SOUTH WEST PRECINCT

Air Quality Assessment (Stage 1)

Prepared for:

Boyuan Bringelly Pty Ltd
c/- Boyuan Holdings Limited
Level 16, 5 Martin Place
Sydney NSW 2000

SLR Ref: 610.19158-R01
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September 2021

Memorandum

To:	Smita Sundarjee	**At:**	Boyuan Bringelly Pty Ltd
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Date:	16 June 2022	**Ref:**	610.19158-M01-v1.0-20220617.docx
Subject:	South West Precinct Air Quality Assessment (Stage 1)		

CONFIDENTIALITY

This memorandum aims to serve as a cover letter for the Air Quality Assessment (AQA) report (reference No: 610.19158-R01-v1.0-20210929) dated 29 September 2021 completed by SLR for the Stage 1 works of the South West Precinct.

It is noted that the findings, recommendations, and conclusions of the AQA report were based on a previous Indicative Layout Plan (ILP) shown in **Figure 1**, which considered the entirety of Sub-Precinct 5 (Subject Site). Since the completion of the AQA report, the Subject Site boundary has changed, and the updated ILP is shown in **Figure 2**.

The updated ILP only incorporates Lots 2 & 4 in DP 1216380, Lot 2 in DP 1241819 and Lot 500 in DP 1231858 as shown in **Figure 2**.

The findings, recommendations, and conclusions of the AQA report remain relevant, providing a holistic assessment of the precinct to inform future development on the Subject Site. It is intended that the AQA report will be updated to reflect the updated ILP and any comments received following the public notification.

If you have any questions, please feel free to contact the undersigned.

Sahar Bagheri

Checked/
Authorised by: VM (16/6/22)

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Figure 1 Sub-Precinct 5 Site Layout – Air Quality Assessment (29 September 2021)

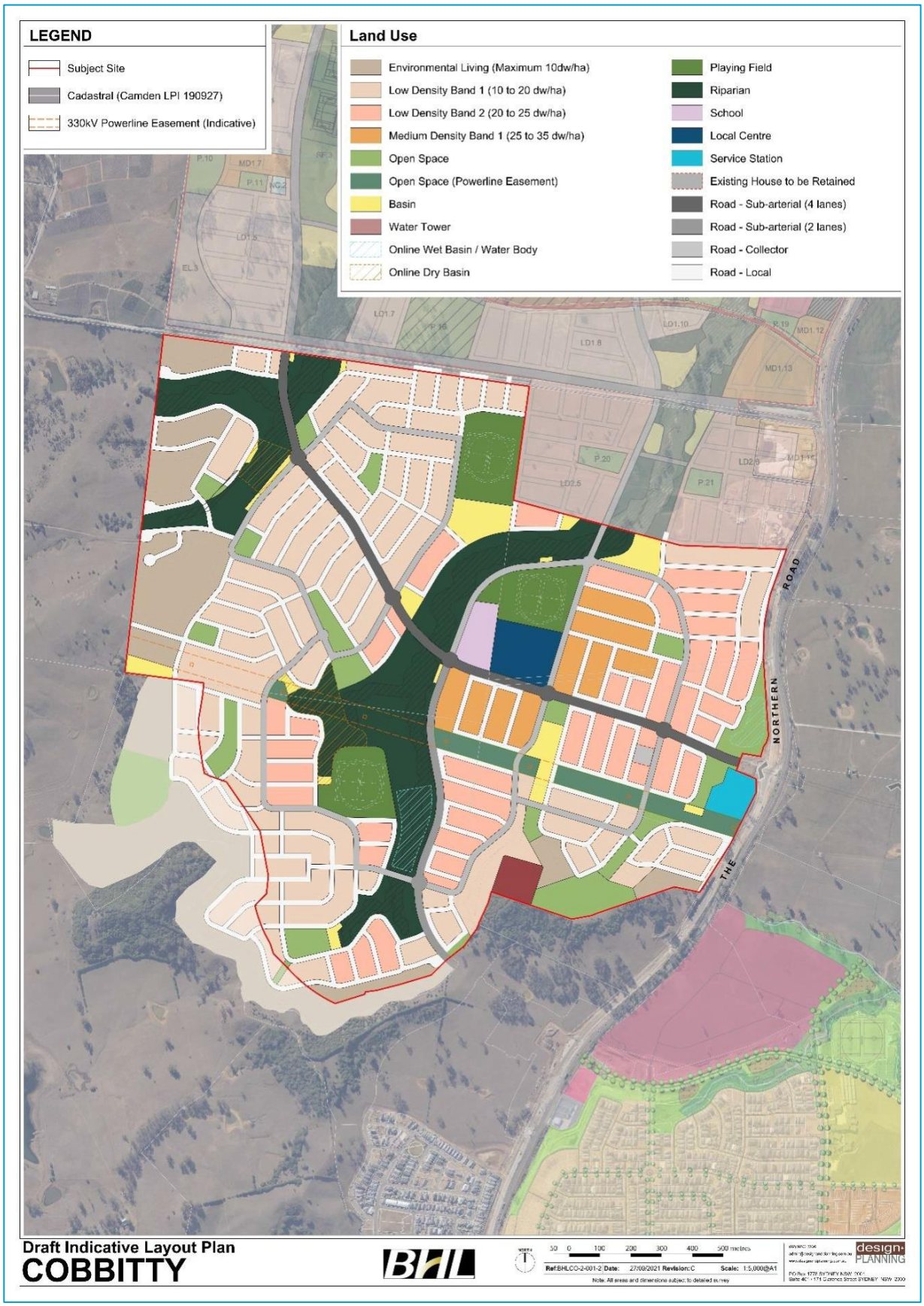
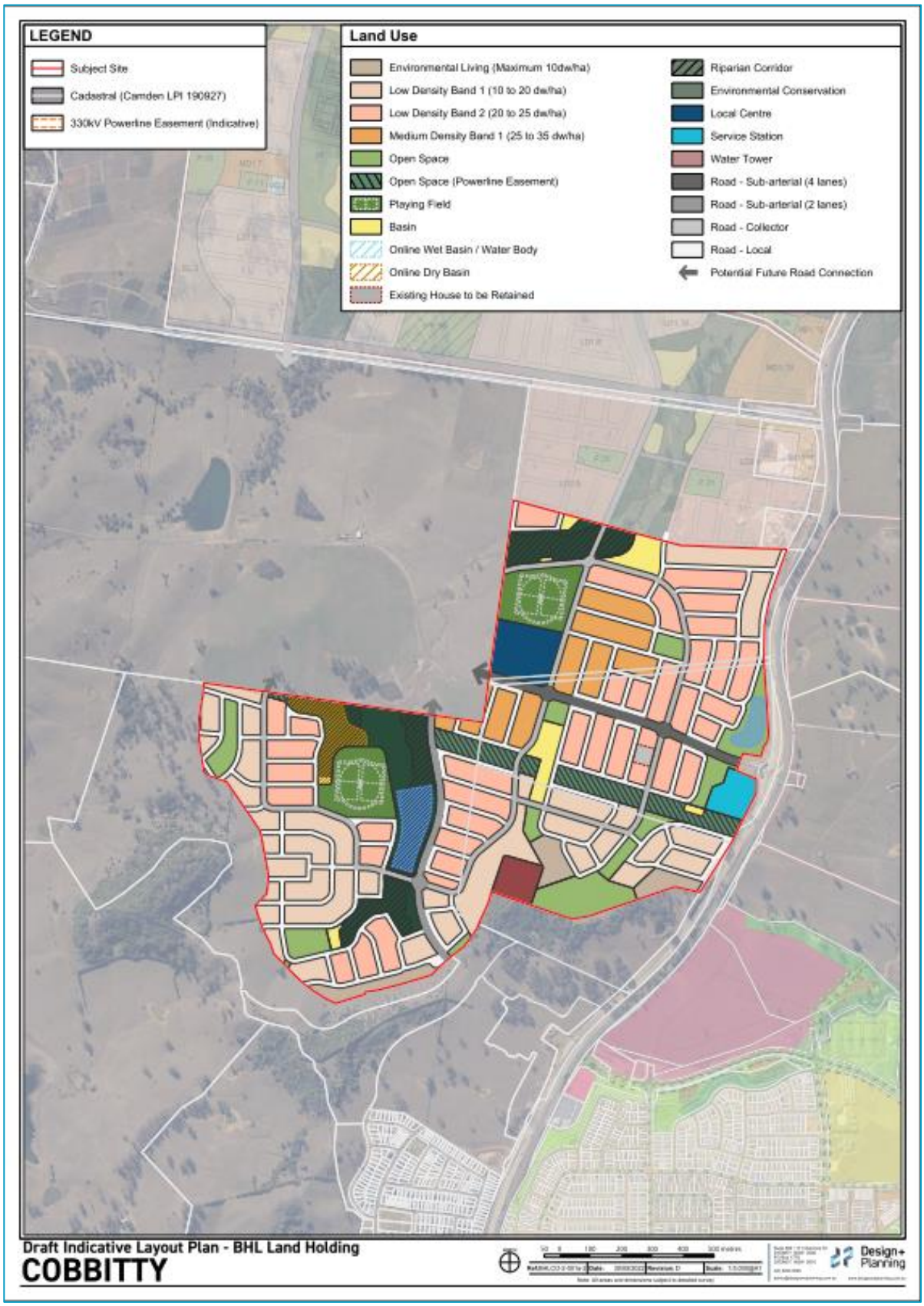


Figure 2 Updated Sub-Precinct 5 Site Layout



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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Boyuan Bringelly Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.19158-R01-v1.0	29 September 2021	Sahar Bagheri	Varun Marwaha Kirsten Lawrence	Varun Marwaha

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Boyuan Holdings Limited (BHL) to conduct an air quality assessment to accompany a planning proposal to rezone Precinct 5 (the subject site) of the South Creek West (SCW) release area in southwest Sydney, NSW.

This report provides a desktop assessment of the potential air quality impacts of identified existing and future air emission sources in the local area on Precinct 5. The desktop assessment relies on:

- Publicly available air quality impact assessments; and
- Recommended minimum separation distances for relevant activities.

The objectives of the study are to:

- Investigate and identify any sources of air pollutants (including odour) with potential to have adverse air quality impacts on Precinct 5.
- Investigate the potential for air quality impacts from those identified sources and identify the approximate separation distances which would nominally be required between the air pollutant source and urban development.
- Where appropriate, make recommendations for further, more detailed assessments.

2 Project Overview

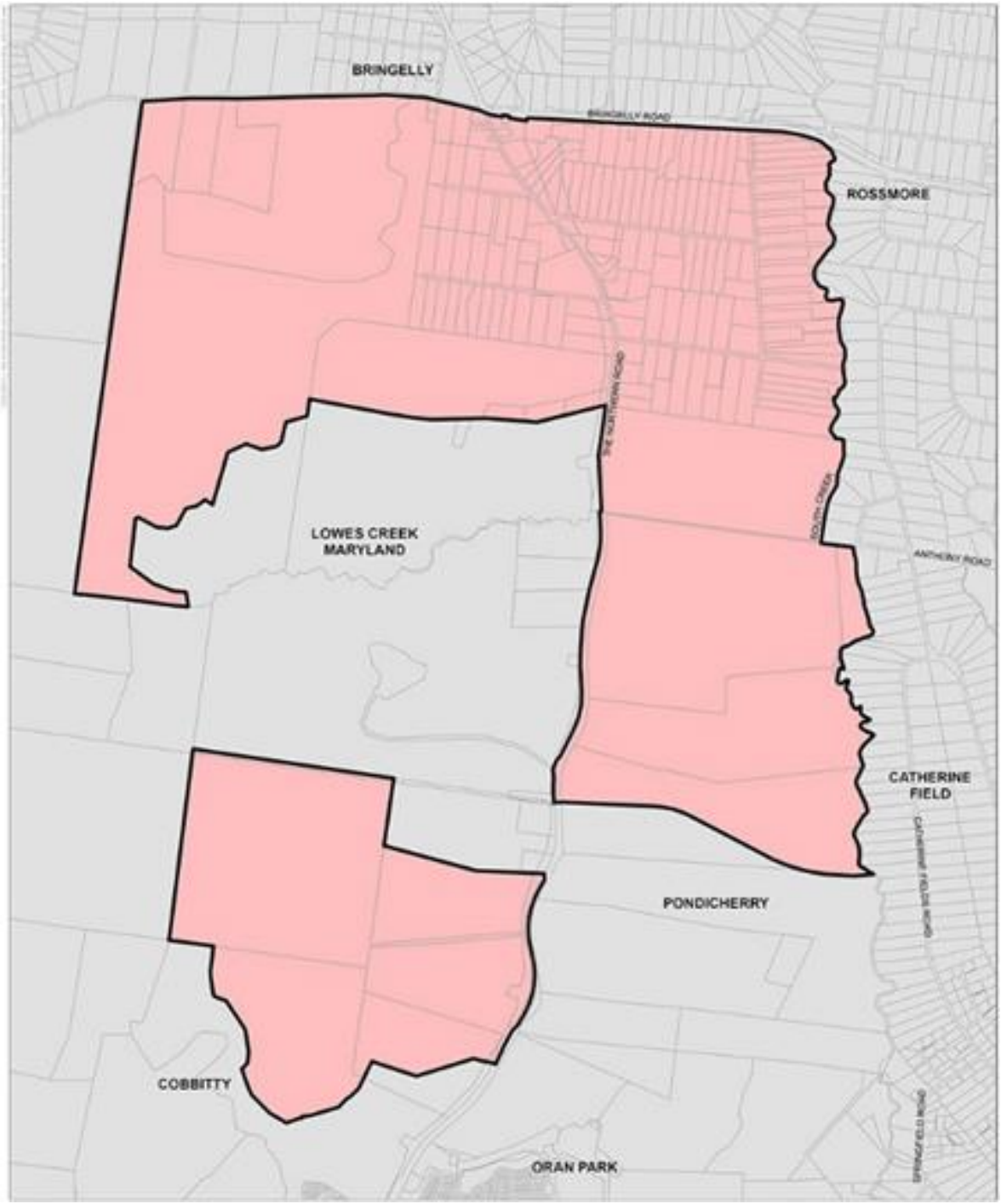
The South Creek West (SCW) land release area forms part of the South West Growth Area (SWGA). Given the scale of the release area, the Department of Planning, Industry and Environment (DPIE) divided SCW into five distinct precincts numbered 1 – 5. The land to which this Planning Proposal relates to is referred to as Cobbitty Sub-Precinct 5, also known as Precinct 5. It totals approximately 303 hectares (ha) and has been characterised by rural residential and agricultural land uses and activities.

The SCW Precinct was released by the Minister for Planning on 24 November 2017 for urban development. The release formally commenced the rezoning process for land within the precinct, including the subject site.

Precinct 5 is located within the southwest portion of SCW, within the suburb of Cobbitty in the Camden LGA. Precinct 5 adjoins the Lowes Creek Maryland (LCM) Precinct, which has recently been rezoned to the north, the Pondicherry precinct to the east, which is in the process of being rezoned, and the growing town centre and suburbs of Oran Park to the south.

The location of Precinct 5 with respect to the Oran Park and LCM Precinct boundaries is shown in **Figure 1**.

Figure 1 Locality of Precinct 5, Oran Park and Lowes Creek Maryland Precinct



2.1 Proposal

BHL, as the major landholder in the precinct, seeks to initiate the preparation of a planning proposal for the rezoning of Precinct 5, consistent with the Draft Indicative Layout Plan (ILP). This is to facilitate the orderly redevelopment of Precinct 5 into a residential community.

The intended outcome of this Planning Proposal is to amend the current *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* to facilitate the urban development of Precinct 5 as part of the SWGA and as envisaged in the Greater Sydney Commission's Regional Plan and District Plan.

The Draft ILP has been prepared to support the planning proposal and precinct rezoning and has been informed by extensive specialist consultant studies. The site will comprise approximately 3,800 dwellings and a population of 12,000 people within a thriving community supported by:

- Easy access to jobs in the Western Sydney Aerotropolis
- Local shops, community uses and services, and proximity to the Oran Park Town Centre
- Over 78 ha of open space, including 32 ha of sporting fields and local parks
  - Open space typologies also include creeks, grasslands, playgrounds, and other nature-based recreations areas
- Pedestrian and cycling connections including a central green corridor
- Prominent creeks and riparian areas that retain water in the local environment
- A future local school
- Integrated stormwater and services infrastructure that improve local amenity

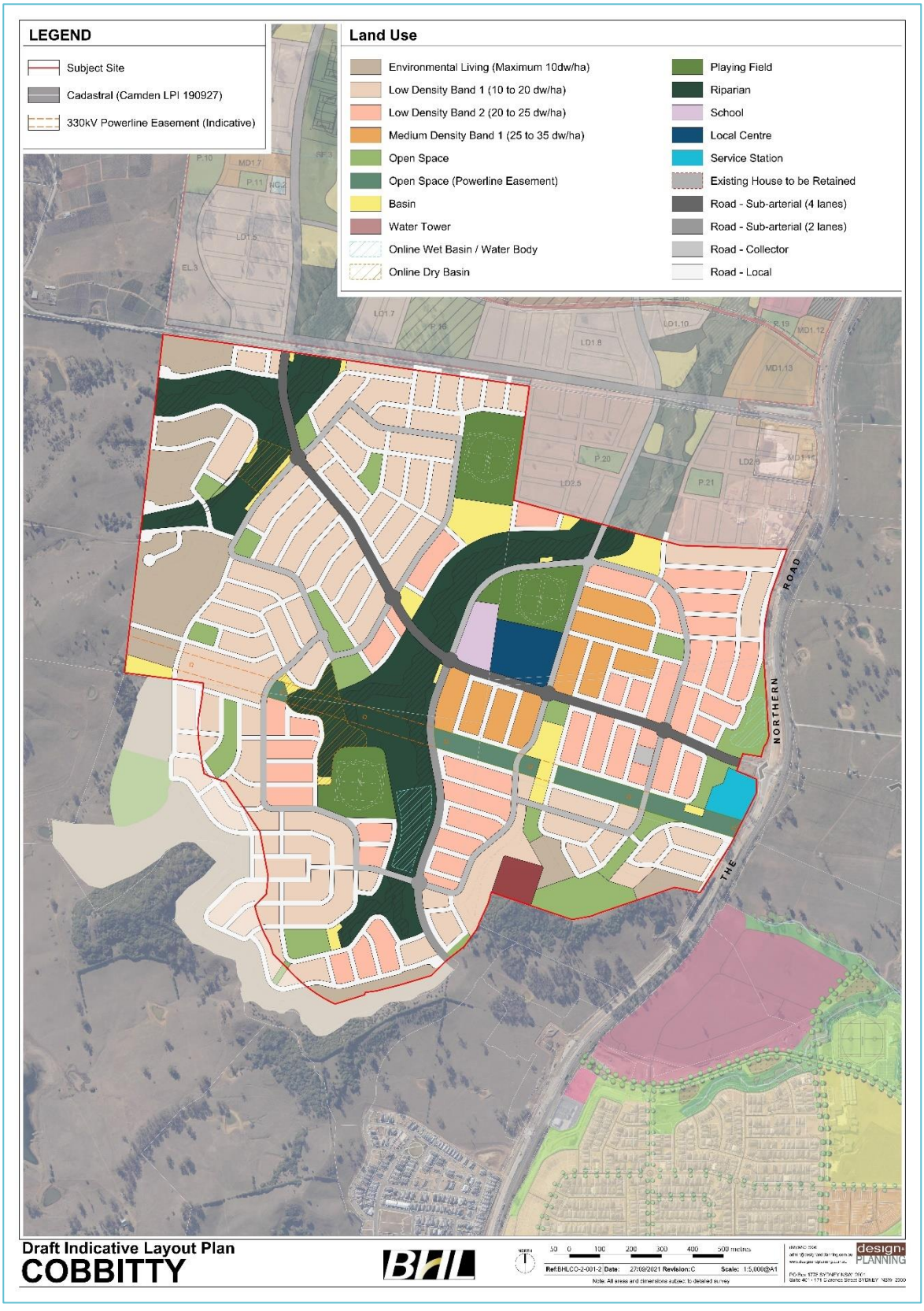
The proposed new planning controls comprise amendments to *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* and associated environmental planning instruments including the rezoning of the precinct to reflect land uses shown in the Draft ILP.

This Planning Proposal also seeks to introduce a site-specific Schedule to the *Camden Growth Centre Precincts Development Control Plan* to support the Precinct's development in accordance with the Draft ILP and supporting technical investigations.

2.2 Indicative Layout Plan

The land uses within Precinct 5 will include residential, open space, basin, playing field, riparian, school, local centre and a service station. The Draft Indicative Layout Plan (ILP) is shown in **Figure 2**.

Figure 2 DRAFT Indicative Site Layout – Precinct 5



2.3 Desktop Review

A desktop review was undertaken to identify existing and future air emission sources with potential to have an impact on air quality within Precinct 5. This review included:

- A review of aerial imagery of the region surrounding Precinct 5;
- A search of the National Pollutant Inventory database; and
- A search of projects listed on the Major Projects Portal.

A summary of the identified air emissions sources are presented in **Figure 3** and listed in **Table 1**.

Figure 3 Identified Potential Air Emission Sources in the Vicinity of Precinct 5

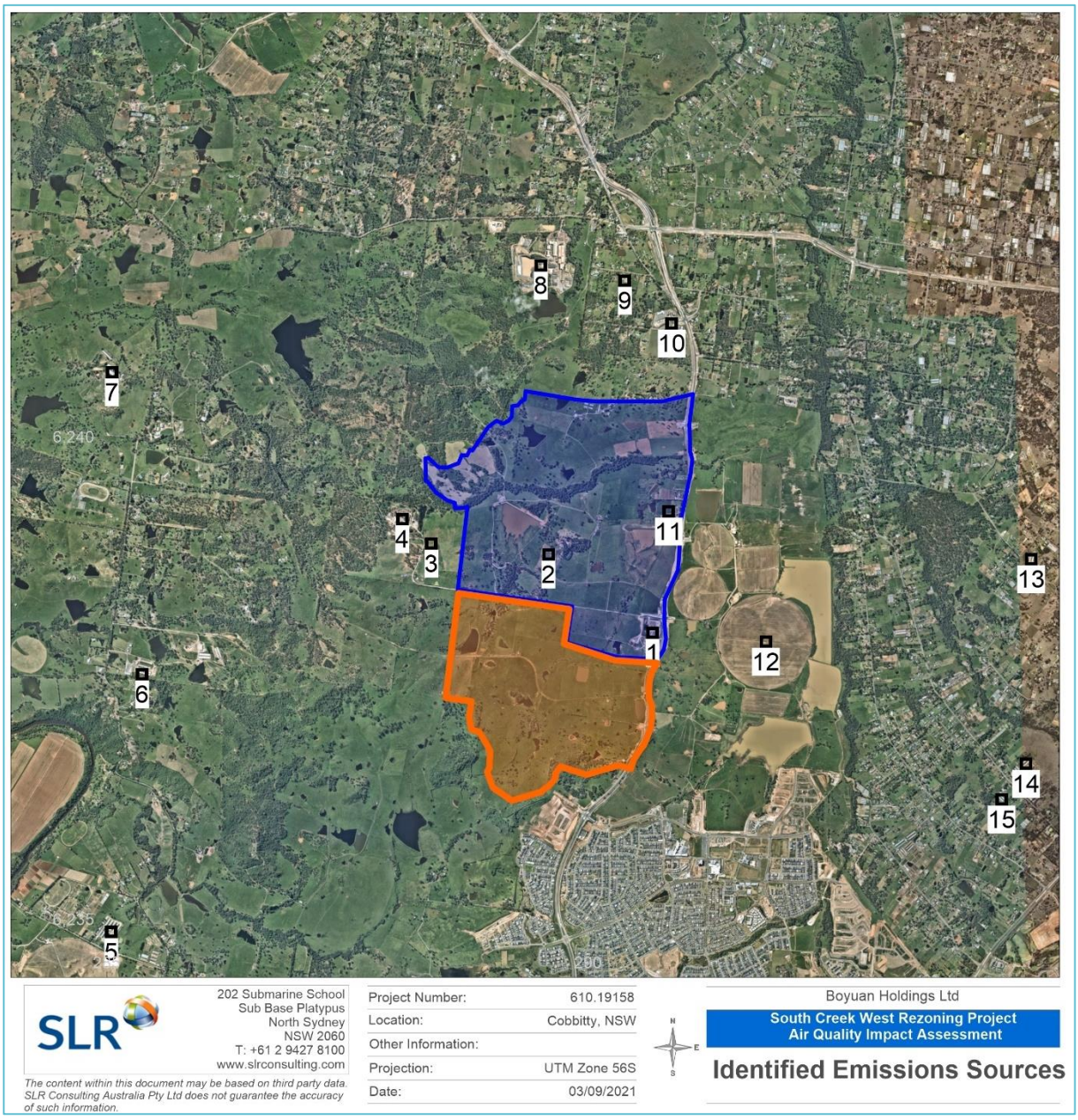


Table 1 Identified Potential Air Emission Sources in the Precinct 5 Region

Source ID	Address	Brief Description	Distance from the nearest Precinct 5 Boundary
1	Access from Northern Road	Soil mixing business	400 m
2	Access from Northern Road	Duck farming	550 m
3	Access from Northern Road	Tomato farming	200 m
4	Access from Northern Road	W2R Compost farm	850 m
5	169 Cut Hill Road, Cobbitty	Duck farming	4,500 m
6	18 Coates Park Road, Cobbitty	Chicken sheds	2,500 m
7	205 Coates Park Road, Cobbitty	Equestrian centre	4,500 m
8	60 Greendale Road, Bringelly	Bringelly Brickworks (Boral)	3,500 m
9	Loftus Road, Bringelly	Hydroponic lettuce farming	3,450 m
10a 10b	Access from Northern Road	Northern Road concrete batching plant; Northern Road asphalt plant	3,400 m
11	The Northern Road, Lowes Creek	Strawberry farming	1,500 m
12	The Northern Road, Lowes Creek	Turf production	800 m
13	313 Eastwood Road, Leppington	Chicken sheds	3,600 m
14	108 Deepfields Road, Leppington	Refrigerated chicken meat facility	3,900 m
15	101 Deepfields Road, Leppington	Chicken sheds	3,850 m

In addition to the existing sources identified above, the ILP includes a proposed service station on the eastern boundary of Precinct 5. This activity also has potential to give rise of localised air quality impacts. There will also be traffic-related emissions from the local road network that have potential to impact on air quality within Precinct 5.

2.4 Investigation & Site Visit of Surrounding Area

A site visit was conducted by SLR on 24 January 2020 (between 10:00 am to 1:00 pm) to confirm the sources identified from the desktop review and to verify that there are no other activities with potential for significant air emissions within the vicinity of the Precinct.

The following general observations were made during the site visit.

- The weather was overcast with slight ongoing drizzle at the time of site visit. The winds were mainly blowing from the southwest direction during the hours of 10:00 am and 1:00 pm.
- The Northern Road upgrade works were being undertaken, and only one lane was open for traffic in each direction. The Northern Road section between the Bringelly Road (to the north) and Peter Brock Drive (to the south) was a 'no stopping' zone.
- Access into the LCM Precinct was not possible due to the construction of various intersections taking place at the time of the site visit.
- The land use in the vicinity of Precinct 5 was comprised mainly of agricultural operations and low density residential developments.

- No odour was experienced in the vicinity of Precinct 5.

Further details based on observations of each of the 15 identified potential air emissions sources listed in **Table 1** are provided in the sections below.

Source # 1 – Soil Mixing Business (Access from Northern Road)

A soil mixing business is located at the northeast corner of the Precinct 5 boundary. During the site visit, it was noted that the soil mixing process was non-operational and the stockpiles were covered by a tarpaulin. No odour or dust was detected during the site visit. It is noted that this source lies within the LCM Precinct boundary, and is to be decommissioned as part of the LCM development (SLR 2016), therefore this source is not considered any further in this assessment.

Photo 1 Soil Mixing Business located on The Northern Road (Source # 1)

Source # 2 – Duck Farming

The site comprises three (3) sheds used for duck rearing. During the Precinct 5 site visit, access to this site was not possible due to the Northern Road upgrade works taking place at the time. As part of the LCM Precinct development, these sheds are proposed to be demolished (SLR 2016), therefore this source is not considered any further in this assessment.

Photo 2 Duck Rearing Sheds located within Precinct boundary (Source # 2)

Source: SLR 2016

Source # 3 – Tomato Farming (Access from Northern Road)

A tomato farm was identified 200 m northwest of the nearest Precinct 5 boundary in previous surveys performed by SLR of the area. Due to the Northern Road upgrade works, it was not possible to access this site, therefore it could not be established whether this site is still operational.

There is potential for some odours to be generated at times by the tomato farm, for example during the spreading of fertiliser, effluent disposal or chemical spraying on the tomato plants.

As part of the LCM Precinct development, this activity is proposed to be relocated (SLR 2016), therefore this source is not considered any further in this assessment.

Photo 3 Tomato Farming located on the Precinct Boundary (Source # 3)

Source: SLR 2016

Source # 4 – Composting Business (Access from Northern Road)

A composting business (W2R Compost Farm) was identified approximately 850 m northwest of the nearest Precinct 5 boundary in previous surveys performed by SLR of the area. Due to the Northern Road upgrade works, it was not possible to access this site, therefore it could not be established if this site is still operational. No operational information such as the annual tonnage of waste processed by the business, is known.

Considering relatively close proximity to the proposed Precinct boundary, it is anticipated that should the business continue to operate, some odour impact may be experienced at the western Precinct 5 boundary. Therefore it is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Figure 4 Composting Business located on the Precinct Boundary (Source # 4)

Source # 5 - Pepe's Ducks Pty Ltd, 69 Cut Hill Road, Cobbitty

This site comprises ten sheds used for duck rearing. From the access road, the area surrounding the sheds appeared to be neat and tidy. No odour was observed at the time of the site visit, however it is noted that it was not possible to get downwind of the sheds as the winds were blowing from the southwest at the time of the visit. The observations were made from the access road, approximately 80 m south of the closest shed. These duck rearing sheds are located approximately 4.5 km from the nearest Precinct 5 boundary. It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Photo 4 Duck Rearing Sheds located at 169 Cut Hill Road, Cobbitty (Source # 5)

Source # 6 - Broiler Farm (18 Coates Park Road, Cobbitty)

This broiler farm is located at 18 Coates Park Road, Cobbitty on lot 5 of the DP 1012683. As shown in **Photo 5**, four sheds are located at the front (western end) of the site, which are visible from Coates Park Road and were observed to be operational. No odour was noted at the time of the site visit, however it was not possible to get downwind of the sheds as the winds were blowing from the southwest at the time of the visit. The observations were made from Coates Park Road, approximately 300 m west of the closest shed.

Photo 5 shows another group of four (4) sheds located at the back (eastern end) of the property. No operational information is available for these sheds and it was not possible to confirm during the site visit if they are currently operational. Due to the uncertainty whether there are currently four or eight sheds operating at this site, for the purpose of this assessment, separation distances from this source have been calculated based on eight sheds. These chicken sheds are located approximately 2.5 km from the nearest Precinct 5 boundary, as shown in **Figure 3**.

Photo 5 Chicken Sheds located at 18 Coates Park Road, Cobbitty (Source # 6)

Source # 7 – Equestrian Centre (205 Coates Park Road, Cobbitty)

An equestrian centre was noted to be operational in the Cobbitty area. No odour was detected during the site visit. It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Considering the nature of the equestrian centre works and large separation distance (4.5 km), it is considered no odour impacts are anticipated from this source, and hence it is not considered any further within this assessment.

Photo 6 Equestrian Centre located at 205 Coates Park Road, Cobbitty (Source # 7)

Source # 8 – Bringelly Brickworks (60 Greendale Road, Bringelly)

Boral bricks operate one of the largest brick-making plants in Sydney at 60 Greendale Road, Bringelly (Bringelly Brickworks). The Bringelly Brickworks comprises a crushing and manufacturing plant, stockpiling areas, product storage and delivery areas, and a quarry which has 6 million tonnes of resource available (Boral 2012).

Bringelly Brickworks is surrounded by residential properties to the north (approximately 400 m), west (approximately 650 m), east (approximately 250 m) and southeast (approximately 650 m).

The Bringelly Brickworks is currently operating under an approval granted by Camden Council on 13 September 1991 (Council ref. DA 91/1194), which permits quarry production up to 200,000 tonnes per annum and brick production up to 160,000 tonnes per annum. A recent application by Bringelly Brickworks (Wilkinson Murray 2013) was submitted to the Department of Environment and Planning (DP&E) to increase brick production to 263,500 tonnes per annum (40% increase).

No odour was detected in the vicinity of the facility during the site visit.

Considering the scale and nature of activities undertaken at Bringelly Brickworks, it is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Photo 7 Boral Bricks located at 60 Greendale Road, Bringelly (Source # 8)

Source # 9 – Hydroponic Lettuce Farming (Loftus Road, Bringelly)

A hydroponic lettuce farm was noted to be operational in Bringelly. No odour was detected in the vicinity of this farm during the site visit. It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Considering the nature of the hydroponic farming process and large separation distance (3,450 m), it is considered no odour impacts are anticipated from this source, and hence it is not considered any further within this assessment.

Photo 8 Hydroponic Lettuce Farming located at Loftus Road (Source # 9)

Source # 10a – Concrete Batching Plant (Access from Northern Road)

A concrete batching plant is located approximately 3,400 m from the nearest Precinct 5 boundary. Due to the Northern Road upgrade works, it was not possible to access this site during the Precinct 5 site visit, however vehicle movements noted within the concrete batching plant suggest that it is currently operational. No odour or dust was noted during the site visit. It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Photo 9 Concrete Batching Plant (Source # 10a)

Source # 10b – Asphalt Plant (Access from Northern Road)

An asphalt plant is located approximately 3,400 m from the nearest Precinct 5 boundary. Due to the Northern Road upgrade works, it was not possible to access this site during the Precinct 5 site visit, however vehicle movements noted within the asphalt plant suggests that it is currently operational. No odour or dust was noted during the site visit. It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Photo 10 Asphalt Plant (Source # 10b)

Source # 11 – Strawberry Farming (The Northern Road, Lowes Creek)

A strawberry farm was identified approximately 1,500 m north of Precinct 5. Due to the Northern Road upgrade works, it was not possible to access this site, therefore it could not be established weather this site is currently operational. The area has been included within the rezoning boundary as part of the LCM development, and is proposed to be decommissioned as part of the LCM development (SLR 2016), therefore it is not considered any further in this assessment.

Photo 11 Strawberry farming located at The Northern Road (Source # 11)

Source # 12 – Turf Production (The Northern Road, Lowes Creek)

A turf production farm was identified 800 m east of the Precinct 5 boundary. A large volume of chicken manure (or mixed compost) was noted to be stored in the form of windrows on site. No specific details of the amount of chicken manure typically stored on site have been able to be obtained. These chicken manure windrows are shown as a red boundary in **Photo 12**. No odour was detected during the site visit, although downwind area was not. A few residences are located approximately 600 m to the east of the turf farm and the nearest residence is located approximately 300 m southwest of the chicken manure windrows.

It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Photo 12 Turf Production Farm located at The Northern Road (Source # 12)

Note: Chicken manure storage (open windrows) is shown in 'red'.

Source # 13 – Poultry Farm (313 Eastwood Road, Leppington)

The site comprises four (4) poultry sheds, all naturally ventilated. No odour was noted at the time of the site visit and sheds appeared to be non-operational at the time. The sheds are elevated above Alma Road. These chicken sheds are located approximately 3.6 km from the nearest Precinct 5 boundary as shown in **Figure 3**. It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Photo 13 Chicken Sheds located at 313 Eastwood Road, Leppington (Source # 13)

Source # 14 - Poultry Farm and Processing Facility (108 Deepfields Road, Leppington)

The site comprises a refrigerated chicken meat processing facility and shop. In addition, it was observed that four (4) naturally ventilated poultry sheds were situated behind the factory. No odour was noted at the time of the site visit. These chicken sheds are located approximately 3.9 km from the nearest Precinct 5 boundary as shown in **Figure 3**. It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Photo 14 Chicken Sheds located at 108 Deepfields Road, Leppington (Source # 14)

Source # 15 – Poultry Farm (101 Deepfields Road, Leppington)

The site comprises three operational poultry sheds. The sheds were observed to have blue tarpaulin sheets covering the side walls. These chicken sheds are located approximately 3.9 km from the nearest Precinct 5 boundary as shown in **Figure 3**. It is considered appropriate to assess this site with respect to the separation distance to the Precinct 5 boundary.

Photo 15 Chicken Sheds located at 101 Deepfields Road, Leppington (Source # 15)

2.5 Identified Existing Local Air Emission Sources

The **Table 2** shows a summary of the poultry farms and other industrial and agricultural facilities identified as existing potential sources of air emissions that could have an impact on air quality and amenity levels at Precinct 5.

Table 2 Identified Odour Sources in the Precinct 5 Region

Source ID	Description	Preliminary Assessment	Pollutants
1	Soil mixing business	Not considered any further	NA
2	Duck farming	Not considered any further	NA
3	Tomato farming	Not considered any further	NA
4	Composting business	To consider separation distance	Odour
5	Duck farming	To consider separation distance	Odour
6	Chicken Sheds (8 sheds)	To consider separation distance	Odour
7	Equestrian Centre	Not considered any further	NA
8	Bringelly Bricks	To consider separation distance	Odour, products of fuel combustion, air toxics, nuisance dust
9	Hydroponic Lettuce Farming	Not considered any further	NA
10	Concrete Batching Plant and Asphalt Plant	To consider separation distance	Odour, products of fuel combustion, air toxics, nuisance dust
11	Strawberry farming	Not considered any further	NA
12	Turf production	To consider separation distance	Odour
13	Chicken Sheds	To consider separation distance	Odour
14	Refrigerated chicken meat facility	To consider separation distance	Odour
15	Chicken Sheds	To consider separation distance	Odour

Based on the types of air pollution sources identified above, the air pollutants of interest have been identified as:

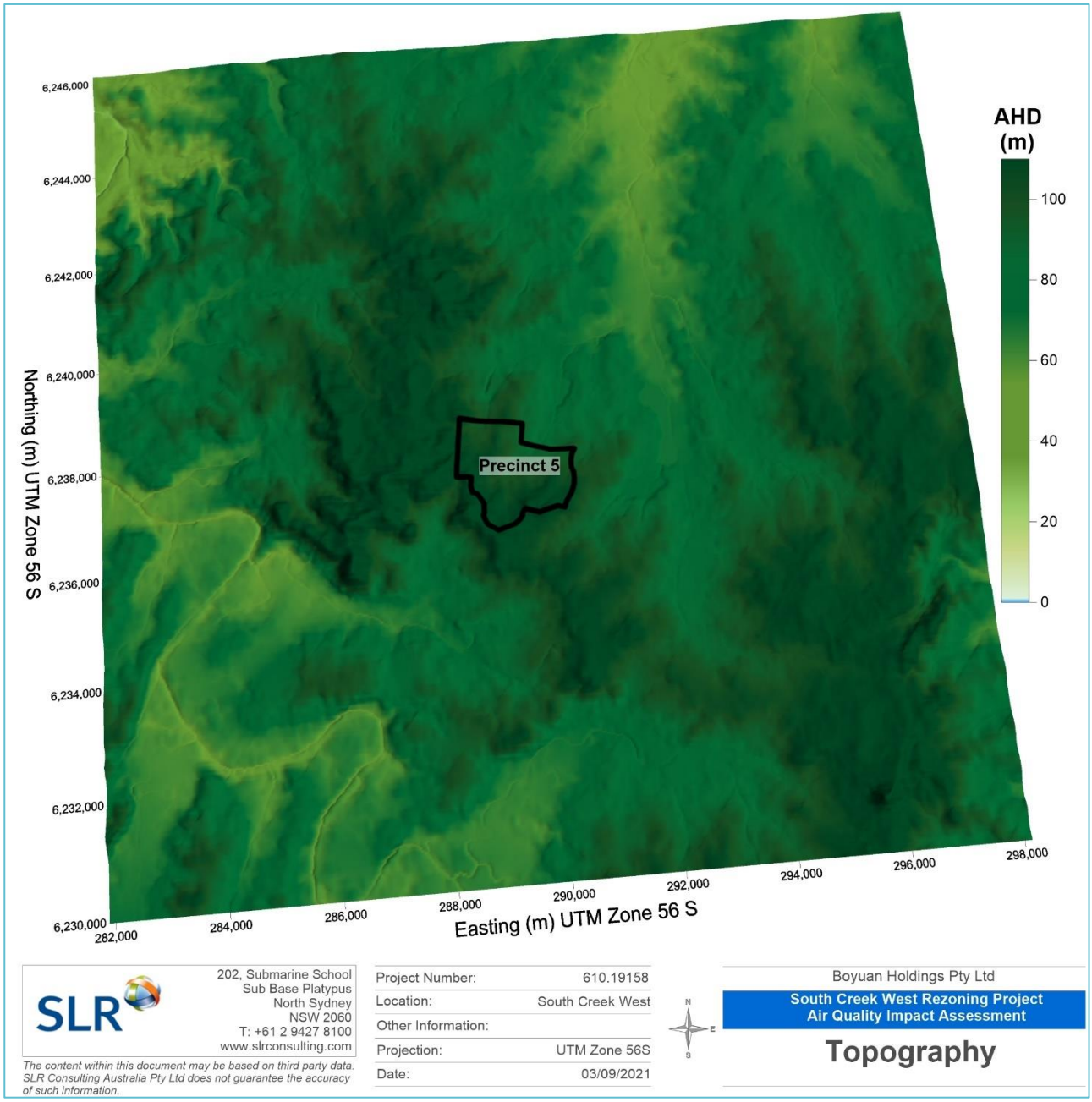
- Odour from the poultry farms, composting operation and asphalt plant;
- Emissions of particulate matter, oxides of nitrogen, sulfur oxides and hydrogen fluoride, and individual air toxics from the Bringelly Brickworks and fugitive dust emissions from the associated quarrying operations;
- Emissions of particulate matter, oxides of nitrogen, sulfur oxides, and individual air toxics from the Northern Road asphalt plant;
- Products of fuel combustion (including particulate matter) and fugitive dust from the Northern Road concrete batching plant; and
- Products of fuel combustion (including particulates) from local road traffic.

3 Receiving Environment

3.1 Topography

Local topography is important in air quality studies as local atmospheric dispersion can be influenced by night-time katabatic (downhill) drainage flows from elevated terrain or channelling effects in valleys or gullies. As shown in **Figure 5**, the elevation of the Precinct 5 ranges from approximately 60 m to 80 m Australian Height Datum (AHD), and is generally at a higher level than the surroundings, which would inhibit any potential for drainage flows towards Precinct 5.

Figure 5 Regional Topography



3.2 Local Wind Conditions

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) will also influence dispersion.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station recording wind speed and wind direction data is the Camden Airport Automatic Weather Station (AWS), located approximately 6.5 km southwest of Precinct 5 (Station ID 68192). For the purpose of this assessment, it is assumed that the wind conditions recorded by the Camden Airport AWS are representative of the wind conditions experienced at Precinct 5.

Annual and seasonal wind roses for the years 2016 to 2020 compiled from data recorded by the Camden Airport AWS are presented in **Figure 6**. Wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from North). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

The 'Beaufort Wind Scale' (consistent with terminology used by the BoM) presented in **Table 3** was used to describe the wind speeds experienced at Precinct 5.

Table 3 Beaufort Wind Scale

Beaufort Scale #	Description	m/s	Description on Land
0	Calm	0-0.5	Smoke rises vertically
1	Light air	0.5-1.5	Smoke drift indicates wind direction
2-3	Light/gentle breeze	1.5-5.3	Wind felt on face, leaves rustle, light flags extended, ordinary vanes moved by wind
4	Moderate winds	5.3-8.0	Raises dust and loose paper, small branches are moved
5	Fresh winds	8.0-10.8	Small trees in leaf begin to sway, crested wavelets form on inland waters
6	Strong winds	>10.8	Large branches in motion, whistling heard in telephone wires; umbrellas used with difficulty

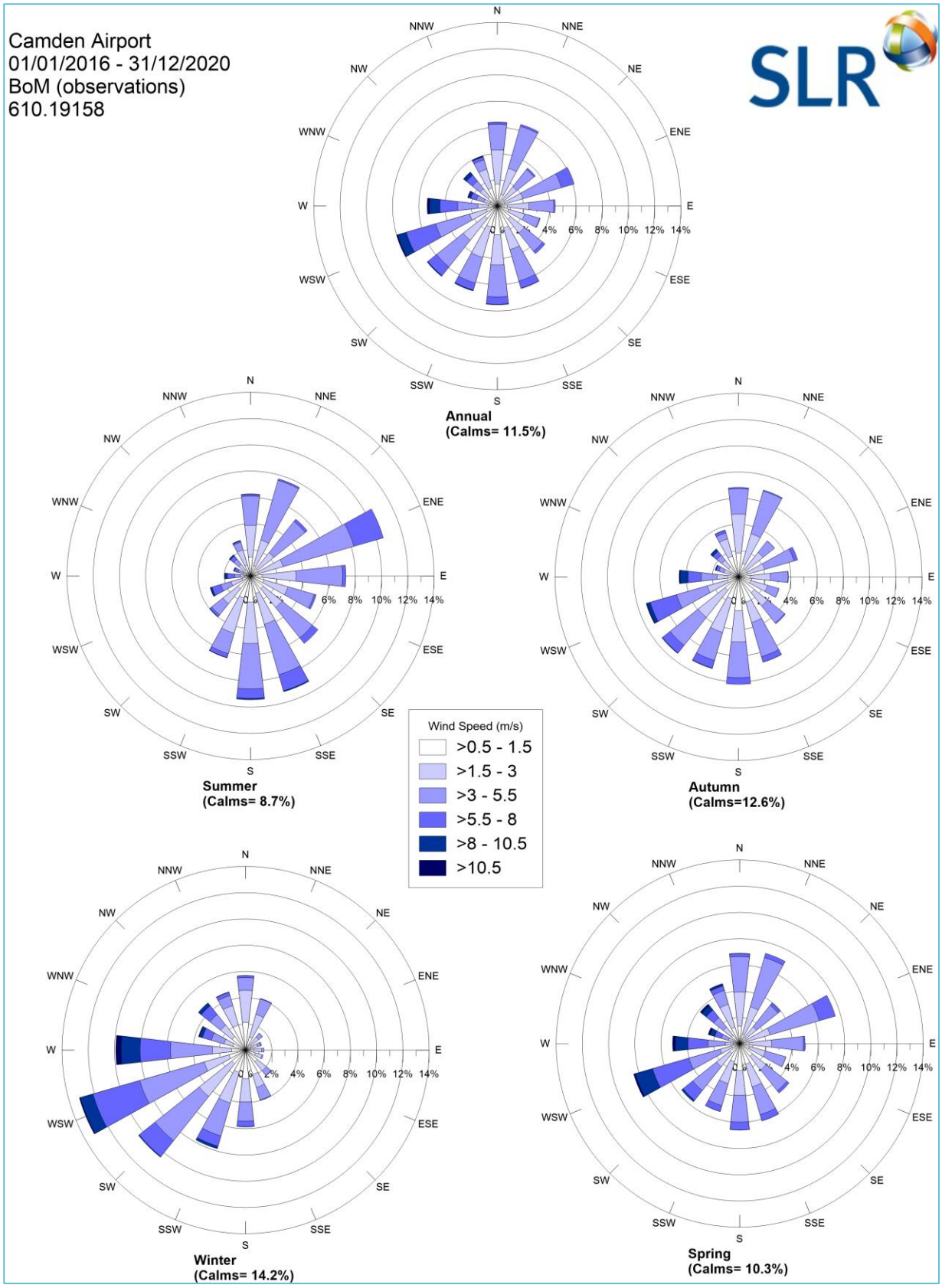
Source: http://www.bom.gov.au/lam/glossary/beaufort.shtml

The annual wind roses for the years 2016 to 2020 (**Figure 6**) indicate that there is no predominant wind directions in the area, and winds are experienced from all directions almost evenly except from the southeast and west-northwest, from where winds are experienced infrequently. The annual frequency of calm wind conditions was recorded approximately 11.5% on average between 2016 and 2020. Overall, the wind roses indicate that there is some seasonal variation in wind directions recorded by the Camden Airport AWS, however wind speeds are relatively consistent throughout the year.

The seasonal wind roses from 2016 to 2020 (**Figure 6**) indicate that:

- During summers, wind speeds ranged from calm to strong winds (between 0.5 m/s and 12.1 m/s). The majority of winds originated from the south-eastern quadrant, and between the north-northeast and east-northeast, with very few winds from other directions. Calm wind conditions were recorded approximately 8.7% of the time during summer.
- During autumns, wind speeds ranged from calm to strong winds (between 0.5 m/s and 11.8 m/s). The majority of winds were between north and north-northeast as well as south and west-southwest, with very few winds from other directions. Calm wind conditions were observed to occur 12.6% of the time during autumn.
- During winters, wind speeds ranged from calm to strong winds (between 0.5 m/s and 13.7 m/s). The majority of winds originated from between west and south-southwest, with few winds from other directions. Calm wind conditions were observed to occur approximately 14.2% of the time during winter.
- During springs, wind speeds ranged from calm to strong winds (between 0.5 m/s and 13.1 m/s). The majority of winds originating from south-western and south-eastern quadrants. Calm wind conditions were observed to occur approximately 10.3% of the time during spring.

Figure 6 Seasonal Wind Roses for Camden Airport (2016 to 2020)



4 Legislation, Regulation and Guidance

4.1 Pollutants of Concern

As identified in **Section 2.3**, the key sources of air pollutants in the area are considered to be:

- Odour from the existing poultry farms, composting operations and asphalt plant;
- Process emissions from the brick kilns at the existing Boral Brickworks Bringelly and the Northern Road Asphalt Plant, including:
  - Particulate matter
  - oxides of nitrogen
  - sulfur dioxide
  - hydrogen fluoride and fluorine
  - hydrogen sulphide
  - hydrogen chloride
  - small quantities of heavy metals and volatile organic compounds;
- Products of fuel combustion (including particulate matter) from vehicles travelling on the local road network (in particular, The Northern Road).
- Fugitive dust emissions from quarrying activities associated with the Boral Brickworks Bringelly and material handling activities at the Northern Road Asphalt Plant operations;

The service station proposed to be located on the eastern boundary of Precinct 5, will also have the potential to emit volatile organic compounds (VOCs) due to the volatilisation of fuel during storage and handling.

The following sections outline the potential health and amenity issues associated with the above pollutants of concern, while **Section 4.2** identifies the relevant air quality assessment criteria.

4.1.1 Particulate Matter

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms “dust” and “particulates” are often used interchangeably. The health effects of particulate matter are strongly influenced by the size of the airborne particles. Smaller particles can penetrate further into the respiratory tract, with the smallest particles having a greater impact on human health as they penetrate to the gas exchange areas of the lungs. Larger particles primarily cause nuisance associated with coarse particles settling on surfaces.

The term “particulate matter” refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP). Particulate matter with an aerodynamic diameter of 10 microns or less is referred to as PM_{10}. The PM_{10} size fraction is sufficiently small to penetrate the large airways of the lungs, while $PM_{2.5}$ (2.5 microns or less) particulates are generally small enough to be drawn in and deposited into the deepest portions of the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

4.1.2 Products of Combustion

Emissions associated with the combustion of fossil fuels at Boral Brickworks and the Northern Road Asphalt Plant and from local road traffic will include carbon monoxide (CO), oxides of nitrogen (NO_x), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and VOCs.

CO is an odourless, colourless gas formed from the incomplete burning of fuels in motor vehicles. It can be a common pollutant at the roadside and highest concentrations are found at the kerbside with concentrations decreasing rapidly with increasing distance from the road. CO in urban areas results almost entirely from vehicle emissions and its spatial distribution follows that of traffic flow.

PM_{10} and $PM_{2.5}$ are emitted as part of the vehicle exhaust and also as result of brake and tyre wear, and due to the resuspension of road dust due to wake effects as cars and vehicles travel along the road. The incomplete combustion of fuel in diesel powered vehicles can generate particulate in the form of black soot.

Oxides of nitrogen (NO_X) is a general term used to describe any mixture of nitrogen oxides formed during combustion. In atmospheric chemistry, NO_X generally refers to the total concentration of nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO will be converted to NO_2 soon after leaving the engine exhaust.

Engine exhausts can also contain emissions of sulfur dioxide (SO_2) due to impurities in the fuel. The sulfur content in diesel fuel has significantly reduced over the years and currently ambient SO_2 concentrations in Australian cities are typically well below regulatory criteria.

4.1.3 Individual Air Toxics

Individual toxic air pollutants are generally defined on the basis that they are carcinogenic, mutagenic, teratogenic, highly toxic or persistent in the environment. They include individual VOCs, metals and compounds, dioxins and furans, polycyclic aromatic hydrocarbons etc.

Some VOCs are also highly odorous and can give rise to nuisance impacts at concentrations above their individual odour threshold.

4.1.4 Odour

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management, but are generally not intended to achieve “no odour”.

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the *odour threshold* and defines one odour unit (ou). An odour goal of less than 1 ou would theoretically result in no odour impact being experienced.

In practice, the character of a particular odour can only be judged by the receiver’s reaction to it, and preferably only compared to another odour under similar social and regional conditions. Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 ou to 10 ou depending on a combination of the following factors:

- *Odour quality*: whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- *Population sensitivity:* any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it may contain.
- *Background level:* whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- *Public expectation:* whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a wastewater treatment works.
- *Source characteristics:* whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily than diffuse sources. Emissions from point sources can be more easily controlled using control equipment. Point sources tend to be located in urban areas, while diffuse sources are more often located in rural locations.
- *Health Effects:* whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

An example for this can be shown in a theoretical case of a bakery. A person walking past the bakery may smell the bakery odours and 'like' these baking odours (it can be shown that people generally react positively to baking odours). However, a person living next to the bakery and who experiences the baking odours throughout their house and garden on a continuous basis may find the baking odours a nuisance to the point where they complain to local authorities.

4.2 Air Quality Criteria

4.2.1 Particulate Matter and Products of Combustion

State air quality guidelines specified by the NSW Environmental Protection Agency (EPA) for the pollutants identified in **Section 4.1** are published in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (EPA 2017) [hereafter 'Approved Methods']. The ground level air quality impact assessment criteria listed in Section 7 of the Approved Methods have been established by NSW EPA to achieve appropriate environmental outcomes and to minimise risks to human health. They have been derived from a range of sources and are the defining ambient air quality criteria for NSW, and are considered to be appropriate for use in this assessment.

A summary of the relevant impact assessment criteria for particulate matter and products of combustion is provided in **Table 4**.

Table 4 NSW EPA Goals for Particulate Matter and Combustion Gases

Pollutant	Averaging Period	Concentration	
CO	15 minutes	87 ppm	100 mg/m^3
	1 hour	25 ppm	30 mg/m^3
	8 hours	9 ppm	10 mg/m^3
NO_2	1 hour	12 pphm	246 µg/m^3
	Annual	3 pphm	62 µg/m^3
PM_{10}	24 Hours Annual	- -	50 µg/m^3 30 µg/m^3
$PM_{2.5}$	24 Hours Annual	- -	25 µg/m^3 8 µg/m^3
SO_2	10 minutes	25 pphm	712 µg/m^3
	1 hour	20 pphm	570 µg/m^3
	24 hours	8 pphm	228 µg/m^3
	Annual	2 pphm	60 µg/m^3

Source: EPA 2017

In relation to the air quality criteria shown in **Table 4**, it is noted that on 18 May 2021, the National Environment Protection Council (NEPC) varied the National Environment Protection (Ambient Air Quality) Measure (hereafter the Ambient Air NEPM) standards for ozone, NO_2 and SO_2 based on the latest scientific understanding of the health risks arising from these pollutants. In addition, the updated Ambient Air NEPM includes a reduced goal for $PM_{2.5}$ by 2025. As the ambient air quality criteria set out in the Approved Methods are based on the standards in the Ambient Air NEPM, an evaluation of this assessment's compliance with the new standards set out in the Ambient Air NEPM has also been performed. A summary of the updated standards for NO_2 and $PM_{2.5}$ is provided below in **Table 5**.

Table 5 Recent Changes to National Ambient Air Quality Criteria Relevant to this Assessment

Pollutant	Averaging Period	Previous NEPM Standard (µg/m^3)	New NEPM Standard (µg/m^3)
NO_2	1-Hour	246	165
	Annual	62	31
SO_2	1-Hour	570	215
$PM_{2.5}$	24-Hour	25	20
	Annual	8	7

4.2.2 Individual Air Toxics

The impact assessment criteria for individual air toxics relevant to Northern Road Asphalt Plant and Concrete Batching Plant are presented in **Table 6**.

Table 6 NSW EPA Impact Assessment Criteria for Individual Air Toxics

Pollutant	Averaging Period	Concentration	
		(µg/m³)	(mg/m³)
Formaldehyde[1]	1-hour	20	0.020
Dioxins and furans[2]	1-hour	$2.0x10^{-6}$	$2.0x10^{-9}$
Hydrogen chloride (HCl)	1-hour	140	0.14
Polycyclic aromatic hydrocarbons (PAHs) as benzo [a] pyrene	1-hour	0.4	0.0004
Antimony & compounds	1-hour	9	0.009
Arsenic & compounds	1-hour	0.09	0.00009
Beryllium & compounds	1-hour	0.004	0.000004
Cadmium & compounds	1-hour	0.018	0.000018
Chromium III & compounds	1-hour	9	0.009
Chromium VI & compounds	1-hour	0.09	0.00009
Copper dusts (raw) or copper fumes	1-hour	3.7	0.0037
Mercury (inorganic)	1-hour	1. 8	0.0018
Nickel & compounds	1-hour	0.18	0.00018
Zinc chloride fumes	1-hour	18	0.018

[1] The criterion for formaldehyde has been selected to assess the total volatile organic compounds (VOCs) as it is the most stringent criterion out of all the VOCs.

[2] Dioxins and furans as toxic equivalent must be calculated according to the potency equivalency factors listed in the clause 40 of the (POEO) Regulation.

4.2.3 Odour

The equation used by the NSW EPA to determine the appropriate impact assessment criteria for complex mixtures of odorous air pollutants, as specified in the document '*Technical framework: assessment and management of odour from stationary sources in NSW*' (hereafter the Odour Framework [DEC 2006a]), is expressed as follows:

$$\text{Impact assessment criterion (ou)} = (\log_{10}(\text{population})-4.5)/-0.6$$

A summary of the impact assessment criteria given for various population densities, as drawn from the Odour Framework, is given in **Table 7**. Based on the proposed future development within Precinct 5, a criterion of 2 ou would be appropriate for this Project.

Table 7 NSW EPA Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants

Population of Affected Community	Impact Assessment Criteria for Complex Mixtures of Odours (ou) (nose-response-time average, 99th percentile)
Urban area (≥ 2000)	2.0
~300	3.0
~125	4.0
~30	5.0
~10	6.0
Single residence (≤ 2)	7.0

Source: DEC 2006

As identified in **Section 2.3**, multiple odour generating sources exist in the vicinity of the Precinct 5; including a number of poultry farms and a composting farm. However, as odours from the poultry farms will have a different characteristic compared to odours from composting, it is not appropriate to assume that the odours are directly cumulative. The *Technical Notes: Assessment and management of odour from stationary sources in NSW* (DEC 2006b) only requires:

> *"Where it is likely that two or more facilities with **similar odour character** will result in cumulative odour impacts, the combined odours due to emissions resulting from all nearby facilities should also be assessed against the odour assessment criteria."*

On this basis, the potential impacts of odour emissions from the poultry farms and composting farm have been addressed separately.

4.3 Recommended Separation Distances

In situations where the specifics of a development are unknown (eg the potential locations of residential developments, or the nature, scale and potential impact of industrial or commercial land uses), the application of minimum recommended separation distances (or 'buffer' distances) provides a valuable screening tool to judge whether a detailed assessment is required to evaluate the potential risk of conflicting land uses.

4.3.1 Poultry Farms

The NSW EPA document '*Technical Notes: Assessment and Management of odour from stationary sources in NSW*' (hereafter the 'Technical Notes' [DEC 2006b]) sets out how to calculate separation distances for proposed broiler chicken farms that would use current standard production technology.

This methodology prescribed by the Technical Notes enables the separation distance to be varied according to the broiler chicken shed numbers, and management standards proposed and achieved. The recommended minimum distance between the broiler chicken sheds and impact areas is not simply increased proportionally to the number of broiler chicken sheds but instead considers the probable pattern of odour dispersion. This means that large broiler chicken farms are not sited unnecessarily long distances away from impact areas.

An assessment of the recommended separation distances for the poultry farm operations identified in the vicinity of Precinct 5 is presented in **Section 5.2.1**, with additional details of the methodology used included in **Appendix A**.

4.3.2 Brickworks and Ceramic Manufacturing

A number of state regulatory authorities in Australia have prescribed a separation distance for particular activities to be as a screening tool. Reference has been made to the separation distances prescribed by the regulatory authorities in the Australian Capital Territory (ACT), Victoria (VIC) and South Australia (SA), and a summary is shown in **Table 8**.

Table 8 Recommended Separation Distances – Brickworks and Ceramic Manufacturing

Source	Relevant Industry	Activity Notes	Separation Distance (m)
Bringelly Brickworks	Brick, tile, pipe, and refractory manufacturing[1]	Production of bricks, tiles, pipes, pottery goods or refractories, processed in dryers or kilns (>10,000 tonnes per year)	250
	Ceramic works[2]	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
	Ceramic works[3]	Fluoride emissions from ceramic works may pose a risk of damage to vegetation and animal health at levels lower than those required to impact on human health. Due to the high temperatures used, odour can also be a potential concern. Fugitive dust may result from material handling operations.	750

Source: [1] VIC EPA 2013, [2] ACT EPA 2018, [3]SA EPA 2016

The Bringelly Brickworks is located well beyond the separation distance recommended by all the regulatory agencies reviewed.

4.3.3 Asphalt Plant

The recommended separation distances prescribed by various regulatory authorities for asphalt plants is shown in **Table 9**.

Table 9 Recommended Separation Distances – Asphalt Plant

Source	Relevant Industry	Activity Notes	Separation Distance (m)
Northern Road Asphalt Plant	Asphalt Plant[1]	Production of asphalt (>100 tonnes per week)	500
	Hot mix asphalt preparation[2]	Conduct of works at which crushed or ground rock aggregates are mixed with bituminous or asphaltic materials for the purposes or producing road building mixtures	1,000
	Hot mix asphalt preparation [3]	Typical asphalt plants now provide a method of direct truck delivery and have gas reclaim systems to ensure odour emission rates are significantly lower than older plants. Odour is a main concern, where the odours are usually aliphatic organic chemicals.	1,000 (applicable to new residential development proposed in the vicinity of existing industry)

Source: [1] VIC EPA 2013, [2] ACT EPA 2018, [3]SA EPA 2016

The Northern Road asphalt plant is located well beyond the separation distance recommended by all the regulatory agencies reviewed.

4.3.4 Concrete Batching Plant

The recommended separation distances prescribed by various regulatory authorities for concrete batching plants is shown in **Table 10**.

Table 10 Recommended Separation Distances – Concrete Batching Plant

Source	Relevant Industry	Activity Notes	Separation Distance (m)
Northern Road Concrete Batching Plant	Concrete Plant[1]	Production of Concrete (>5,000 tonnes per week)	100
	Concrete Batching Works[2]	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
	Concrete Batching Works[3]	There is potential for dust generation with delivery of sand and aggregates, cement and fly ash (a cementitious material used to enhance the quality of concrete and similar to cement), loading of the aggregate weigh-hoppers, and loading of the trucks.	200

Source: [1] VIC EPA 2013, [2] ACT EPA 2018, [3]SA EPA 2016

The Northern Road concrete batching plant is located well beyond the separation distance recommended by all the regulatory agencies reviewed.

4.3.5 Composting Operations

The recommended separation distances prescribed by various regulatory authorities for composting operations is shown in **Table 11**.

Table 11 Recommended Separation Distances – Composting Operations

Source	Relevant Industry	Activity Notes	Separation Distance (m)
Composting Operations	Green Waste[1]	Open, turned windrow 36,000 tpa to 50,000 tpa	 2,000
	Composting Works [2]	Compost is produced at a rate of: >200 tpa >20 tpa and <200 tpa	 1,000 300
	Composting Works[3]	Impacts on air quality are the primary factor to consider with composting facilities. The potential for odour is influenced by the type and condition of the organic waste received and the composting method used. Potential sources of odour are windrows and lagoons. Dust can also be produced as part of composing works, eg from vehicle movements, windrow formation and turning, screening, stockpiling, loading and transport. (>200 tpa) (>20 & <200 tpa) (<20 tpa)	 1,000 300 100

Source: [1] VIC EPA 2013, [2] ACT EPA 2018, [3]SA EPA 2016

The W2R compost farm is located within the separation distance recommended by all the regulatory agencies reviewed for throughputs of greater than 200 tpa.

4.3.6 Turf Farms

The NSW Department of Primary Industries published 'Planning for Turf Farms' (DPI 2014), which suggests a minimum separation distance of 100 m between turf farms and dwellings and other sensitive developments. There are no specific separation distance guidelines for chicken manure storage in NSW.

4.3.7 Service Stations

The recommended separation distances prescribed by various regulatory authorities for service stations is shown in **Table 12**.

Table 12 Recommended Separation Distances – Service Stations

Source	Relevant Industry	Activity Notes	Separation Distance (m)
Service Station	Petroleum storage[1,2]	Storage of petroleum products or crude oil in tanks, tanks exceeding 2,000 tonnes (fixed roof)	250
	Service station/retail outlet[3]	All 24 hour operations (except on highways/freeways)	200

Source: [1] VIC EPA 2013, [2] ACT EPA 2018, [3]SA EPA 2016

5 Air Quality Impact Assessment

Air quality at Precinct 5 will be affected by regional background air quality, as well as the localised impacts of air emission sources within the surrounding area. The following section presents a summary of ambient air quality monitoring data available for the region, as well as an assessment of the potential impacts of the emission sources identified as requiring assessment in **Table 2**.

5.1 Background Air Quality

Air quality monitoring is performed by the NSW Department of Planning, Industry and Environment (DPIE) at a number of monitoring stations across NSW. The nearest such station is located at Camden Aerodrome, approximately 6.5 km southwest of Precinct 5. The Camden Air Quality Monitoring Station (AQMS) was originally commissioned from 1994 to 2004, and then recommissioned in 2014. The Camden AQMS monitors concentrations of following air pollutants:

- Oxides of nitrogen (NO, NO_2 and NO_X); and
- Fine particles ($PM_{2.5}$ and PM_{10}).

A summary of the monitored pollutant concentrations for the last five years (2016-2020) is presented in **Table 13** and the data are presented graphically in **Figure 7** to **Figure 9**

Table 13 Summary of Air Quality Monitoring Data at Camden AQMS (2016 - 2020)

Pollutant	NO_2		PM_{10}		$PM_{2.5}$	
	Maximum 1-hour	Annual	Maximum 24-hour	Annual	Maximum 24-hour	Annual
	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
2016	59.5	9.6	43.6	14.4	36.0	6.4
2017	90.2	10.0	48.4	14.7	27.7	6.7
2018	59.5	11.3	68.1	17.5	37.0	7.2
2019	61.5	11.2	139.2	22.5	155.3	11.8
2020	75.9	9.1	268.6	16.6	149.3	7.7
Criterion	**246**	**62**	**50**	**25**	**25**	**8**

The monitoring data for NO_2 indicate that the respective air quality criteria (short term and long term) for this pollutant are easily achieved at the Camden AQMS site.

Figure 7 Measured 1-Hour Average NO_2 Concentrations at Camden AQMS (2016 - 2020)

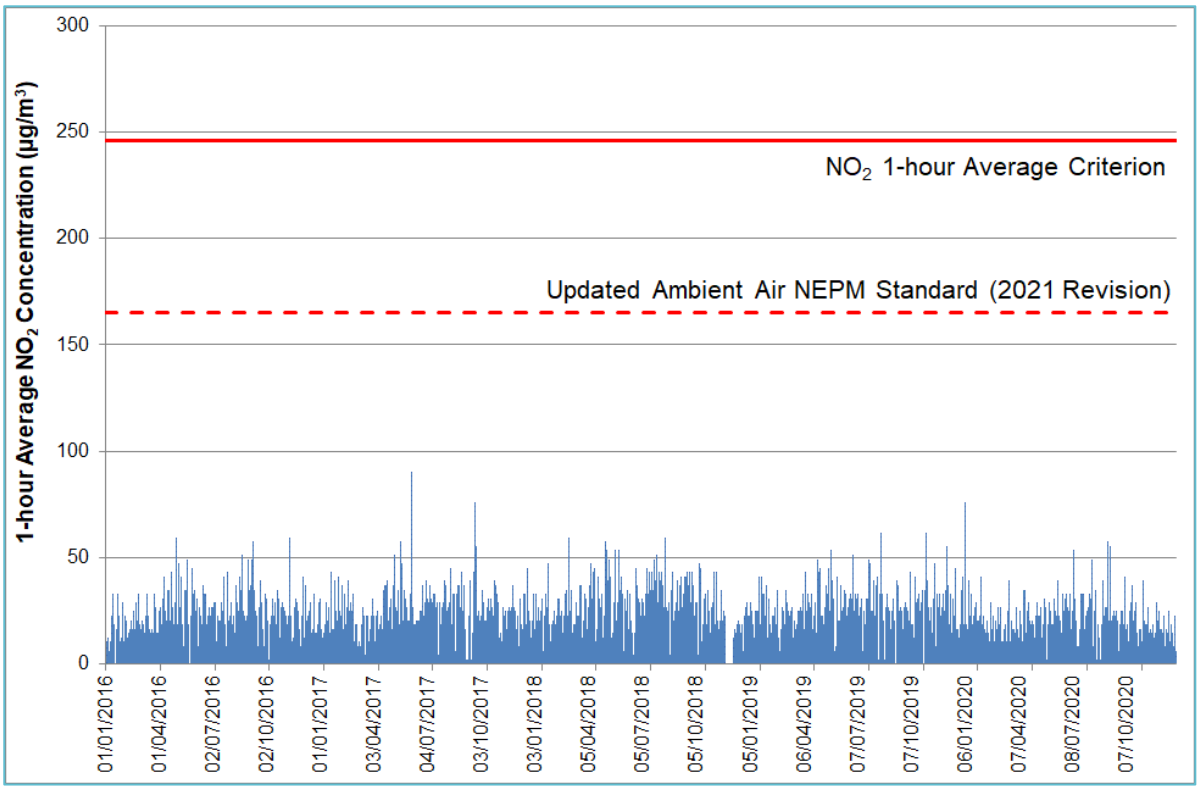


Figure 8 Measured 24-Hour Average PM_{10} Concentrations at Camden AQMS (2016 - 2020)

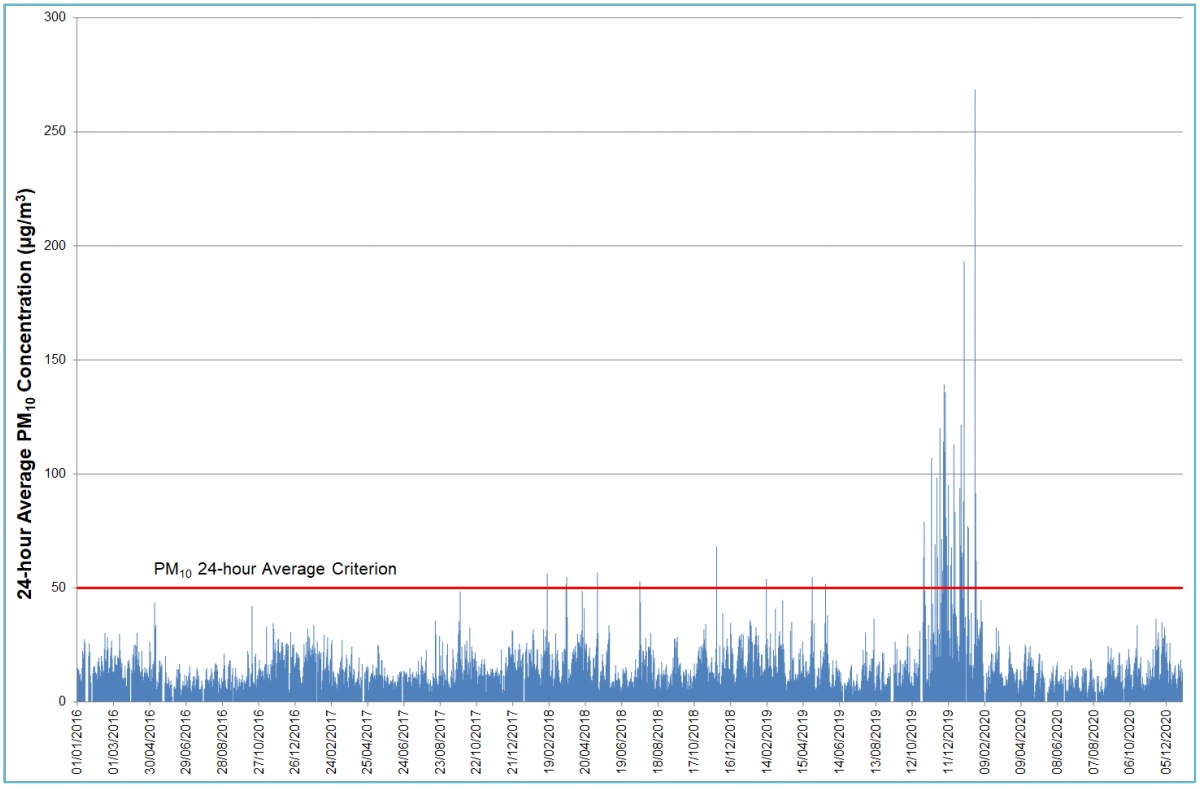
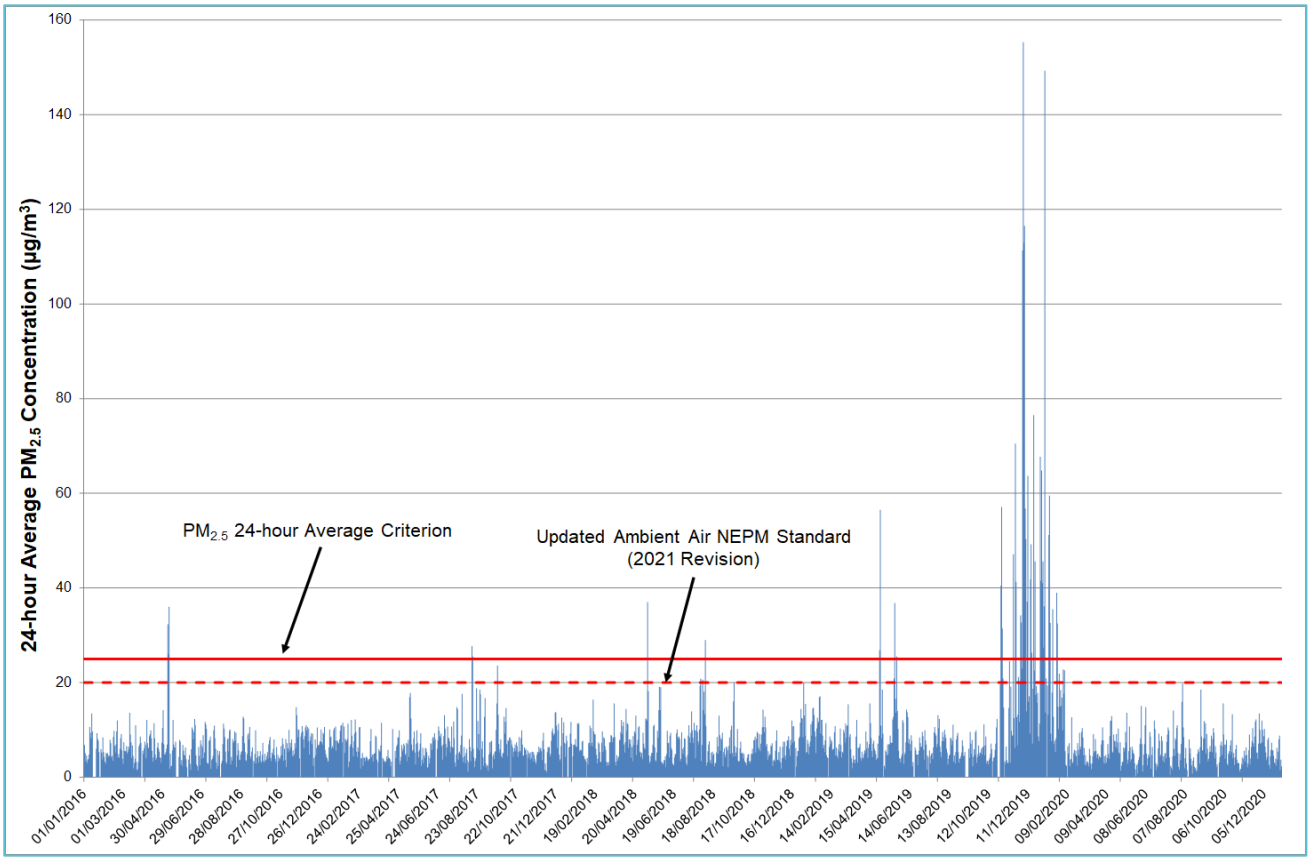


Figure 9 Measured 24-Hour Average $PM_{2.5}$ Concentrations at Camden AQMS (2016 - 2020)



Exceedances of the 24-hour average PM_{10} criterion were recorded by the Camden AQMS in all years except 2016 and 2017. A review of the exceedances recorded during 2018, 2019, and 2020 indicates that they were associated with natural events such as bushfires or dust storms, or hazard reduction burns.

Based on their review of ambient monitoring data from their 43 station air quality monitoring network, NSW EPA (in their publication *NSW* Annual Air Quality Statement 2020 [DPIE 2021]), concluded that the air quality in NSW met national standards between 85% and 99% of the time across regions.

Ambient monitoring of toxic air pollutants is not routinely carried out as part of the NSW DPIE's air quality monitoring network. The Ambient Air Quality Research Project was completed by NSW EPA in the late 1990s and early 2000s, which analysed the ambient levels of air toxics (including dioxins, organics, PAHs and heavy metals) at sites representative of general urban air quality in the Sydney, Newcastle and Wollongong area (EPA 2002). The aim of the study was to obtain data on the concentrations of a wide range of air toxics. The study ran for 5.5 years from early 1996 to August 2001 and examined dioxins, 41 organic compounds, 11 PAHs and 12 heavy metals. The study concluded:

> *"In summary, the study found that most air toxics levels in NSW are low and well below current international standards and benchmarks."*

Even though the study is almost 20 years old, current air toxic levels are expected to still be low compared to ambient air quality criteria given the ongoing technical improvements in car engines technology and emissions controls.

However, even though the air quality is generally good in the Sydney region, there is potential for fugitive dust emissions from the existing sources in the vicinity of the Precinct 5 (such as Northern Road concrete batching plant and Boral Bricks Bringelly quarrying operations) to elevate local ambient particulate concentrations and contribute to additional exceedances of the 24-hour average criteria.

5.2 Localised Impacts of Existing Sources of Airborne Pollutants

5.2.1 Poultry Farms

Poultry shed odour emissions consist of a complex mixture of odorous molecules. Based on the measurement of several natural and tunnel ventilated poultry sheds, Jiang et al (Jiang and Sands 2000) concluded that ammonia [NH_3] and dimethyl sulphide [$(CH_3)_2S$] were, by volume, the major odorous constituents inside the broiler sheds investigated and that the biodegradation of accumulated faecal matter within the poultry sheds was the most significant source of odour. Gaseous odorous compounds from the litter and chicken bodies are transferred into the shed air at varying rates depending on a range of environmental conditions in the shed. Water is also known to act as a catalyst in the processes of odour generation, transfer and transport.

Chapter 5 of the Odour Technical Notes (DEC 2006) sets out the following methodology to calculate separation distances for poultry farms using current standard production technology. Details of this methodology and how it has been applied to the poultry farms identified in the vicinity of the Precinct 5 are presented in **Appendix A**. The Odour Technical notes states that the use of this methodology gives prescribed distances that have been found to lead to an acceptable air quality impact on the amenity of the local environment.

Equation 1 (refer to **Appendix A**) has been used derive the minimum recommended separation distance between the existing poultry farms and any future development, assuming an odour performance criterion of 2 ou or less. The calculated separation distances are provided in **Table 14**.

Table 14 Calculated Minimum Separation Distances for Surrounding Poultry Farms

Source ID	Address	Number of Sheds	Shed Area[1] (m^2)	Number of Standard Sheds[2]	Separation Distance (m)	
					Calculated	Actual
5	169 Cut Hill Road, Cobbitty	10	13,860	10.7	3,150	4,500
6	18 Coates Park Road, Cobbitty	8	14,580	11.2	3,265	2,500
13	313 Eastwood Road, Leppington	4	3,926	3.0	1,422	3,600
14	108 Deepfields Road, Leppington	4	4,256	3.3	1,522	3,900
15	101 Deepfields Road, Leppington	3	3,864	3.0	1,422	3,850

[1] Estimated from aerial imagery.

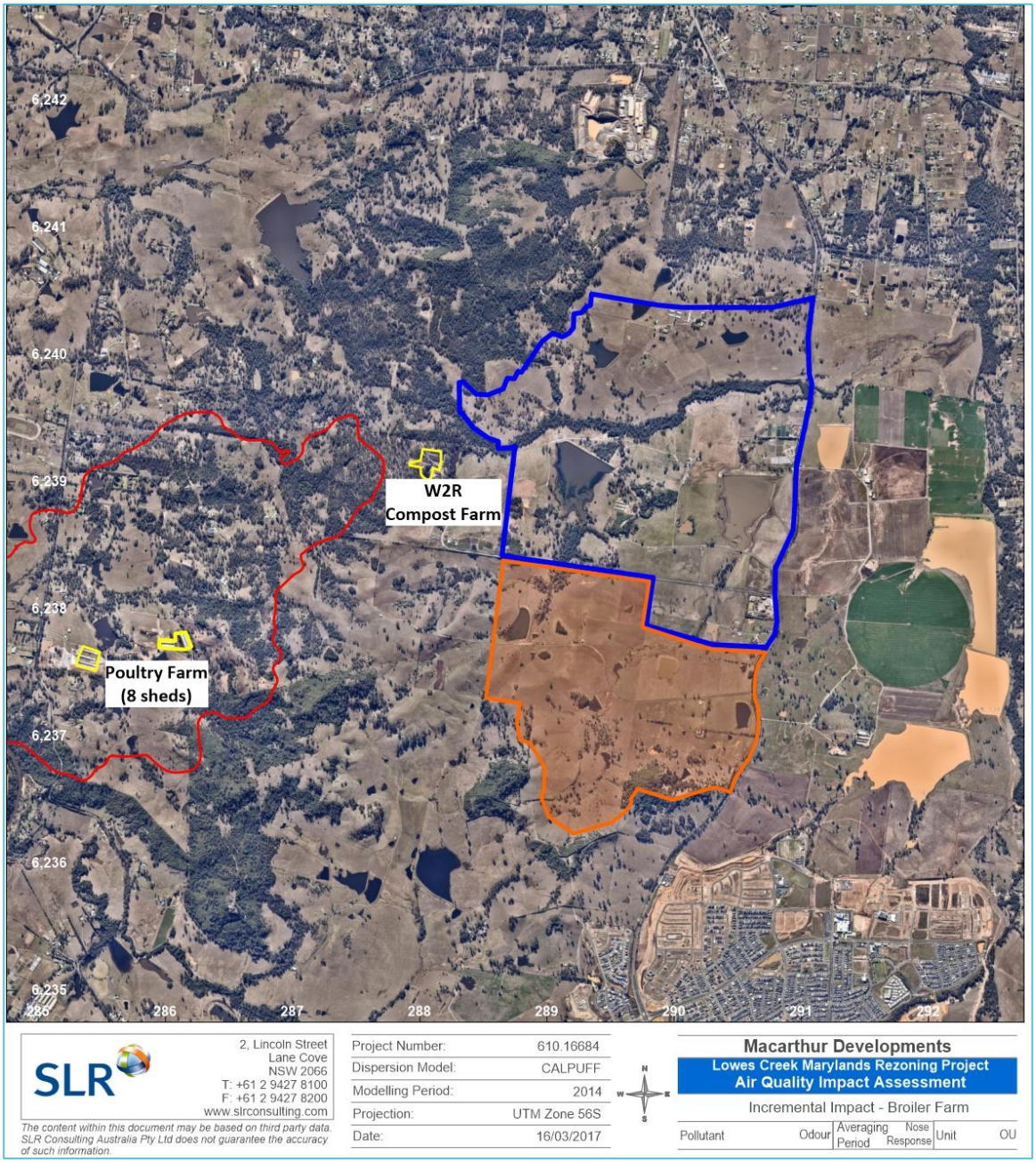
[2] Number of standard sheds based on standard shed area of 1,300 m^2.

A comparison of actual versus calculated minimum separation distances is also provided in **Table 14**. The actual separation distances are shown to be greater than the calculated separation distance for all poultry farms except the poultry sheds located at Coates Park Road (ie Source 6), for which the calculated minimum separation distance is greater than the actual separation distance.

As discussed in **Section 4.3**, this assessment has been used as an initial 'screening' assessment for estimating the potential risk of odour impacts and is based on a range of generic conservative assumptions. Given the uncertainty in regards to operational details (such as bird numbers, production cycles etc) at this poultry farm, the already existing residential properties and the vegetative buffer, further reference has been made to the Level 3 odour assessment completed for this farm as part of the LCM Precinct (SLR 2017).

Figure 10 shows the incremental odour impacts predicted as a result of the estimated odour emissions from the broiler farm located on 18 Coates Park Road only. It can be seen from **Figure 10** that odour emissions from the broiler farm are predicted to comply with the criterion of 2 ou at Precinct 5, hence they would not be expected to have any odour impacts at Precinct 5.

Figure 10 Predicted Incremental Ground Level 99th Percentile Odour Concentrations – Poultry Farm



Source: Figure 13 of SLR 2017

5.2.2 Bringelly Brickworks

The Bringelly Brickworks is located approximately 3.5 km north of the Precinct 5 boundary. The separation distance prescribed by the various regulators for related activities and sensitive land uses ranged from 250 m to 750 m (see **Section 4.3.2**).

Based on the large separation distance, Bringelly Brickworks is not anticipated to have any impact on Precinct 5.

5.2.3 Northern Road Asphalt Plant

The Northern Road Asphalt Plant is located approximately 3.4 km north of Precinct 5 boundary. The separation distance prescribed by the various regulators for related activities and sensitive land uses ranged from 500 m to 1,000 m (see **Section 4.3.3**).

Based on the large separation distance, Northern Road Asphalt Plant is not anticipated to have any impact on Precinct 5.

5.2.4 Northern Road Concrete Batching Plant

The Northern Road concrete batching plant is located approximately 3.4 km north of Precinct 5 boundary. The separation distance prescribed by the various regulators for concrete production activities and sensitive land uses ranged from 100 m to 200 m (see **Section 4.3.4**).

Based on the large separation distance, Northern Road concrete batching plant is not anticipated to have any impact on Precinct 5.

5.2.5 Composting Operations

The W2R compost farm is located approximately 850 m northwest of the closest Precinct 5 boundary. The separation distance prescribed by the various regulators for composting operations and sensitive land uses ranged from 100 m to 2,000 m (see **Section 4.3.4**), depending on the annual tonnage of waste processed on site. There is therefore a possibility that the separation distance between Precinct 5 and the W2R compost farm would not comply with the recommended separation distance between composting operations and sensitive land uses.

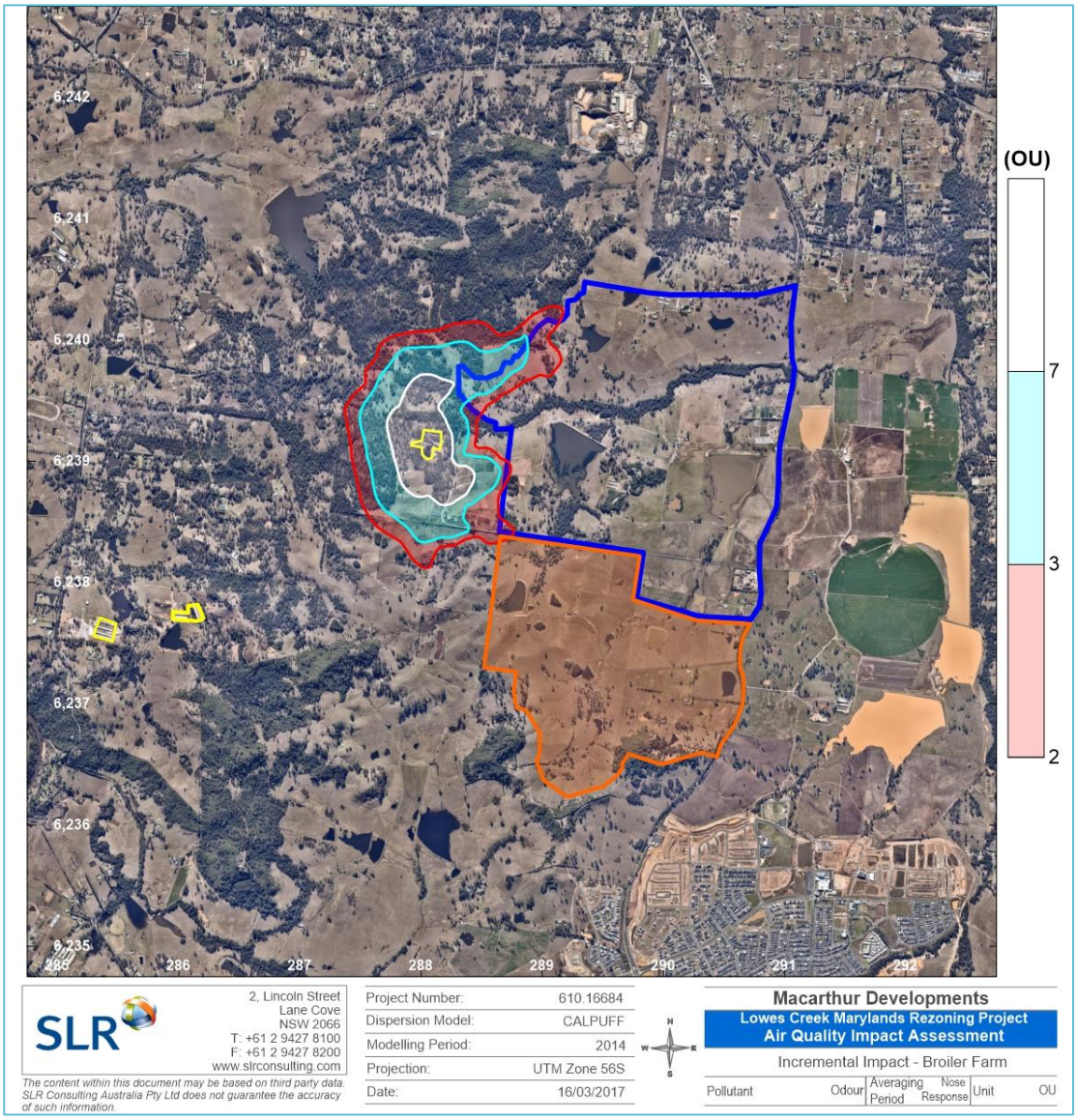
As discussed in **Section 4.3**, the recommended separation distances have been used as an initial 'screening' assessment for identifying the potential risk of odour impacts. Given the uncertainty in regards to operational details (such as types of waste handled, quantity of waste handled, composting cycles etc) of the W2R compost farm, reference has been made to the Level 3 odour assessment completed for this facility as part of the LCM Precinct (SLR 2017) and a submission prepared by Urbanco as part of the public exhibition process in November 2018 (Urbanco 2018). The Urbanco submission (Urbanco 2018) presented detailed odour modelling results conducted by Airlabs for odour emissions from the W2R composting operations as part of their submission.

The incremental odour impacts predicted as a result of the estimated odour emissions from the W2R compost farm only based on emissions estimation and modelling performed by SLR and Airlabs are shown in **Figure 11** and **Figure 12** respectively. In **Figure 12**, the Airlabs contours are presented as dashed lines, whereas the SLR contours are shown as solid lines.

It can be seen from **Figure 11** that odour emissions from the W2R compost farm are predicted to comply with the criterion at Precinct 5, with the exception of a small area at the northwestern end of Precinct 5. **Figure 12** shows that the contours predicted by modelling conducted by Airlabs are smaller and the criterion of 2 ou does not encroach upon on the Precinct 5 boundary. It is noted that there are no details provided on the model inputs and assumptions in the Airlabs report, so the Airlab results presented in **Figure 12** should be read with caution. Nevertheless the results indicate a low odour risk from the W2R composting operations on Precinct 5.

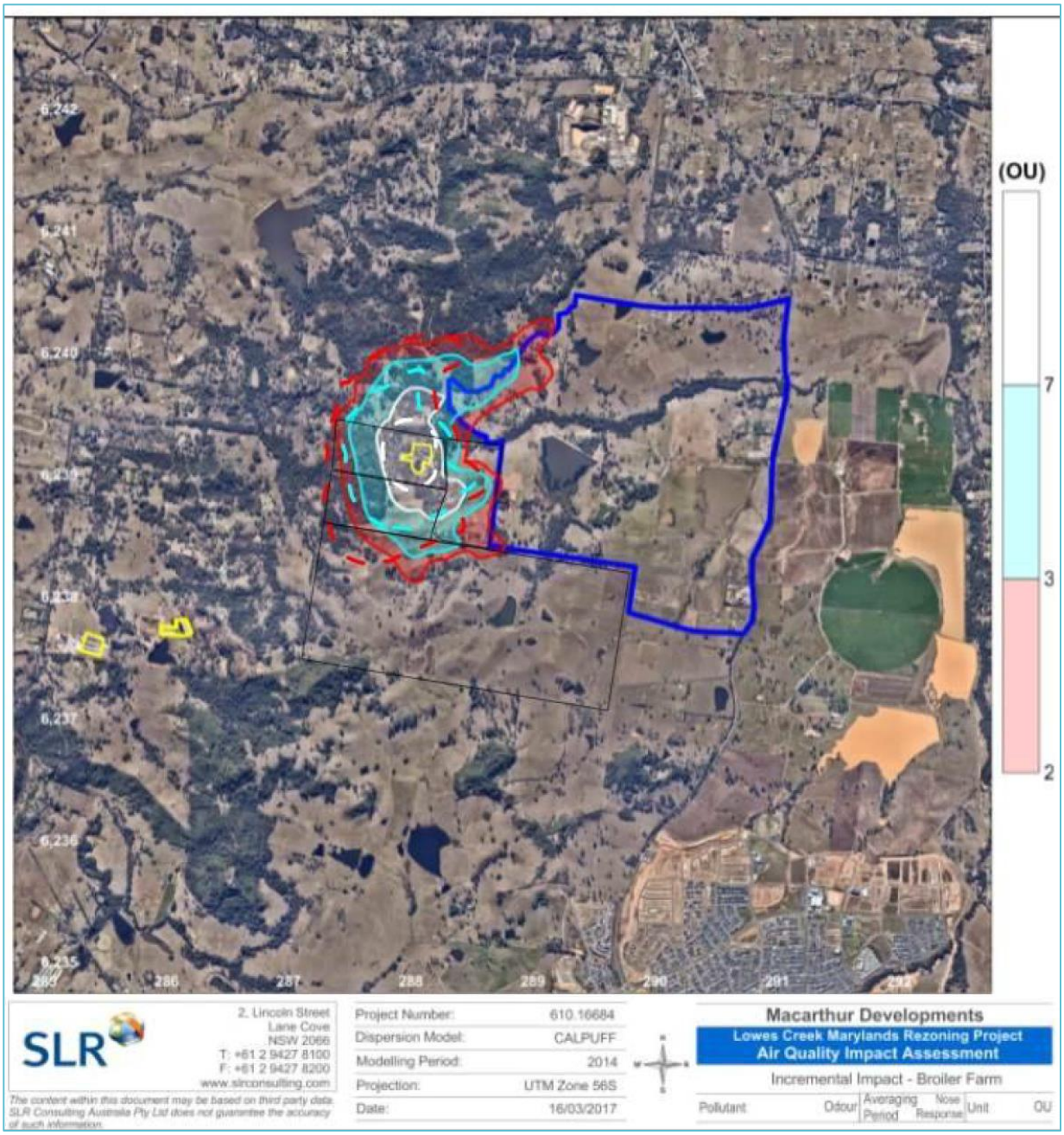
Further, a review of the draft ILP (see **Section 2.2**) shows that the potentially impacted area in Precinct 5 is proposed to be zoned environmental living (maximum 10 dwellings/ha). For comparison, the housing density in the low density band 1 is proposed to be 10 to 20 dwellings/ha. It is recommended that a series of odour surveys be performed to 'ground truth' the results of the modelling and to confirm whether this area of land is in fact odour affected.

Figure 11 Predicted Incremental Ground Level 99th Percentile Odour Concentrations – W2R Compost Farm



Source: Figure 14 of SLR 2017

Figure 12 Odour Mapping



Source: Figure 24 of Urbanco 2018

5.2.6 Turf Farm

Considering the generally low odour potential for the turf farming operations, the presence of existing residential properties 600 m to the east of the turf farm and 300 m southwest of the chicken manure windrows, and the proposed Precinct boundary being located at a similar distance (800 m) towards the west, the activities at this site are not anticipated to give rise to any odour impacts on the proposed Precinct 5.

Based on the separation distance, the turf farm located east of Precinct 5 is not anticipated to have any impact on Precinct 5.

5.2.7 The Northern Road

A modelling assessment was completed by Jacobs in 2017 to assess potential air quality impacts due to the operation of the upgraded Northern Road. The impacts to air quality at surrounding receivers were evaluated using the Roads and Maritime Tool for Roadside Air Quality (TRAQ) CALINE-based dispersion model. The results were predicted at 50 m and 100 m from the road.

It was concluded that (Jacobs 2017):

> *"Predictions from this assessment indicate that for the timeframes assessed, any changes in local air quality at surrounding receivers will be small and within the existing range of air quality variations within the area. At a regional scale, impacts associated with operations were assessed to be of minimal significance."*

Considering the results of the Jacobs report, and the Draft ILP, the air emissions from traffic on The Northern Road are not anticipated to have any significant impacts on Precinct 5.

5.3 Proposed Service Station

A review of the Draft ILP shows a proposed service station located on the southeastern boundary of Precinct 5, as shown in **Figure 13**. It can be seen that open space number 4 is also proposed between the service station and the nearest residential zone.

The separation distance between the proposed service station and the nearest residences is estimated to be approximately 200 m. This meets the recommended minimum separation distance for service stations set by SA EPA (in the absence of guidance from NSW EPA). The fuel bowsers and storage tank vents will also be located further within the service station boundary, giving a larger separation distance from these key emission points.

Stage 1 and Stage 2 vapour recovery systems (which control VOC emissions during the filling of storage tanks and vehicles at the bowser respectively), is also a requirement for new service stations within the Sydney metropolitan area selling more than 0.5 million litres of fuel per annum.

Based on the above, no adverse air quality impacts are expected for the proposed residential areas within Precinct 5 as a result of the proposed service station. It is recommended that a vegetative screen be planted between the service station boundary and nearest residential properties to enhance dispersion of any emissions.

Figure 13 Location of the Proposed Service Station in Precinct 5

Note: Proposed service station boundary marked in blue. Nearest residential zone is marked in brown.

6 Conclusions

SLR was commissioned by BHL to conduct an air quality assessment to accompany a planning proposal to rezone Precinct 5 of the South Creek West (SCW) release area in southwest Sydney, NSW.

The SCW release area forms part of the South West Growth Area (SWGA). Given the scale of the release area, the Department of Planning, Industry and Environment (DPIE) divided SCW into five distinct precincts numbered 1 – 5. The land to which this Planning Proposal relates to is referred to as Cobbitty Sub-Precinct 5, also known as Precinct 5. It totals approximately 303 hectares (ha) and has been characterised by rural residential and agricultural land uses and activities.

The objectives of this study were to:

- Investigate and identify any sources of air pollutants (including odour) with potential to have adverse air quality impacts on Precinct 5.
- Investigate the potential for air quality impacts from those identified sources and identify the approximate separation distances which would nominally be required between the air pollutant source and urban development.
- Where appropriate, make recommendations for further, more detailed assessments.

The results of this assessment indicate that there is a low likelihood of any odour impacts along the northwest corner of Precinct 5 associated with the existing composting operation located approximately 850 m northwest of the nearest Precinct 5 boundary. A review of the draft ILP shows that the potentially impacted area in Precinct 5 is proposed to be zoned environmental living. It is recommended that a series of odour surveys be performed to 'ground truth' the predicted impacts and to confirm whether this area of land is in fact likely to be odour affected.

It is noted that Precinct 5 is located within an area that is progressively being rezoned to allow residential urban development. As a result, some existing industries in the vicinity of Precinct 5 are likely to be relocated or decommissioned, and may therefore not need to be considered as a permanent odour source. In relation to this, a small number of identified sources that were screened out of the assessment as they are to be decommissioned or relocated as part of the LCM Precinct development. However it is possible that some of these rural agricultural sources and the Precinct 5 development may co-exist in the future, even if for a limited time.

The Technical Notes also states that "*land uses may need to change in the short, medium or long term to accommodate the changing needs of society. Existing activities would be taken into consideration when changing zoning, but are not necessarily the critical determinant of future preferred land use*".

7 References

- ACT EPA 2018, Separation Guidelines for Air Emissions, Australian Capital Territory - Environment Protection Authority, November 2018.
- Boral 2012, Bringelly Brickworks Expansion – Project And Site Overview, Boral Property Group, 15 November 2012.
- DEC 2006a, Technical framework: assessment and management of odour from stationary sources in NSW, Department of Environment and Conservation NSW, November 2006.
- DEC 2006b, Technical Notes: Assessment and management of odour from stationary sources in NSW, Department of Environment and Conservation NSW, November 2006.
- DEHP 2013, Odour Impact Assessment from Developments, prepared by Department of Environment and Heritage Protection, available online at https://environment.des.qld.gov.au/licences-permits/business-industry/pdf/guide-odour-impact-assess-developments.pdf, accessed on 11 March 2019.
- DNR 1997, Planning guidelines – Separating Agricultural and Residential Land Uses, Queensland Department of Natural resources, August 1997.
- DPI 2014, Planning for Turf Farms, NSW Department of Primary Industries, February 2014.
- DPIE 2021, NSW Annual Air Quality Statement 2020, available online at https://www.environment.nsw.gov.au/topics/air/nsw-air-quality-statements/annual-air-quality-statement-2020, accessed on 03 September 2021.
- EPA 2002, Ambient Air Quality Research Project (1996-2001) – Dioxins, Organics, Polycyclic Aromatic Hydrocarbons and Heavy Metals, EPA 2002/35, May 2002.
- EPA 2017, Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Environment Protection Authority NSW, January 2017.
- Jacobs 2017, The Northern Road Upgrade Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park - Appendix P – Technical working paper: Air Quality, Jacobs, June 2017.
- Jiang & Sands 2000, *Odour and Ammonia Emissions from Broiler Farms, RIRDC Project UNS-11A*, Rural Industries Research and Development Corporation, Canberra 2000.
- OEH 2017a, NSW Annual Compliance Report 2015, National Environment Protection (Ambient Air Quality) Measure, published by Office of Environment and Heritage, OEH 2017/0211, May 2017.
- OEH 2017b, NSW Air Quality Statement 2016 – Towards Cleaner Air, published by Office of Environment and Heritage, OEH 2017/0013, January 2017.
- OEH 2018, NSW Air Quality Statement 2017 –Clearing the Air, published by Office of Environment and Heritage, OEH 2018/0044, January 2018.
- OEH 2019, NSW Annual Air Quality Statement 2018, published by Office of Environment and Heritage, OEH 2019/0031, January 2019.
- SA EPA 2016, Evaluation distances for effective air quality and noise management, South Australian Environment Protection Authority, August 2016.
- SLR 2016, Odour Impact Assessment, Lowes Creek Maryland Precinct, Report number 610.16684 R02 v1.0, 31 October 2016.

- SLR 2017, Odour Impact Assessment, Lowes Creek Maryland Precinct, Report number 610.16684 R03 v1.1, 30 November 2017.
- Urbanco 2018, Lowes Creek Maryland Precinct – Exhibition Submission, 765 The Northern Road, dated 9 November 2018, available online at: https://s3.ap-southeast-2.amazonaws.com/dpe-files-production/s3fs-public/dpp/296616/294134_181109%20LCM%20Submission.pdf, accessed on 3 September 2021.
- VIC EPA 2013, *Recommended separation distances for industrial residual air emissions*, Publication number 1518, March 2013, authorised and published by EPA Victoria, 200 Victoria Street, Carlton.
- Wilkinson Murray 2013, Boral Brickworks Bringelly – Air Quality Impact Assessment, report number: 12185-N, version D, May 2013.

APPENDIX A

Separation Distance Calculation Methodology

Isolated Poultry Farms

Variable separation distances are measured from the closest point of the poultry farm to the closest point of a receptor. Variable separation distances are based on the dispersion of odours from their source. They are used to determine the allowable numbers of poultry sheds and the management practices necessary to satisfy air quality objectives. A weighting factor allows for different types of premises.

Equation 1 below is specified for calculating separation distance for a given number of poultry sheds, as derived from Equation 5.2 of the Odour Technical Notes.

Equation 1, Separation distance, given the number of poultry sheds

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

Where:

D is the separation distance in metres between the closest points of the poultry sheds and the most sensitive receptor or impact location

N is the number of poultry sheds

S Composite site factor = S1 x S2 x S3 x S4 x S5. Site factors S1, 52, 53, S4 S5 relate to shed design, receptor, terrain, vegetation and wind frequency.

Composite Site Factor (S)

The value of S to apply in **Equation 1** depends on site-specific information pertaining to the proposed shed type, receptor, terrain, vegetation and wind frequency, as set out in the following tables. Site factors shown in bold have been adopted for the purpose of this assessment.

Shed Factor (S1)

The shed factor, S1, depends on the method of shed ventilation. Details of the ventilation system design are not available for the shed identified in the vicinity of the Site, however based on the fact that they are all existing sheds and relatively small operations (up to ten sheds only), it has been assumed they are all naturally ventilated.

Table A1 Shed Factor (S1)

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

* Barriers – e.g. walls or hedges designed to mitigate dust and odour emissions from controlled fan ventilated sheds.

Receptor Factor (S2)

The receptor factor, S2, varies depending on the likely impact area and is determined from **Table A2** (eg for a town, the distance is measured from the closest point of the proclaimed town boundary).

An S2 factor corresponding to medium towns (500- 2,000 persons) is chosen for this assessment. This is considered appropriate as the Site is located within a semi-rural region, with residences located sporadically.

Table A2 Receptor Factor (S2)

Receptor type	Value
Large towns, greater than 2000 persons	1.05
Medium towns, 500—2000 persons	**0.75**
Medium towns, 125—500 persons	0.55
Small towns, 30—125 persons	0.45
Small towns, 10—30 persons	0.35
Rural residence	0.30
Public area (occasional use)	0.05*

* The value for a public area would apply to areas subject to occasional use. Higher values may be appropriate for public areas used frequently or sensitive in nature, such as frequently-used halls and recreation areas. These should be assessed individually.

Terrain Factor (S3)

The terrain factor, S3, varies according to topography and its ability to disperse odours and is determined from **Table A3**.

- **High relief** is regarded as up-slope terrain or a hill that projects above the 10% rising slope from the poultry sheds. Thus the receptor location will be either uphill from the poultry sheds, behind a significant obstruction or have significant hills and valleys between the sheds and the receptor.
- **Low relief** is regarded as terrain, which is generally below the 2% falling slope from the poultry sheds. Thus the receptor will be downhill from the poultry sheds.
- **Undulating hills** is regarded as terrain where the topography consists of continuous rolling, general low level hills and valleys with minimal vegetation, but without sharply defined ranges, ridges or escarpments.
- **A valley drainage zone** has topography at low relief (as above) with significant confining sidewalls.

Topographical features at the selected site may adversely affect the odour impact under certain circumstances. During the early evening or night time, under low wind speed conditions, population centres located in a valley at a lower elevation than a poultry farm may be subject to higher odour concentrations as a result of down-valley wind or the occurrence of low-level inversions. Unless site-specific information has been gathered under conditions dominated by low wind speeds, the value for the factor S3 should apply.

Based on the topographical data review in **Section 3.1**, a terrain factor of 1.0 (corresponding to terrain with less than 10% upslope, 2% downslope and not in valley drainage zone) has been selected for this assessment.

Table A3 Terrain Factor (S3)

Terrain	Value[1]
Valley drainage zone	2.0
Low relief (greater than 2% downslope from site)	1.2
Flat (less than 10% upslope, 2% downslope and not in valley drainage zone)	**1.0**
Undulating country between poultry farm and receptor	0.9
High relief (greater than 10% upslope from site) or significant hills and valleys between poultry farm and receptor	0.7

Note[1] For sources 5, 6a and 6b, a terrain factor of 0.9 was used as there is undulating terrain between these sources and the Precinct boundary.

Vegetation Factor (S4)

The vegetation factor, S4, varies according to vegetation density and is determined from **Table A4**. The vegetation density is assessed by the effectiveness with which the vegetation stand will reduce odour by dispersion.

Table A4 Vegetation Factor (S4)

Vegetation	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

Based on the available aerial imagery, a vegetation factor of 0.9 (corresponding to 'few trees, long grass') has been selected for this assessment.

Wind Frequency Factor (S5)

The wind frequency factor, S5 is determined from **Table A5**. 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 degrees) 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 degrees) with a frequency of less than 5 % of the time for all hours over a whole year.

The poultry farms are located in a range of wind directions relative to the Site. Based on the windroses shown in **Section 3.2**, a wind factor of 1.0 (between 5% – 60%) was selected for this assessment.

Table A5 Wind Factor (S5)

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

Summary of Site factors (S1 to S5)

Based on the discussion presented above, the site factors chosen for the current assessment are summarised in **Table A6**.

Table A6 Summary of Level 1 Odour Impact Assessment Site Factors

Site Factor	Value
Shed Factor, S1	690
Receptor Factor, S2	0.75
Terrain Factor, S3	1.0
Vegetation Factor, S4	0.9
Wind Frequency Factor, S5	1.0
Composite Site Factor, S (S1 x S2 x S3 x S4 x S5)	**466**

Separation Distance Calculation Methodology –Two Poultry Farms in Close Proximity

Two poultry farms may be considered as one single odour source if they are closer than half the shortest separation distance from each poultry farm to the receptor.

For poultry farms considered as separate entities, a 20% increase in separation distance may apply.

Number of Poultry Sheds, N

For the purposes of **Equation 1**, the number of poultry sheds (N) assumes that a standard shed is 100 m x 13 m (area of 1,300 m^2) and contains 22,000 chickens. Alternatively, the value of N may be derived as the total number of chickens at the farm divided by 22,000.

As the number of birds at each farm identified in the area surrounding the Site is unknown, this assessment has estimated the area of each shed at each farm using aerial photography, and the total shed area for each farm was divided by 1,300 m^2 to calculate a value for N for use in the calculations.

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