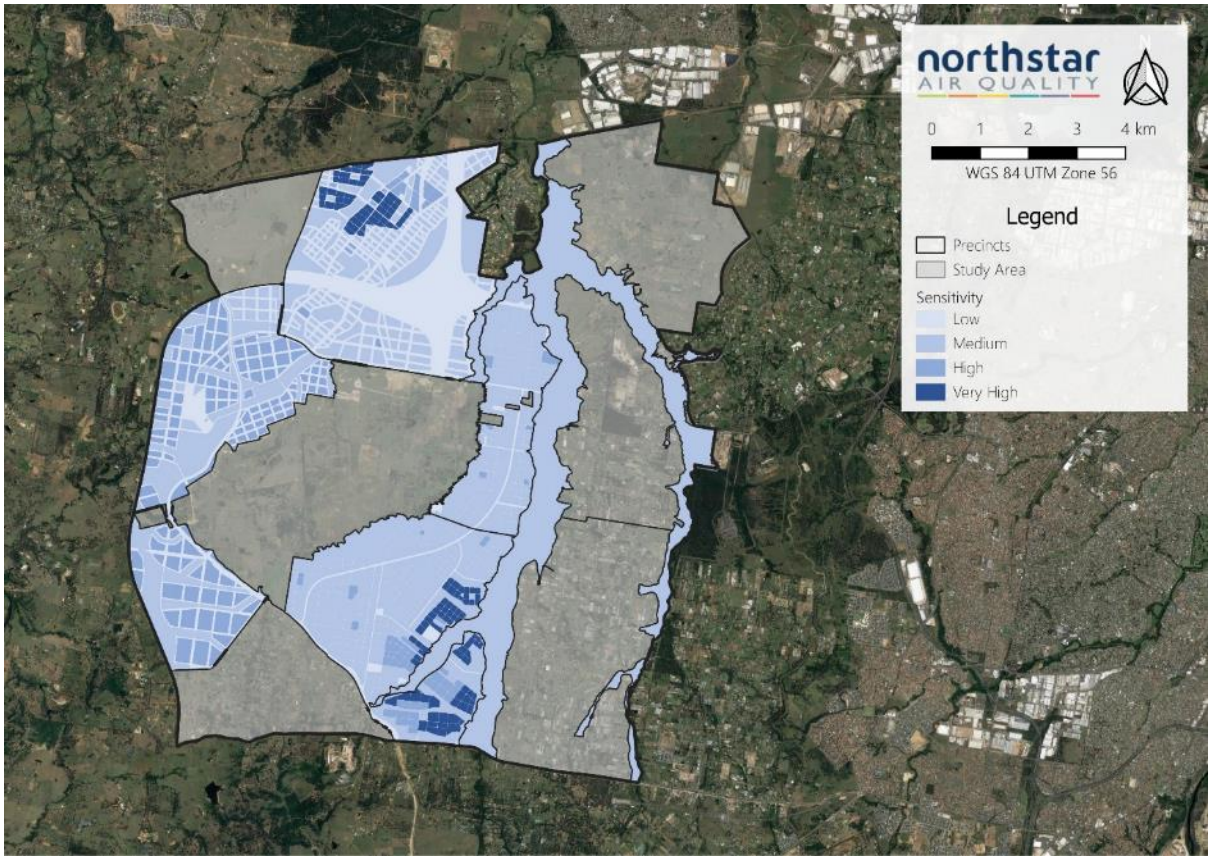
Figure 28 presents the sensitivity of the relevant land uses under potential future conditions with areas associated with each land sensitivity presented in **Table 18**.

Figure 27 Future baseline – draft precinct plans



Source: Aurecon, 2020

Figure 28 Sensitivity – future baseline



Source: Northstar Air Quality Pty Ltd

The distribution of sensitivity across the precincts is summarised in **Table 18**.

Table 18 Distribution of land sensitivity – future baseline

Precinct	Total area (ha)[B]	Sensitivity							
		Low		Medium		High		Very high	
		Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total
Northern Gateway	1 616	742.8	46%	761.9	47%	38.6	2%	72.3	4%
Agribusiness	1 560	364.3	23%	500.9	32%	695.7	45%	0.0	0%
Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek [A]	3 349	535.0	16%	2 599.8	78%	98.8	3%	113.0	3%

Note (A) Assessed as a single contiguous area in this study.
(B) Precinct areas derived from (NSW Government, 2020).

4.2 Magnitude

The baseline magnitude of existing (and approved) activities is assessed in the following section. The methodologies to determine magnitude are discussed in **Section 3.1.2** and **Section 3.3**. These are different depending upon the processes performed by those activities, and the nature of their emissions.

Magnitude is presented as an aggregation of all activities and sequentially by activity. Magnitude is applied to the 'existing baseline' and 'future baseline'.

4.2.1 Aggregated Activities

The assessed aggregated levels of magnitude are presented in **Table 19** and illustrated in **Figure 29**.

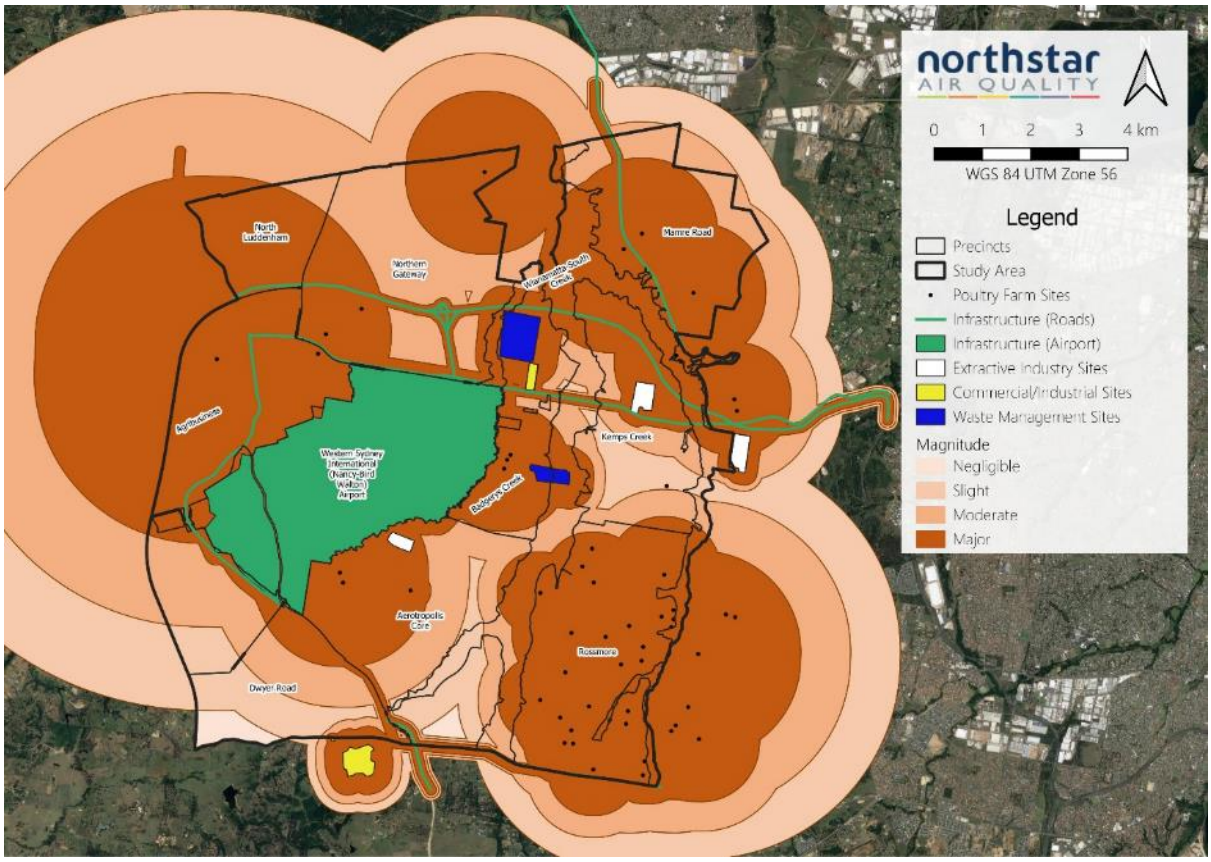
The disaggregated magnitude levels (by sector) are illustrated sequentially in **Section 4.2.2** to **Section 4.2.6**.

Table 19 Distribution of magnitude

Precinct	Total area (ha)[B]	Magnitude							
		Low		Medium		High		Very high	
		Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total
Northern Gateway	1 616	0.0	0%	1.5	0%	696.1	43%	919.4	57%
Agribusiness	1 560	0.0	0%	107.2	7%	325.7	21%	1 126.3	72%
Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek [A]	3 349	33.4	1%	313.1	9%	893.7	27%	2 105.9	63%

Note (A) Assessed as a single contiguous area in this study.
(B) Precinct areas derived from (NSW Government, 2020).

Figure 29 Magnitude – aggregated activities

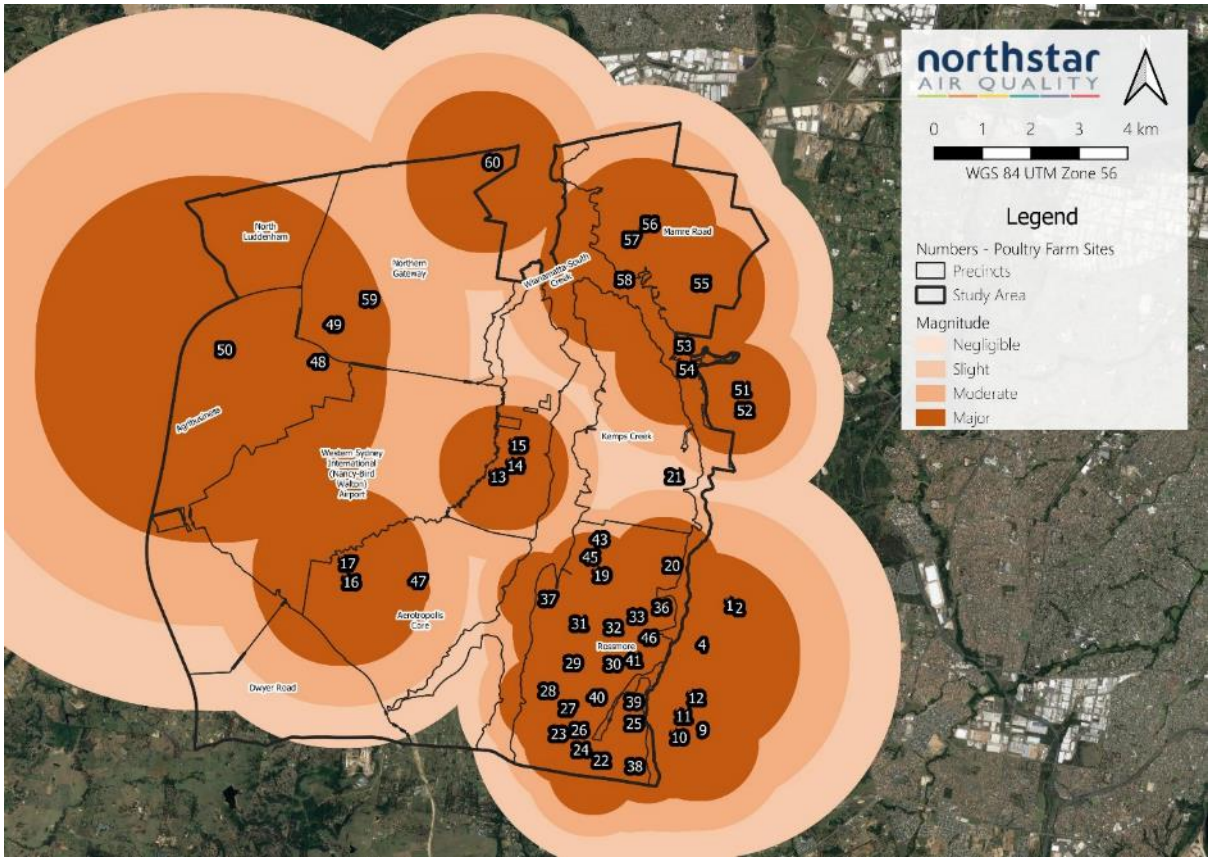


Source: Northstar Air Quality Pty Ltd

4.2.2 Agriculture

The assessed levels of magnitude associated with agricultural activities are illustrated in **Figure 30**.

Figure 30 Magnitude – agriculture

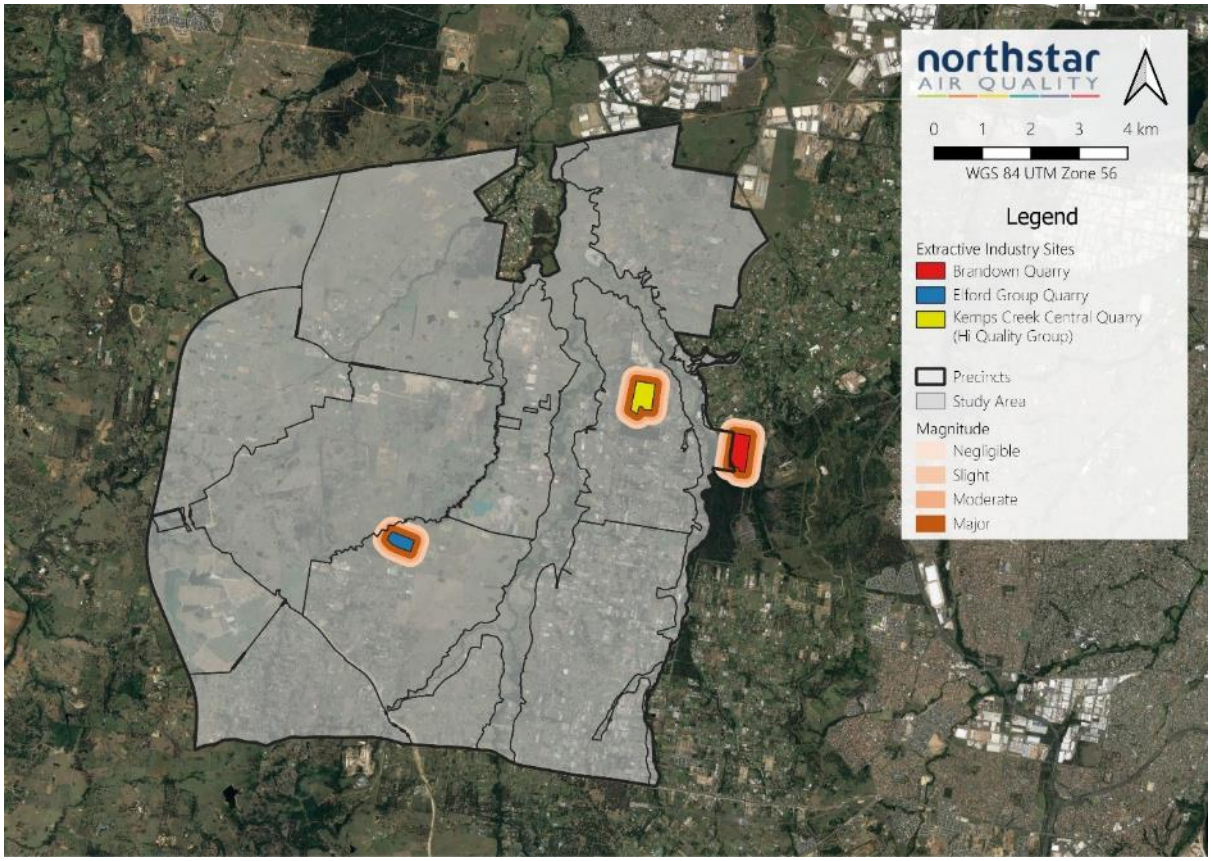


Source: Northstar Air Quality Pty Ltd

4.2.3 Extractive Industries

The assessed levels of magnitude associated with extractive activities are illustrated in **Figure 31**.

Figure 31 Magnitude – extractive industries

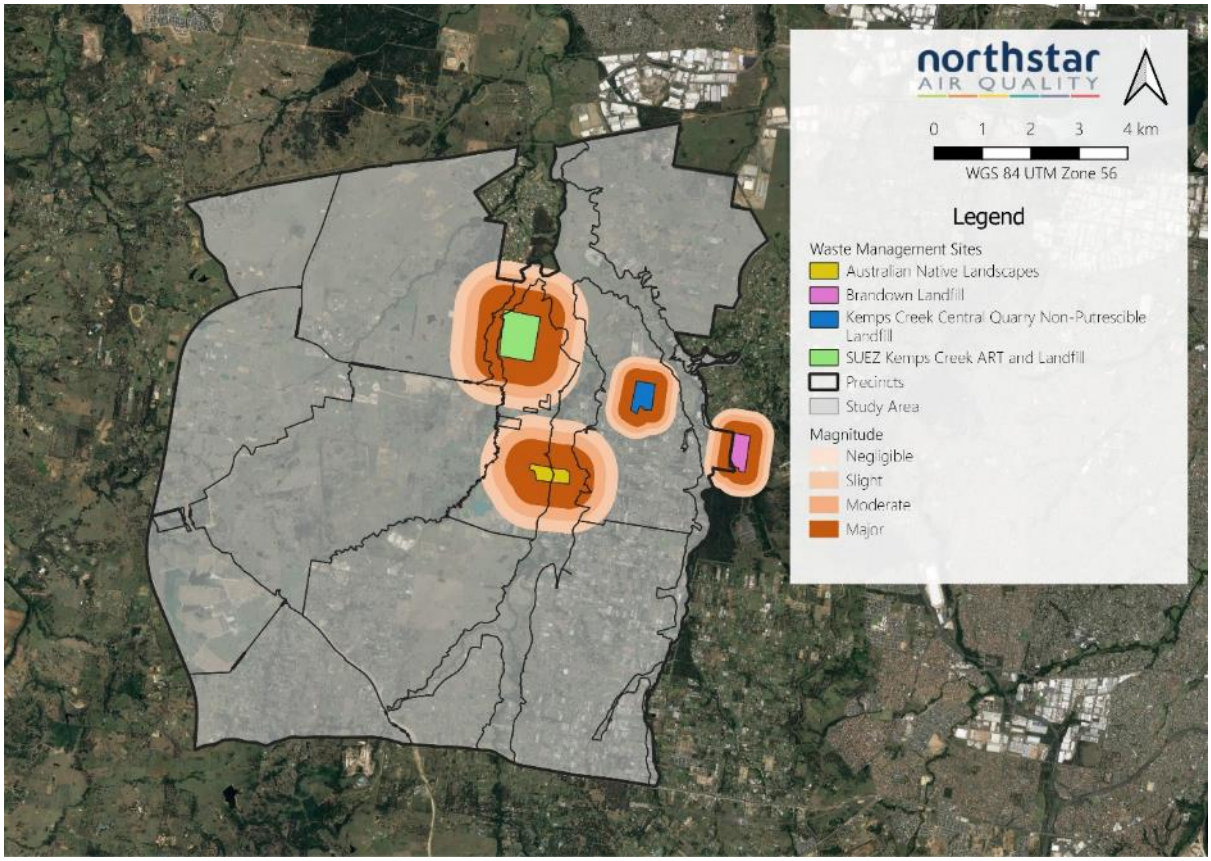


Source: Northstar Air Quality Pty Ltd

4.2.4 Waste Management

The assessed levels of magnitude associated with waste management activities are illustrated in **Figure 32**.

Figure 32 Magnitude – waste management

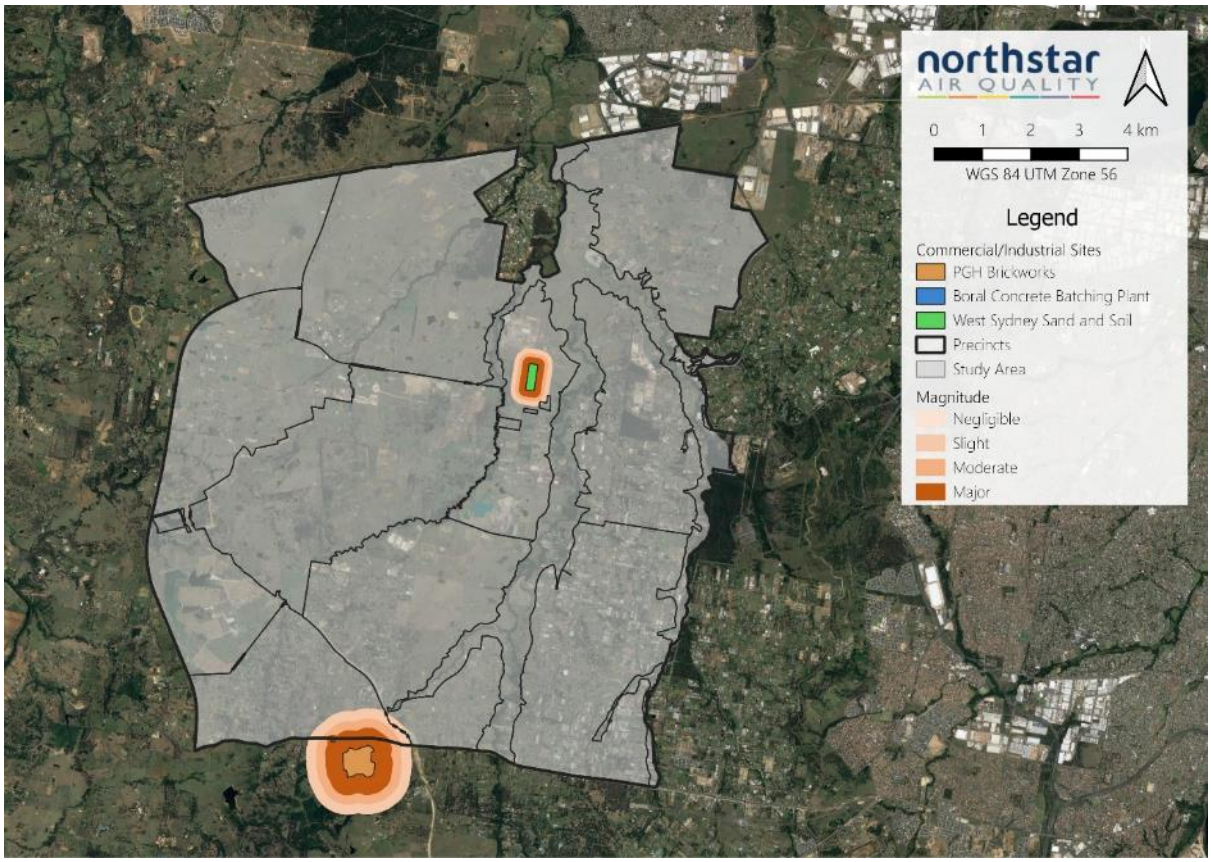


Source: Northstar Air Quality Pty Ltd

4.2.5 Commercial & Industrial

The assessed levels of magnitude associated with commercial and industrial activities are illustrated in **Figure 33**.

Figure 33 Magnitude – commercial and industrial

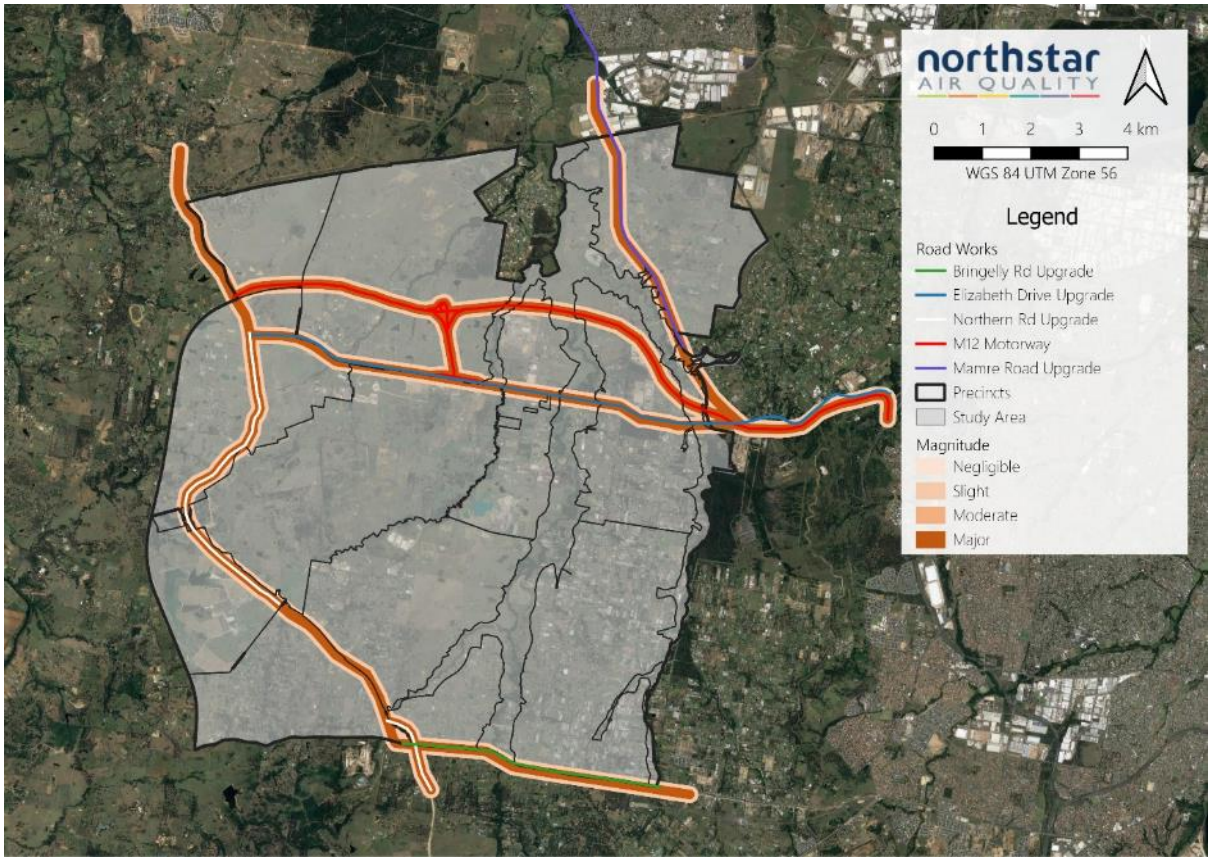


Source: Northstar Air Quality Pty Ltd

4.2.6 Infrastructure

The assessed levels of magnitude associated with infrastructure are illustrated in **Figure 34**.

Figure 34 Magnitude – infrastructure



Source: Northstar Air Quality Pty Ltd

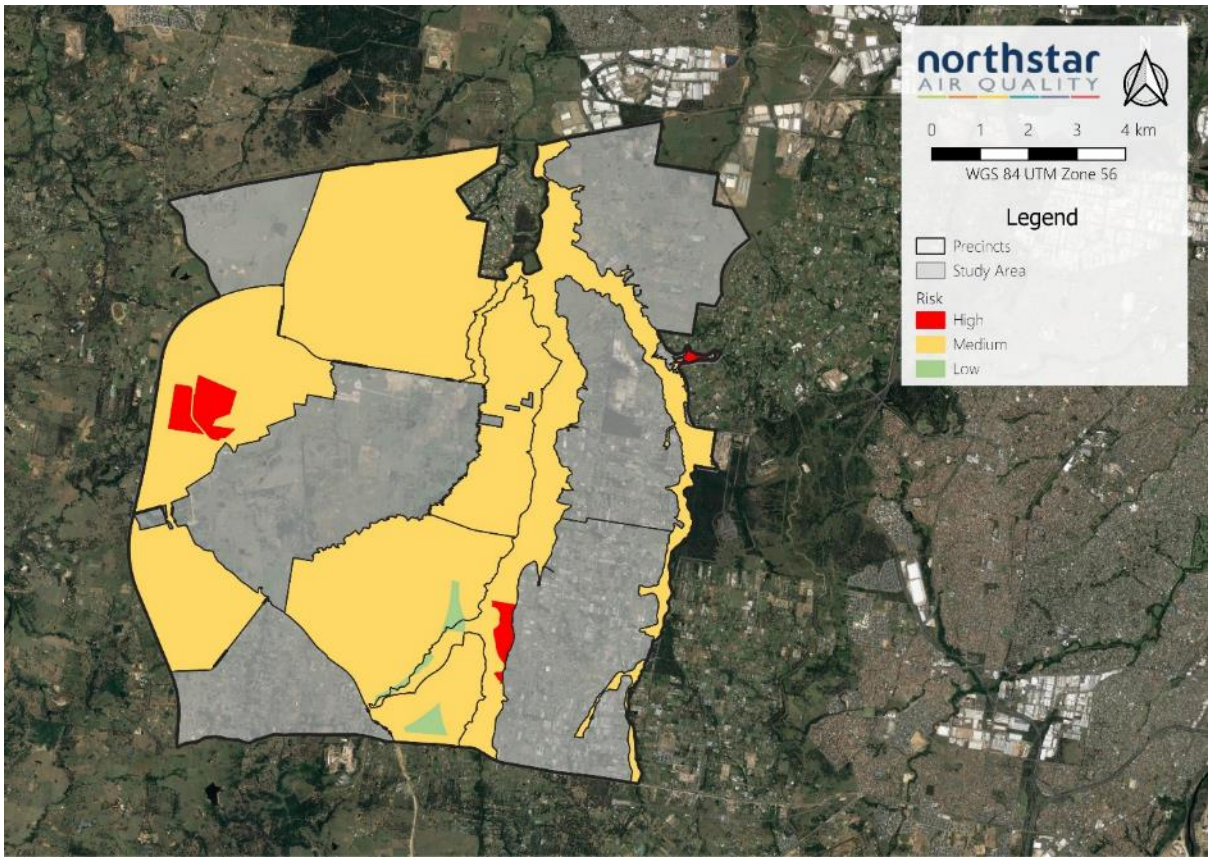
4.3 Risk

The risk assessment associated with the baseline conditions is outlined in the following section. Risk is the product of sensitivity and magnitude.

4.3.1 Existing Baseline – All Precincts

The assessed levels of risk associated with all activities under the existing baseline across all precincts are illustrated in **Figure 35**.

Figure 35 Risk – existing baseline, all precincts



Source: Northstar Air Quality Pty Ltd

The distribution of risk categories across the entire study area for the existing baseline scenario is summarised in **Table 20**.

Table 20 Distribution of risk – existing baseline

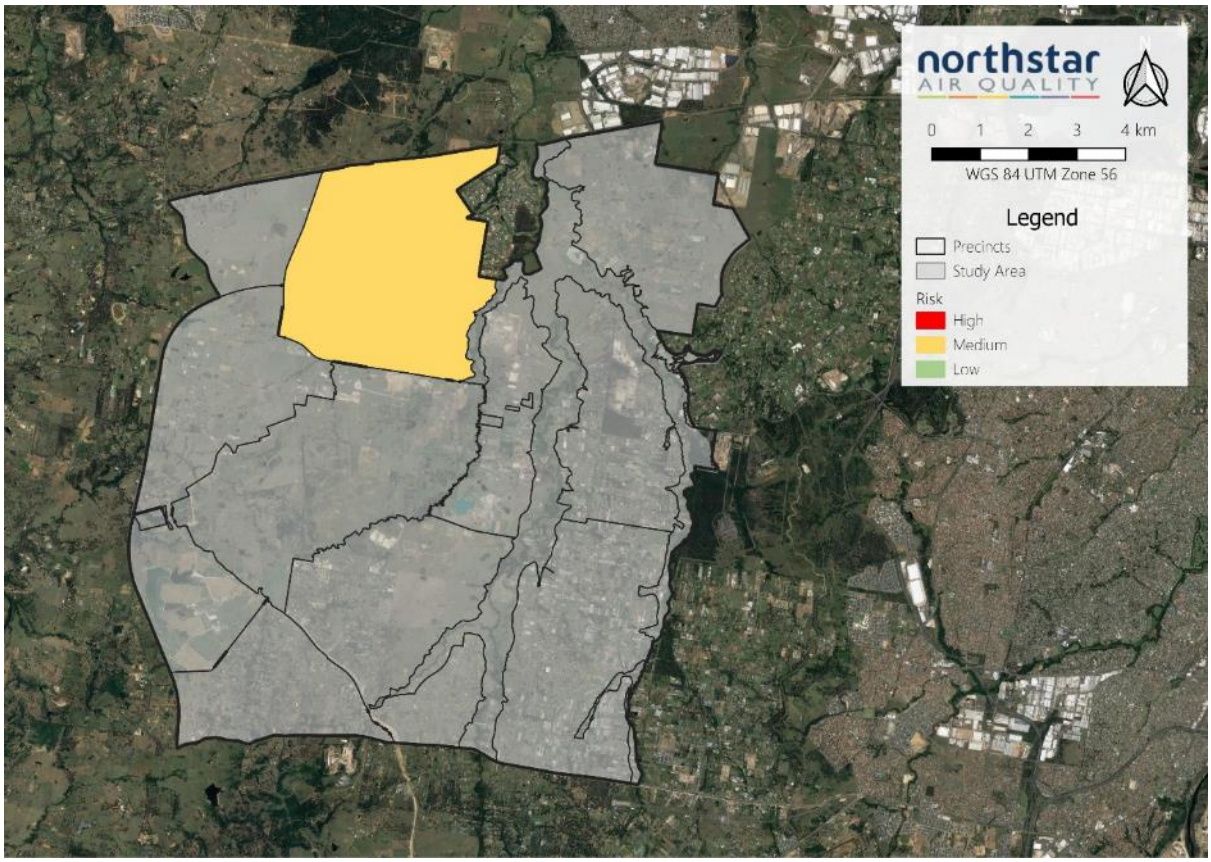
Precinct	Total area (ha)[B]	Risk					
		Low		Medium		High	
		Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total
Northern Gateway	1 616	0.0	0%	1 617.1	100%	0.0	0%
Agribusiness	1 560	0.0	0%	1 434.1	92%	125.1	8%
Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek [A]	3 349	83.0	2%	3 209.5	96%	53.6	2%

Note (A) Assessed as a single contiguous area in this study.
(B) Precinct areas derived from (NSW Government, 2020).

4.3.2 Existing Baseline - Northern Gateway

The assessed levels of risk associated with all activities under the existing baseline across the Northern Gateway Precinct are illustrated in **Figure 36**.

Figure 36 Risk – existing baseline, Northern Gateway

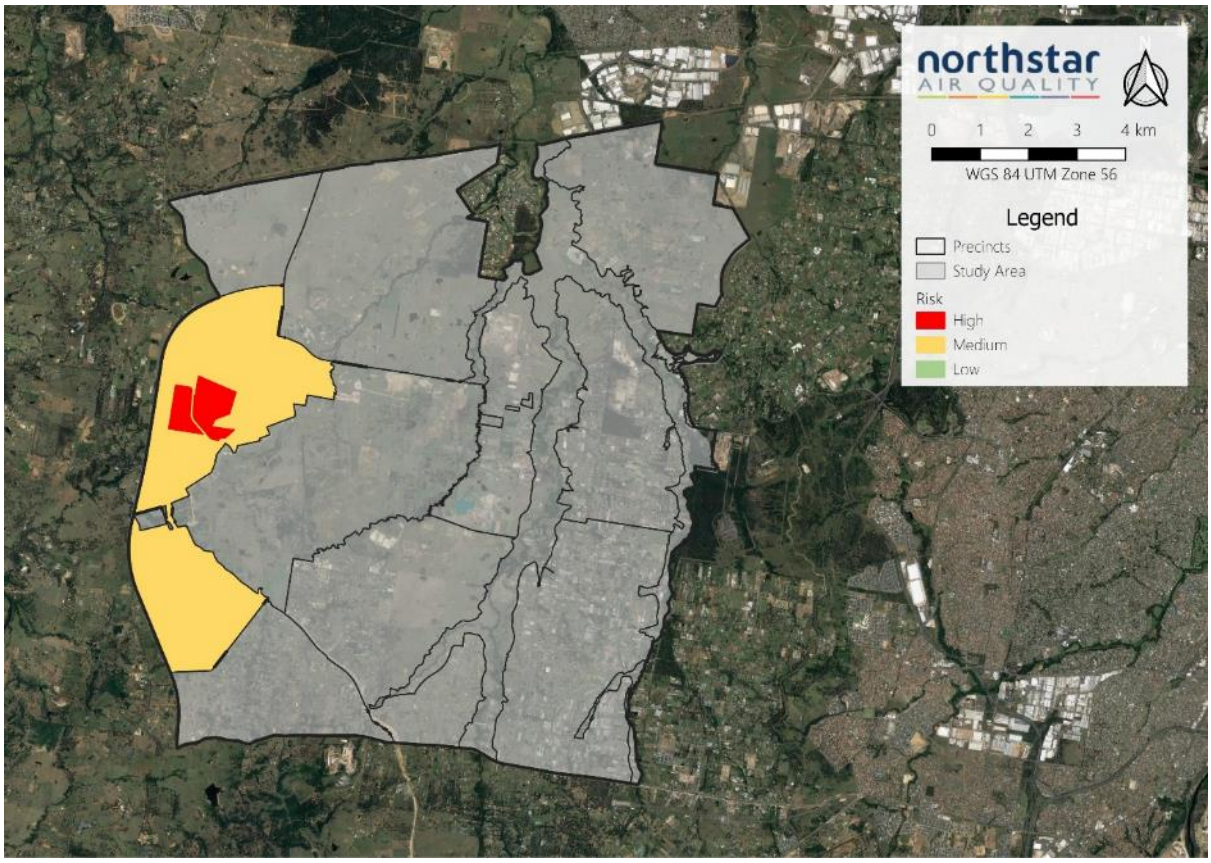


Source: Northstar Air Quality Pty Ltd

4.3.3 Existing Baseline – Agribusiness

The assessed levels of risk associated with all activities under the existing baseline across the Agribusiness Precinct are illustrated in **Figure 37**.

Figure 37 Risk – existing baseline, Agribusiness

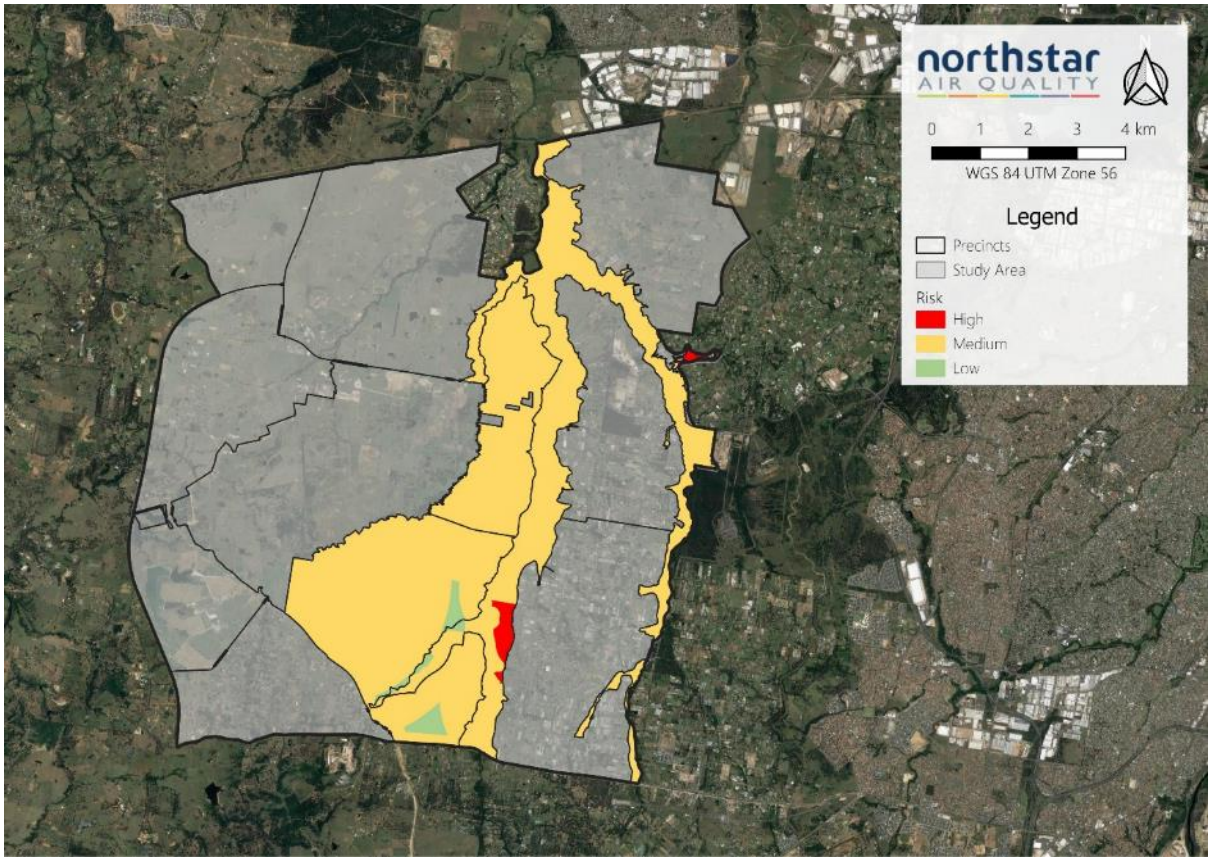


Source: Northstar Air Quality Pty Ltd

4.3.4 Existing Baseline - Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek

The assessed levels of risk associated with all activities under the existing baseline across the Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek Precincts are illustrated in **Figure 38**.

Figure 38 Risk – existing baseline, Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek

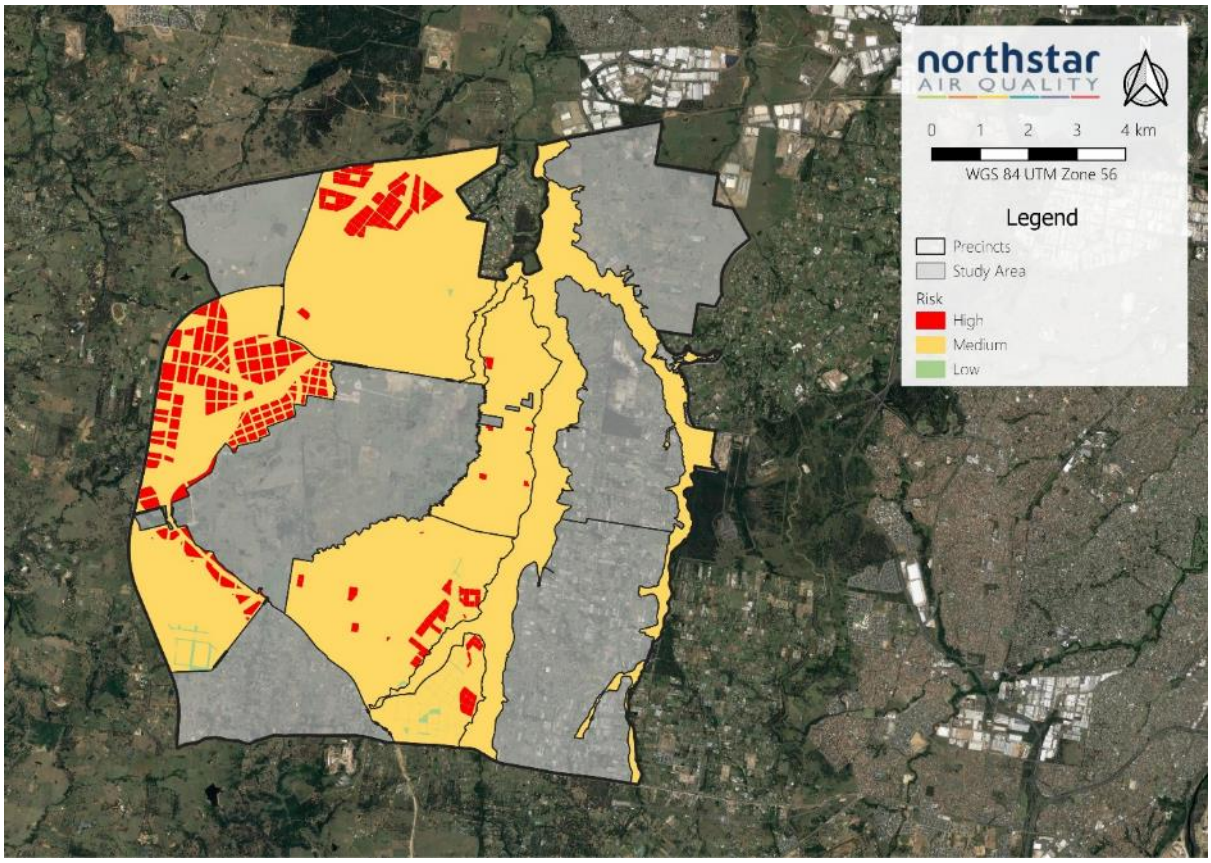


Source: Northstar Air Quality Pty Ltd

4.3.5 Future Baseline – All Precincts

The assessed levels of risk associated with all activities under the future baseline across all Precincts are illustrated in **Figure 39**.

Figure 39 Risk – future baseline, all precincts



Source: Northstar Air Quality Pty Ltd

The distribution of risk categories across the entire study area for the future baseline scenario is summarised in **Table 21**. The assessed risk is further illustrated in **Section 4.3.6** to **Section 4.3.8**.

Table 21 Distribution of existing risk – future baseline

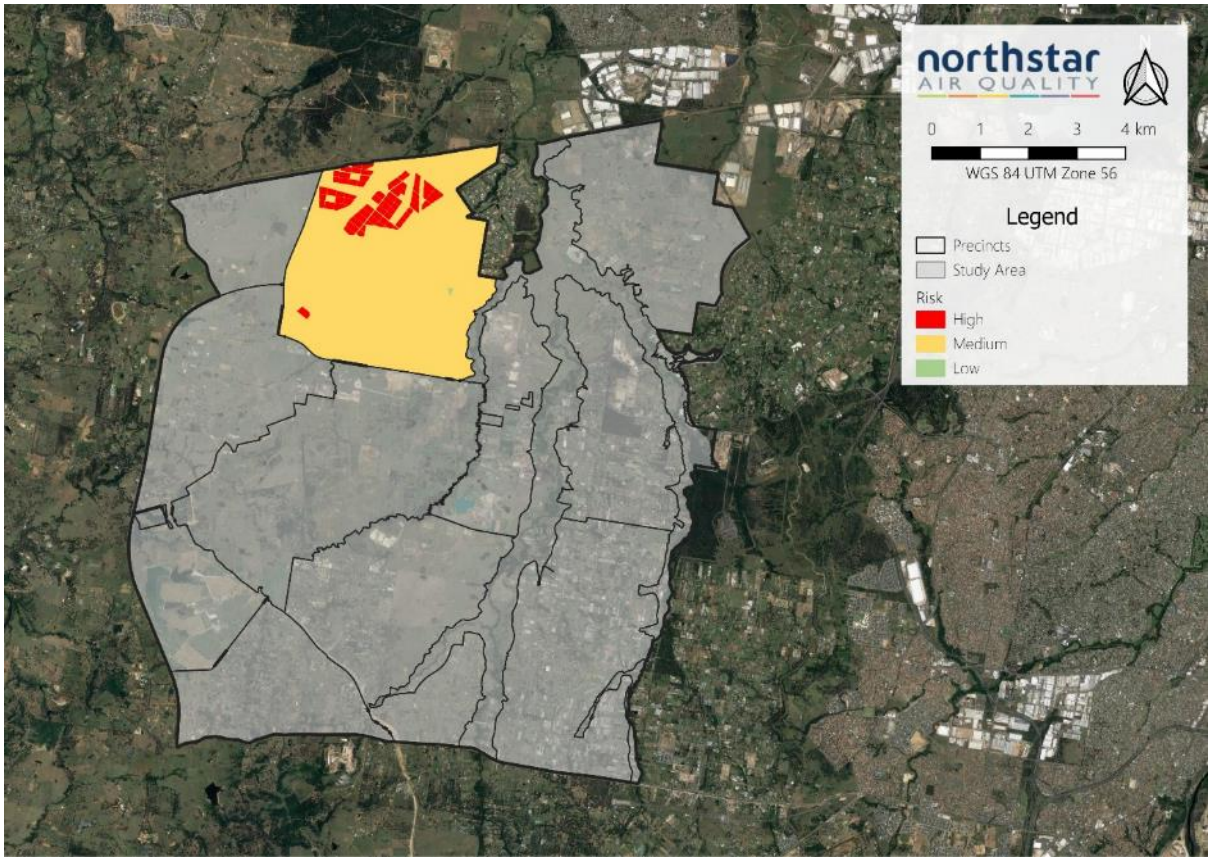
Precinct	Total area (ha)[B]	Risk					
		Low		Medium		High	
		Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total
Northern Gateway	1 616	1.5	0.1%	1 514.3	94%	99.8	6%
Agribusiness	1 560	15.2	1%	1 063.5	68%	482.2	31%
Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek [A]	3 349	69.2	2%	3 212.6	96%	64.8	2%

Note (A) Assessed as a single contiguous area in this study.
(B) Precinct areas derived from (NSW Government, 2020).

4.3.6 Future Baseline - Northern Gateway

The assessed levels of risk associated with all activities under the future baseline across the Northern Gateway Precinct are illustrated in **Figure 40**.

Figure 40 Risk – future baseline, Northern Gateway

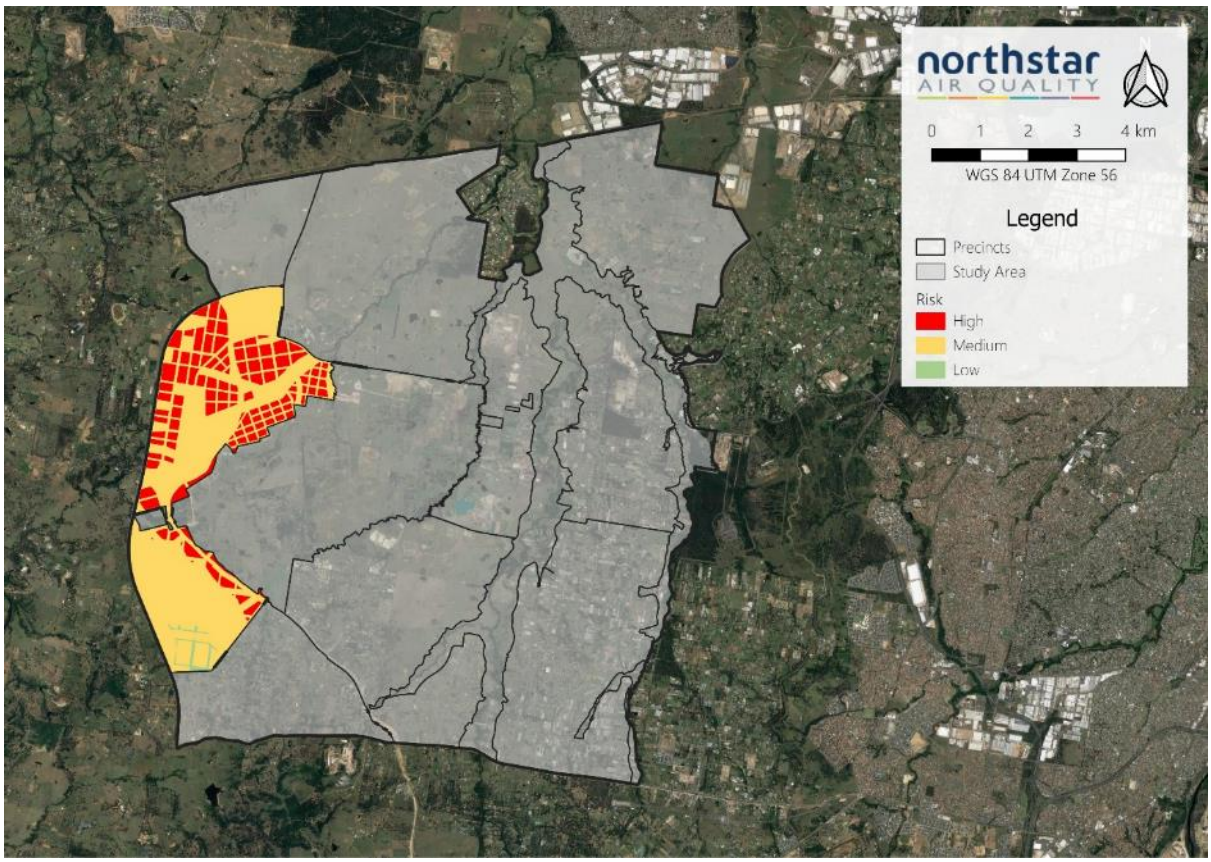


Source: Northstar Air Quality Pty Ltd

4.3.7 Future Baseline – Agribusiness

The assessed levels of risk associated with all activities under the future baseline across the Agribusiness Precinct are illustrated in **Figure 41**.

Figure 41 Risk – future baseline, Agribusiness

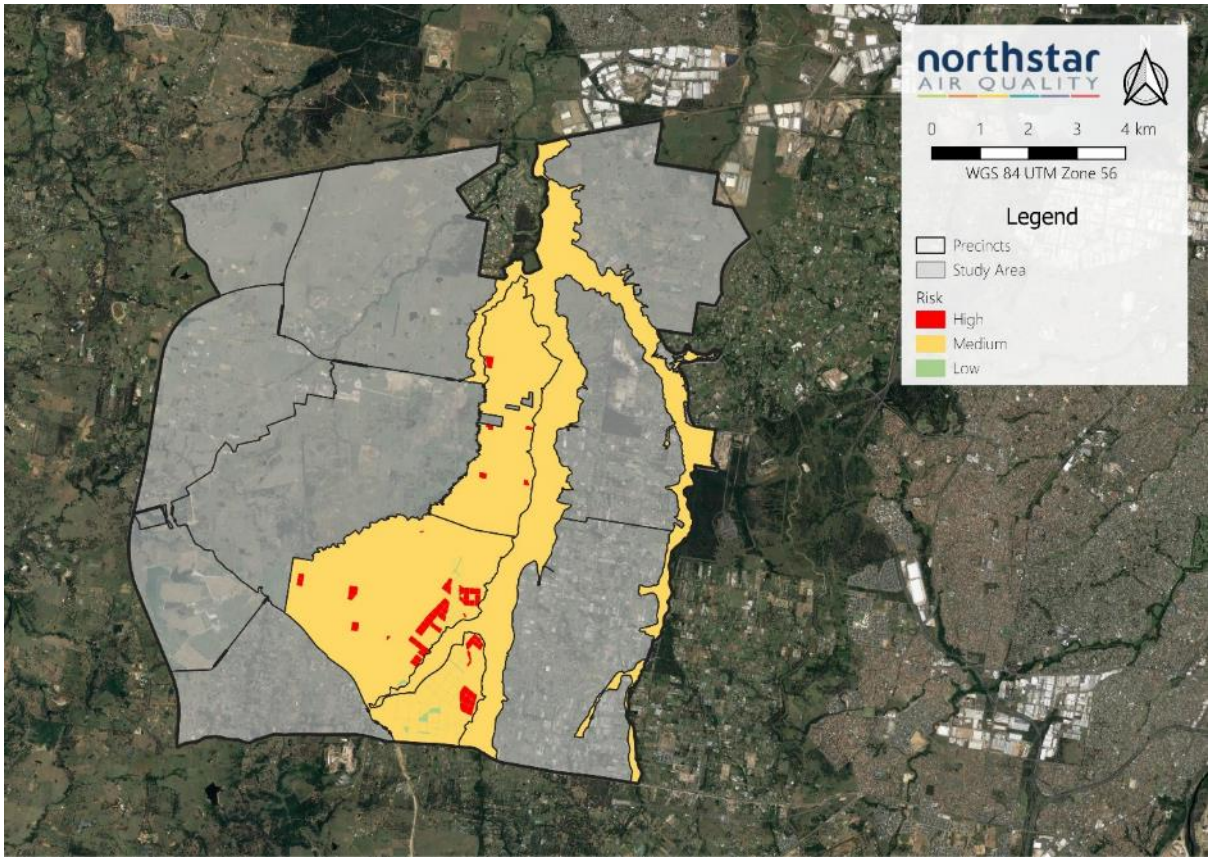


Source: Northstar Air Quality Pty Ltd

4.3.8 Future Baseline - Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek

The assessed levels of risk associated with all activities under the future baseline across the Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek Precincts are illustrated in **Figure 42**.

Figure 42 Risk – future baseline, Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek



Source: Northstar Air Quality Pty Ltd

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5 DISCUSSION

Based upon the assumptions outlined in the report, the following discussion is provided.

5.1 Sensitivity

The baseline assessment summarises air quality and odour land use sensitivity over the study area as follows.

5.1.1 Existing Baseline

Section 4.1.1 presents the summary of the area assessed by sensitivity classification for the existing baseline scenario, with the corresponding percentage of the total, as derived using the method outlined in **Section 3.1.1**.

This assessment shows that under the existing land use/zonings the majority (87 % to 99 %) of land is classified as medium sensitivity across all precincts. Low sensitivity land use is most prevalent in the Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek Precinct, with very high sensitivity land most prevalent in the Agribusiness precinct, relative to other precincts.

5.1.2 Future Baseline

Section 4.1.2 presents the summary of the area assessed by sensitivity classification for the future baseline scenario, with the corresponding percentage of the total, as derived using the method outlined in **Section 3.1.1**.

This assessment shows that based upon the draft precinct plan land use designations the distribution of sensitivity varies by precinct. The majority of land in Northern Gateway (46%) is low sensitivity, the majority of land in Agribusiness is of medium (32 %) and high sensitivity (45 %) and the majority of land in Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek is of medium sensitivity (78 %).

5.2 Magnitude

Section 4.2.1 presents the summary of the area assessed by magnitude classification, with the corresponding percentage of the total, as derived using the method outlined in **Section 3.1.2**.

This assessment shows that the majority (57 % to 72 %) of land is classified as 'very high' magnitude across all precincts. Magnitude is evaluated as aggregated across all sectors (agriculture, extractive industries, waste management, commercial and industrial and infrastructure). The corresponding sector-specific plots of magnitude are provided in **Section 4.2.2** to **Section 4.2.6**.

5.3 Risk

5.3.1 Existing Baseline

Section 4.3.1 presents the summary of the area assessed by risk, with the corresponding percentage of the total, as derived using the method outlined in **Section 3.1.3**.

This assessment shows that under the existing baseline assumptions, the majority of land across all precincts is assessed as of 'medium risk'. The land assessed as medium risk at Northern Gateway is 100 %, 92 % at Agribusiness and 96 % at Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek.

High risk is assessed as 0 % of land at Northern Gateway, 8 % of land at Agribusiness and 2 % of land at Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek.

5.3.2 Future Baseline

Section 4.3.5 presents the summary of the area assessed by risk, with the corresponding percentage of the total, as derived using the method outlined in **Section 3.1.3**.

This assessment shows that, based upon the assumed land uses and screening-level evaluations of magnitude, that the majority of land is assessed as being in 'medium risk'. The land assessed as medium risk at Northern Gateway is 94 %, 68 % at Agribusiness and 96 % at Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek.

High risk is assessed as 6 % of land at Northern Gateway, 31 % of land at Agribusiness and 2 % of land at Aerotropolis Core, Badgerys Creek and Wianamatta-South Creek. The drivers of this risk assessment are identified and discussed in **Section 5.4**. The methodology adopted in this baseline study specifies that land evaluated as 'high risk' should be managed through changes to impact magnitude and sensitivity. Recommendations to address risk are presented in **Section 5.5**.

5.4 Limitations

5.4.1 Sensitivity

The assignment of land sensitivity for the future preferred precinct plans is based on the provision of land use categories as outlined in **Figure 27** and **Table 3**. Some level of judgement is required to enable the appropriate allocation of sensitivity to each land use type.

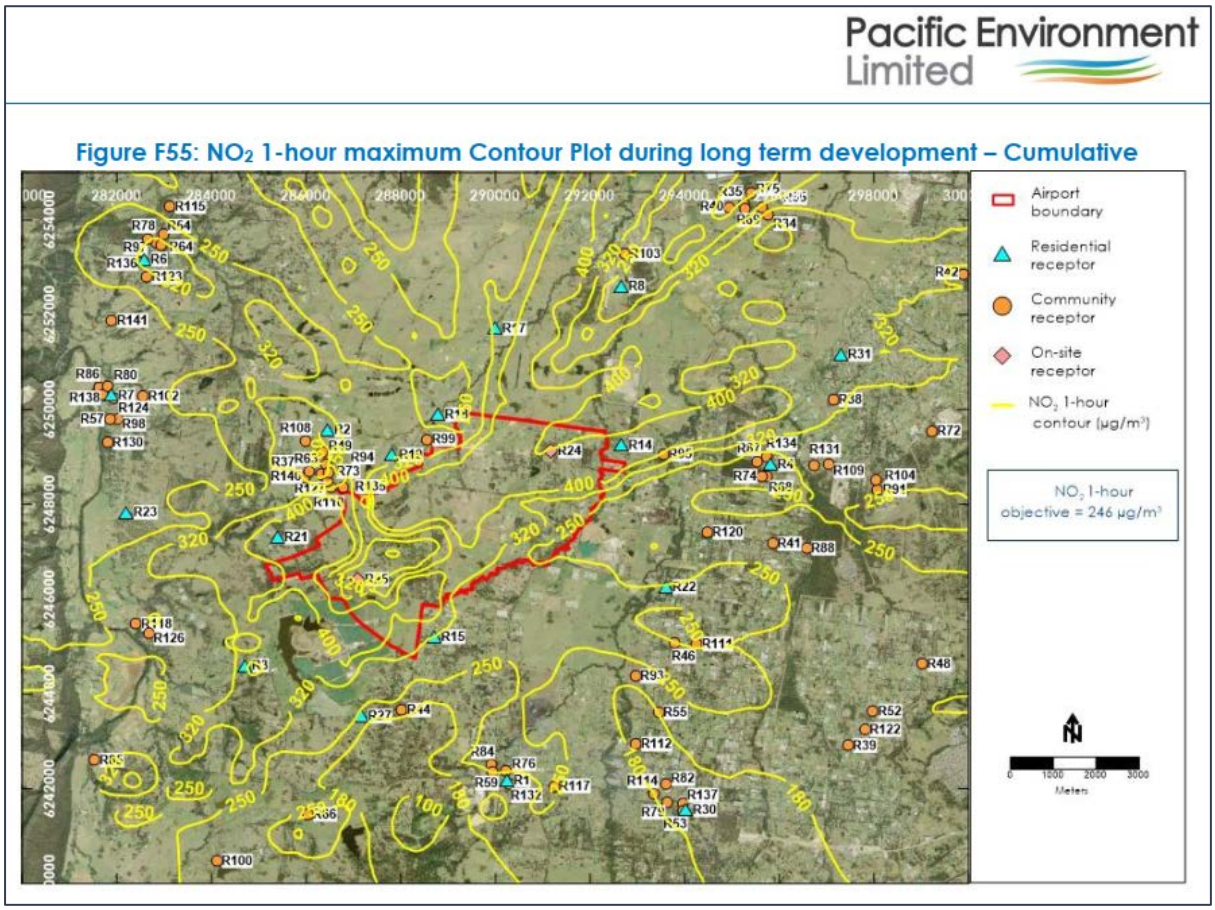
5.4.2 Magnitude

Reference is made to the Western Sydney Airport EIS, Local Air Quality and Greenhouse Gas Assessment (PEL, 2016) which describes the operations associated with the longer term development of the Airport. Figure C-2 of (PEL, 2016) provides a map of the emissions sources anticipated during the longer term development, which is reproduced in **Figure 25**.

In addition to runways and taxiways, cargo and passenger terminals, terminal roads, carparks and a number of boilers and fuel storage areas are anticipated to be located within the Airport boundary, with some of those sources located in close proximity to the boundary of the Airport site. The air quality assessment for the longer-term operations at the Airport determined that impacts associated with particulate matter would be below criteria concentrations at all modelled locations surrounding the Airport (some located on the boundary). Exceedances of the adopted short term (1-hour) NO_2 criterion were predicted to be experienced at significant distances from the Airport boundary due to Airport operations alone, up to 7 km to the northeast of the boundary, and 3 km to the southwest (determined from tabulated data in (PEL, 2016)).

The respective isopleth of the predicted maximum 1-hour NO_2 impacts associated with long-term operation of the Airport reported in (PEL, 2016) has been reproduced in **Figure 43** below:

Figure 43 Predicted 1-hour NO_2, Western Sydney Airport Cumulative Assessment



Based upon the information available at this stage, it is not feasible to identify the discrete magnitude of impacts associated with operational air traffic movements alone. However, given the significant distances of predicted impacts above the adopted criterion reported in (PEL, 2016), it is strongly recommended that the potential magnitude of potential impacts from the Airport is further assessed.

In relation to poultry farming activities, the Level 1 odour assessment has determined a number of significant separation distances, particularly associated with farms of a reasonable size (e.g. farm 50, with 14 sheds). The Level 1 odour assessment methodology is primarily used as a precautionary "go/no-go" tool, and not as an impact assessment tool. Based upon the methodology, this assessment has identified a number of areas (locations) requiring further examination.

As the precinct plans are developed, the developing understanding of future land use and sensitivity will provide further guidance on the risk of impacts from poultry farming activities. Additionally, more detailed odour dispersion modelling may be performed under a Stage 2 study to refine the areas determined under each impact magnitude category.

Impact magnitudes associated with other industry types (waste management, extractive industries) have been based on worst-case separation distances. In a Stage 2 assessment, the most recent dispersion modelling assessment studies available for each operation would be reviewed to determine the predicted impact magnitudes and allow linkage to management practices performed.

5.5 Management Strategies

As required by the brief (and discussed in **Section 1.2.1**), this study is required to identify management strategies for controlling "impacts" (i.e. risks) from the identified sources.

In accordance with the risk assessment methodology adopted, high risks should be managed through changes to both the sensitivity and magnitude components of the risk, medium risks should be managed as low as possible through management of sensitivity and/or risk.

5.5.1 Sensitivity

Management of sensitivity may involve the following strategies:

- Developing and refining the land uses in the precinct plans, as they are developed over time.
- Changing the land use designations presented in the draft precinct plans from more to less sensitive land uses.
- Changing the land uses to those less sensitive to changes in air quality and / or odour.
- Relocating sensitive land uses to preferential locations.
- Staging of development of the WSAP so that the sensitive land uses at elevated risk are managed.

5.5.2 Magnitude

Management of magnitude may involve the following strategies:

- Reducing the magnitude of the identified hazards. At this stage, the risk assessment is limited to a screening-level assessment using a combination of separation distances and the (DEC, 2006) Level 1 odour assessment procedure. Both of these approaches are not case-specific and as such have the potential to misrepresent the potential magnitude of potential air quality and odour impacts. Performing more focused assessments on the identified high-magnitude activities may offer significant opportunity to reduce uncertainty in the process.
- Removing the hazards. Relocating the identified hazards to other locations may manage the resultant risks.

- Managing magnitude through considerate use and development of vegetation buffers to disrupt the dispersion of near-ground level air pollutants and odour. Reference may be made to **Table 10** that shows the potential influence of various vegetation types.
- Staging of the development of the WSAP to that high magnitude hazards are managed.

5.6 Recommendations

The following recommendations are offered:

Recommendation 1

It is recommended that the air quality and odour study should be updated as the precinct plans are developed and refined to provide revised evaluations of sensitivity and subsequently risk. With reference to **Figure 39** (presented in **Section 4.3.5**) it may be identified that significant portions of land are assessed as being 'high risk'. The drivers for this identified risk are the aggregated sensitivity assumptions, and the substantial separation distances derived from agricultural land uses. These are discussed further below.

Recommendation 2

It is recommended that the air quality and odour baseline study should be updated as the land use in the precinct plans are developed.

Recommendation 3

It is recommended that the magnitude of impacts associated with the identified agricultural activities (poultry farming) are refined. The Level 1 assessment methodology is intended to provide a high-level screening assessment, and the study requires further refinement of that methodology as a Level 2/3 odour assessment. Of note, the magnitude of impacts from poultry farms numbers 13, 16, 17, 48, 49, 50, 57, 58 and 60 are recommended to be refined in Stage 2 studies.

Recommendation 4

It is recommended that the magnitude of impacts associated with a number of identified waste management facilities should be refined in Stage 2, notably SUEZ Kemps Creek Advanced Resource Recovery Technology Facility, SUEZ Kemps Creek Landfill and Australian Native Landscapes.

6 REFERENCES

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APPENDIX A

Source Identification

Table A1 Agriculture (poultry farm) activities identified in the study area

Site ID	Number of Sheds	Address	Shed Number	Ventilation	Operational
1	3	545 Fifteenth Avenue, Austral	1.01	Fan	Yes
			1.02	Fan	Yes
			1.03	Fan	Yes
2	2	515 Fifteenth Avenue, Austral	2.01	Fan	Yes
			2.02	Fan	Yes
3	6	310 Thirteenth Avenue, Austral	3.01	Fan	Yes
			3.02	Fan	Yes
			3.03	Fan	Yes
			3.04	Fan	Yes
			3.05	Fan	Yes
			3.06	Fan	Yes
4	3	255 Seventh Avenue, Austral	4.01	Fan	Yes
			4.02	Fan	Yes
			4.03	Fan	Yes
5	4	37 Kelly Street, Austral	5.01	Fan	Yes
			5.02	Fan	Yes
			5.03	Fan	Yes
			5.04	Fan	Yes
6	1	33 Kelly Street, Austral	6.01	Fan	Yes
7	1	18 Kelly Street, Austral	7.01	Fan	Yes
8	8	225 Lawson Rd, Badgerys Creek	8.01	Natural	Yes
			8.02	Natural	Yes
			8.03	Natural	Yes
			8.04	Natural	Yes
			8.05	Natural	Yes
			8.06	Natural	Yes
			8.07	Natural	Yes
			8.08	Natural	Yes
9	4	205 Lawson Rd, Badgerys Creek	9.01	Natural	Yes
			9.02	Natural	Yes
			9.03	Natural	Yes
			9.04	Natural	Yes
10	3	195 Lawson Rd, Badgerys Creek	10.01	Natural	Yes
			10.02	Natural	Yes

Site ID	Number of Sheds	Address	Shed Number	Ventilation	Operational
			10.03	Natural	Yes
11	5	115 Mersey Road, Bringelly	11.01	Fan	Yes
			11.02	Fan	Yes
			11.03	Fan	Yes
			11.04	Fan	Yes
			11.05	Fan	Yes
12	8	135 Mersey Road, Bringelly	12.01	Fan	Yes
			12.02	Fan	Yes
			12.03	Fan	Yes
			12.04	Fan	Yes
			12.05	Fan	Yes
			12.06	Fan	Yes
			12.07	Fan	Yes
			12.08	Fan	Yes
13	2	705 Fifteenth Avenue, Kemps Creek	13.01	Natural	Yes
			13.02	Natural	No
14	4	430 Western Road Kemps Creek	14.01	Natural	Yes
			14.02	Natural	Yes
			14.03	Natural	Yes
			14.04	Natural	Yes
15	3	280 Gurner Ave, Kemps Creek	15.01	Natural	Yes
			15.02	Natural	Yes
			15.03	Natural	Yes
16	3	105 Exter Rd Kemps Creek	16.01	Natural	No
			16.02	Natural	No
			16.03	Natural	Yes
17	3	780 Bringelly Rd, Rossmore	17.01	Natural	Yes
			17.02	Natural	Yes
			17.03	Natural	Yes
18	2	30 Bellfield Ave, Rossmore	18.01	Fan	Yes
			18.02	Fan	Yes
19	2	26 Bellfield Ave, Rossmore	19.01	Fan	Yes
			19.02	Fan	Yes
20	4	2 Wynyard Avenue, Rossmore	20.01	Natural	Yes
			20.02	Natural	Yes
			20.03	Natural	Yes
			20.04	Natural	Yes
21	1	21 Bellfield Avenue, Rossmore	21.01	Fan	Yes
22	3	28 Wynyard Ave, Rossmore	22.01	Natural	Yes
			22.02	Natural	Yes

Site ID	Number of Sheds	Address	Shed Number	Ventilation	Operational
			22.03	Natural	Yes
23	3	47 Wynyard Ave, Rossmore	23.01	Natural	Yes
			23.02	Natural	Yes
			23.03	Natural	Yes
24	4	120 Devonshire Rd, Rossmore	24.01	Natural	Yes
			24.02	Natural	Yes
			24.03	Natural	Yes
			24.04	Natural	Yes
25	4	130 Clementson Dr, Rossmore	25.01	Fan	Yes
			25.02	Fan	Yes
			25.03	Fan	Yes
			25.04	Fan	Yes
26	4	634 Twelfth Ave, Rossmore	26.01	Natural	Yes
			26.02	Natural	Yes
			26.03	Natural	Yes
			26.04	Natural	Yes
27	4	708-710 Twelfth Ave, Rossmore	27.01	Natural	Yes
			27.02	Natural	Yes
			27.03	Natural	Yes
			27.04	Natural	Yes
28	3	40 Herley Ave, Rossmore	28.01	Fan	Yes
			28.02	Fan	Yes
			28.03	Fan	Yes
29	4	670 Fifteenth, Ave, Rossmore	29.01	Natural	Yes
			29.02	Natural	Yes
			29.03	Natural	Yes
			29.04	Natural	Yes
30	3	700 Fifteenth Ave, Rossmore	30.01	Natural	Yes
			30.02	Natural	Yes
			30.03	Natural	Yes
31	3	250 Ramsay Rd, Rossmore	31.01	Natural	Yes
			31.02	Natural	Yes
			31.03	Natural	Yes
32	1	25 King St, Rossmore	32.01	Natural	Yes
33	4	230 King St, Rossmore	33.01	Fan	Yes
			33.02	Fan	Yes
			33.03	Fan	Yes
			33.04	Fan	Yes
34	5	21 Wynyard Ave, Rossmore	34.01	Natural	Yes
			34.02	Natural	Yes

Site ID	Number of Sheds	Address	Shed Number	Ventilation	Operational
			34.03	Natural	Yes
			34.04	Natural	Yes
			34.05	Natural	Yes
35	4	520-530 Twelfth Ave, Rossmore	35.01	Fan	Yes
			35.02	Fan	Yes
			35.03	Fan	Yes
			35.04	Fan	Yes
36	2	107 Victor Ave, Kemps Creek	36.01	Fan	No
			36.02	Fan	No
37	4	67 King St, Rossmore	37.01	Fan	Yes
			37.02	Fan	Yes
			37.03	Fan	Yes
			37.04	Fan	Yes
38	1	54 Watts Rd, Kemps Creek	38.01	Fan	No
39	2	501 Twelfth Ave, Rossmore	39.01	Natural	No
			39.02	Natural	Yes
40	1	315 Badgerys Creek Rd, Badgerys Creek	40.01	Fan	Yes
41	4	2550 Elizabeth Dr, Luddenham	41.01	Natural	Yes
			41.02	Natural	Yes
			41.03	Natural	Yes
			41.04	Natural	Yes
42	6	2179 Elizabeth Dr, Luddenham	42.01	Natural	Yes
			42.02	Natural	Yes
			42.03	Natural	Yes
			42.04	Natural	Yes
			42.05	Natural	Yes
			42.06	Natural	Yes
43	18	2903 The Northern Rd, Luddenham	43.01	Fan	Yes
			43.02	Fan	Yes
			43.03	Fan	Yes
			43.04	Fan	Yes
			43.05	Fan	Yes
			43.06	Fan	Yes
			43.07	Fan	Yes
			43.08	Fan	Yes
			43.09	Fan	Yes
			43.10	Fan	Yes
			43.11	Fan	Yes
			43.12	Fan	Yes
			43.13	Fan	Yes

Site ID	Number of Sheds	Address	Shed Number	Ventilation	Operational
			43.14	Fan	Yes
			43.15	Fan	Yes
			43.16	Fan	Yes
			43.17	Fan	Yes
			43.18	Fan	Yes
44	5	335 Mount Vernon Rd, Mount Vernon	44.01	Natural	Yes
			44.02	Natural	Yes
			44.03	Natural	Yes
			44.04	Natural	Yes
			44.05	Natural	Yes
45	2	350 Mount Vernon Rd, Mount Vernon	45.01	Natural	Yes
			45.02	Natural	Yes
46	4	1135 Mamre Rd, Kemps Creek	46.01	Natural	Yes
			46.02	Natural	Yes
			46.03	Natural	Yes
			46.04	Natural	Yes
47	4	1149 Mamre Rd, Kemps Creek	47.01	Fan	Yes
			47.02	Fan	Yes
			47.03	Fan	Yes
			47.04	Fan	Yes
48	4	290 Aldington Rd, Kemps Creek	48.01	Fan	Yes
			48.02	Fan	Yes
			48.03	Fan	Yes
			48.04	Fan	Yes
49	4	864 Mamre Rd, Kemps Creek	49.01	Fan	Yes
			49.02	Fan	Yes
			49.03	Fan	Yes
			49.04	Fan	Yes
50	3	885 Mamre Rd, Kemps Crek	50.01	Fan	Yes
			50.02	Fan	Yes
			50.03	Fan	Yes
51	4	919 Mamre Rd, Kemps Creep	51.01	Fan	Yes
			51.02	Fan	Yes
			51.03	Fan	Yes
			51.04	Fan	Yes
52	1	775 Luddenham Rd, Luddenham	52.01	Fan	Yes
53	5	425 Luddenham Rd, Luddenham	53.01	Natural	Yes
			53.02	Natural	Yes
			53.03	Natural	Yes
			53.04	Natural	Yes

Site ID	Number of Sheds	Address	Shed Number	Ventilation	Operational
			53.05	Natural	Yes

The identification numbers assigned to the sites in **Table A1** correspond to the numbers observed in **Section 3.3.1**. It should be noted that for poultry farm sheds that could not be confirmed as being fan-ventilated or naturally ventilated, have been for the purposes of this report labelled as fan-ventilated to account for a greater odour risk potential.

Table A2 Extractive industries activities

Identified Activity	Address
Kemps Creek Central Quarry (Hi Quality Group)	1513 – 1519 Elizabeth Drive, Kemps Creek
Brandown Quarry	90 Range Road, Kemps Creek
Elford Group Quarry	320 Badgerys Creek Rd, Badgerys Creek

Table A3 Waste management activities

Identified Activity	Address
SUEZ Kemps Creek Advanced Resource Recovery Technology Facility	1725 Elizabeth Drive, Kemps Creek
SUEZ Kemps Creek Landfill	1725 Elizabeth Drive, Kemps Creek
Brandown Resource Recovery Facility	90 Range Road, Kemps Creek
Brandown Landfill	90 Range Road, Kemps Creek
Kemps Creek Central Quarry Non-putrescible landfill (Hi Quality Group)	1513 – 1519 Elizabeth Drive
Australian Native Landscapes	210 Martin Road, Badgerys Creek

Table A4 Commercial and industrial activities

Identified Activity	Address
PGH Brickworks	2 Greendale Road, Bringelly);
Boral Concrete Batching Plant	80 Greendale Road, Bringelly
West Sydney Sand and Soil Landscape Supplies	1725 Elizabeth Drive, Kemps Creek

Table A5 Infrastructure activities

Identified Activity	Address / Location
The Northern Road Upgrade	Upgrade is located between Mersey Road and Glenmore Parkway.
M12 Motorway Construction	Construction to take place from M7 Motorway to The Northern Road.
Elizabeth Drive Upgrade	Project to cover the entire 14km length of Elizabeth Drive.
Mamre Road Upgrade	Upgrade is limited to a 10km section between M4 Motorway and Kerrs Road.
Bringelly Road Upgrade	Stage 2 of Bringelly Road upgrade between King St and The Northern Road enters the precinct proposal.

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APPENDIX B

Poultry Farm S-Factors

Table B1 Summary of poultry farm locations and operational status

ID	Coordinates		Address	Operational	Ventilation Type	SBCSU	S Factors					Distance
	mE	mS				factor	S1	S2	S3	S4	S5	km
1	297 054	6 245 006	545 Fifteenth Avenue, Austral	Yes	Fan	2.67	980	1.05	1	1	1	2.07
2	297 241	6 244 927	515 Fifteenth Avenue, Austral	Yes	Fan	0.81	980	1.05	1	1	1	0.88
4	296 495	6 244 133	310 Thirteenth Avenue, Austral	Yes	Fan	7.05	980	1.05	1	1	1	4.12
9	296 537	6 242 426	255 Seventh Aveune, Austral	Yes	Fan	3.34	980	1.05	1	1	1	2.42
10	295 966	6 242 562	37 Kelly Street, Austral	Yes	Fan	3.98	980	1.05	1	1	1	2.75
11	296 063	6 242 673	33 Kelly Street, Austral	Yes	Fan	1.39	980	1.05	1	1	1	1.30
12	296 311	6 243 055	33 Kelly Street, Austral	Yes	Fan	2.22	980	1.05	1	1	1	1.81
13	292 399	6 247 882	225 Lawson Rd, Badgerys Creek	Yes	Natural	5.67	690	1.05	1	1	1	2.48
14	292 464	6 248 058	205 Lawson Rd, Badgerys Creek	Yes	Natural	3.40	690	1.05	1	1	1	1.73
15	292 517	6 248 154	195 Lawson Rd, Badgerys Creek	Yes	Natural	0.50	690	1.05	1	1	1	0.44
16	289 125	6 245 454	115 Mersey Road, Bringelly	Yes	Fan	5.23	980	1.05	1	1	1	3.33
17	289 059	6 245 667	135 Mersey Road, Bringelly	Yes	Fan	5.45	980	1.05	1	1	1	3.43
19	294 298	6 245 584	430 Western Road Kemps Creek	Yes	Natural	4.01	690	1.05	1	1	1	1.94
20	295 764	6 245 765	280 Gurner Ave, Kemps Creek	Yes	Natural	4.90	690	1.05	1	1	1	2.24
22	294 379	6 241 744	780 Bringelly Rd, Rossmore	Yes	Natural	3.57	690	1.05	1	1	1	1.79
23	293 778	6 242 269	30 Bellfield Ave, Rossmore	Yes	Fan	1.90	980	1.05	1	1	1	1.62
24	293 953	6 242 258	26 Bellfield Ave, Rossmore	Yes	Fan	1.59	980	1.05	1	1	1	1.43
25	295 035	6 242 689	2 Wynyard Ave, Rossmore	Yes	Natural	4.26	690	1.05	1	1	1	2.03
26	293 914	6 242 535	21 Bellfield Ave, Rossmore	Yes	Fan	1.14	980	1.05	1	1	1	1.13

ID	Coordinates		Address	Operational	Ventilation Type	SBCSU	S Factors					Distance
	mE	mS				factor	S1	S2	S3	S4	S5	km
27	293 673	6 242 814	28 Wynyard Ave, Rossmore	Yes	Natural	3.77	690	1.05	1	1	1	1.86
28	293 255	6 243 145	47 Wynyard Ave, Rossmore	Yes	Natural	3.21	690	1.05	1	1	1	1.66
30	294 909	6 243 911	120 Devonshire Rd, Rossmore	Yes	Natural	3.68	690	1.05	1	1	1	1.83
31	293 874	6 244 537	130 Clements Dr, Rossmore	Yes	Fan	3.24	980	1.05	1	1	1	2.37
32	294 581	6 244 467	634 Twelfth Ave, Rossmore	Yes	Natural	4.91	690	1.05	1	1	1	2.24
33	295 057	6 244 709	708-710 Twelfth Ave, Rossmore	Yes	Natural	4.03	690	1.05	1	1	1	1.95
34	295 925	6 244 685	40 Herley Ave, Rossmore	Yes	Fan	1.58	980	1.05	1	1	1	1.42
35	295 977	6 244 855	670 Fifteenth, Ave, Rossmore	Yes	Natural	2.70	690	1.05	1	1	1	1.47
36	295 726	6 244 910	700 Fifteenth Ave, Rossmore	Yes	Natural	1.83	690	1.05	1	1	1	1.11
37	293 182	6 245 328	250 Ramsay Rd, Rossmore	Yes	Natural	3.11	690	1.05	1	1	1	1.62
38	295 405	6 241 641	25 King St, Rossmore	Yes	Natural	1.29	690	1.05	1	1	1	0.87
39	295 080	6 242 948	230 King St, Rossmore	Yes	Fan	5.02	980	1.05	1	1	1	3.23
40	294 256	6 243 021	21 Wynyard Ave, Rossmore	Yes	Natural	4.51	690	1.05	1	1	1	2.11
41	295 325	6 243 965	520-530 Twelfth Ave, Rossmore	Yes	Fan	3.90	980	1.05	1	1	1	2.70
44	295 482	6 241 904	67 King St, Rossmore	Yes	Fan	1.93	980	1.05	1	1	1	1.64
47	290 535	6 245 324	315 Badgerys Creek Rd, Badgerys Creek	Yes	Fan	0.65	980	1.05	1	1	1	0.76
48	288 501	6 250 134	2550 Elizabeth Dr, Luddenham	Yes	Natural	4.36	690	1.05	1	1	1	2.06
49	288 646	6 250 539	2179 Elizabeth Dr, Luddenham	Yes	Natural	5.96	690	1.05	1	1	1	2.57
50	286 291	6 250 042	2903 The Northern Rd, Luddenham	Yes	Fan	14.47	980	1.05	1	1	1	6.86
51	297 140	6 249 408	335 Mount Vernon Rd, Mount Vernon	Yes	Natural	4.72	690	1.05	1	1	1	2.18
52	297 184	6 249 168	350 Mount Vernon Rd, Mount Vernon	Yes	Natural	2.66	690	1.05	1	1	1	1.45
53	295 923	6 250 289	1135 Mamre Rd, Kemps Creek	Yes	Natural	3.90	690	1.05	1	1	1	1.91
54	296 006	6 250 163	1149 Mamre Rd, Kemps Creek	Yes	Fan	3.58	980	1.05	1	1	1	2.55
55	296 208	6 251 576	290 Aldington Rd, Kemps Creek	Yes	Fan	4.03	980	1.05	1	1	1	2.77
56	295 151	6 252 768	864 Mamre Rd, Kemps Creek	Yes	Fan	4.46	980	1.05	1	1	1	2.97
57	294 706	6 252 402	885 Mamre Rd, Kemps Crek	Yes	Fan	4.56	980	1.05	1	1	1	3.02

ID	Coordinates		Address	Operational	Ventilation Type	SBCSU	S Factors					Distance
	mE	mS				factor	S1	S2	S3	S4	S5	km
58	294 629	6 251 911	919 Mamre Rd, Kemps Creep	Yes	Fan	4.61	980	1.05	1	1	1	3.04
59	289 359	6 251 106	775 Luddenham Rd, Luddenham	Yes	Fan	0.91	980	1.05	1	1	1	0.96
60	291 884	6 253 952	425 Luddenham Rd, Luddenham	Yes	Natural	7.83	690	1.05	1	1	1	3.12