Marsden Park Precinct: North West Growth Centre

ODOUR IMPACT ASSESSMENT

- Final

10 April 2012

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Sinclair Knight Merz
ABN 37 001 024 095
710 Hunter Street
Newcastle West NSW 2302 Australia
Postal Address
PO Box 2147 Dangar NSW 2309 Australia
Tel: +61 2 4979 2600
Fax: +61 2 4979 2666
Web: www.globalskm.com

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Executive Summary

The Marsden Park Precinct is located adjacent to the planned employment lands in the Marsden Park Industrial Precinct, which was rezoned for urban development in 2010. The Marsden Park precinct is expected to accommodate up to 10,000 dwellings and feature a town centre with 30,000 square metres of retail space and some 50 hectares of public recreation space.

Sinclair Knight Merz (SKM) have been commissioned by the Winten Property Group (WPG) to conduct Level 1 and Level 3 Odour Impact Assessments in accordance with the NSW Office of Environment and Heritage (OEH) *Technical Framework – Assessment and Management of Odours from Stationary Sources* (DEC 2006) for the Marsden Park Precinct. This assessment will inform an Indicative Layout Plan (ILP) as part of the precinct planning process and will be one of the supporting background studies for the Marsden Park Precinct planning package, to be prepared as part of the precinct planning process.

This assessment identifies relevant separation distances for significant odour sources within and surrounding the precinct. Odour sources with separation distances that encroach into the Marsden Park Precinct (specifically where sensitive land uses have been proposed, such as residences, schools and aged care facilities) have also subjected to the Level 3 Odour Impact Assessments.

A total of seven poultry farms located in Marsden Park, Riverstone and Schofields, including six broiler farms and one duck farm, have been subjected to a Level 3 Odour Impact Assessment. Odour levels were predicted using the air dispersion model known as CALPUFF (Version 6.267). The results of the modelling indicate that the two odour unit (OU) criterion contour (nose-response times, 99th percentile) may extend into the eastern portion of the Marsden Park Precinct.

The report provides a number of recommendations to be considered during the planning process. Consideration should be given to feasible odour management and mitigation measures which may prevent or reduce the odour concentrations from poultry farms (assuming this is possible) as well as implementation of technologies that capture, contain, treat, disguise or disperse odours within the Precinct. It is noted that the two farms in South Street Marsden Park which are large contributors of total odour are located within sufficiently close proximity to areas that are proposed for high and medium density residential development to be of concern. Significant odour impacts could be expected to occur within these areas while ever the poultry farms are operational. This is notwithstanding the fact that odour producing poultry farms within the Precinct are likely to be replaced by other land uses following the rezoning.

Additionally near the boundary of the predicted 2OU contour the design stage for the precinct should consider the layout of the building and aim to overcome any odour impacts by:

- Facing windows and doors of more sensitive land uses away from the odour source; and
- Landscaping including fences and tall vegetation.

It is also recommended that the Development Control Plan (DCP) for the Precinct include a map of existing odour sources (poultry farms), showing the extent of the possible odour impact as determined by the Level 3 odour assessment.

1. Introduction

1.1. Purpose of this Report

Sinclair Knight Merz (SKM) have been commissioned by the Winten Property Group (WPG) to conduct Level 1 and Level 3 Odour Impact Assessments in accordance with the NSW Office of Environment and Heritage (OEH) *Technical Framework – Assessment and Management of Odours from Stationary Sources* (DEC 2006a) for the Marsden Park Precinct (the Precinct). This assessment will inform an Indicative Layout Plan (ILP) as part of the precinct planning process and will be one of the supporting background studies for the Marsden Park Precinct planning package, to be prepared as part of the precinct planning process.

1.2. Background

1.2.1. North West Growth Centre

Sydney's North West Growth Centre is planned to accommodate approximately 70,000 dwellings and encompasses an area of approximately 10,000 hectares (ha). The North West Growth Centre lies within the Local Government Areas (LGAs) of Baulkham Hills, Blacktown and Hawkesbury and is supported by a major centre at Rouse Hill. The Growth Centre comprises of 16 precincts which will be progressively released over the next 25 to 30 years. The focus of this study is the Marsden Park Precinct (DP&I 2011a).

In July 2011 The Marsden Park Precinct was released for planning as one of two precincts advanced under the NSW Government's *Precinct Acceleration Protocol.*

1.2.2. Marsden Park Planning Precinct

The Marsden Park Precinct is located adjacent to the planned employment lands in the Marsden Park Industrial Precinct, which was rezoned for urban development in 2010. The Marsden Park precinct is expected to accommodate up to 10,000 dwellings and features a town centre with 30,000 square metres of retail space and some 50 hectares of public recreation space (DP&I 2011b).

Precinct planning for Marsden Park is currently underway. In support of the Precinct Planning process, the NSW Department of Planning and Infrastructure (DP&I) has formed a partnership with Blacktown City Council to identify the future zoning and development controls for the Precinct.

This odour assessment is one of a suite of technical studies that will inform the precinct planning process and the preparation of an Indicative Layout Plan and Development Control Plan for the Marsden Park Precinct.

Currently, four layout plan options have been developed for the Marsden Park Precinct. Each layout is composed primarily of a mix of low to high density residential in the north eastern sector, with some commercial space. The remainder of the land is to remain as open space and native vegetation. Layout plans for each of the options is presented in **Appendix A.**

2. Project Description and Scope

2.1. Location

The Marsden Park Precinct is located within the south western section of the North West Growth Centre in the Blacktown LGA. The Precinct is bounded by South Creek to the north, Richmond Road to the east, the Marsden Park Industrial Precinct (MPIP) and St Mary's subdivision to the south, and Stony Creek Road to the west. The location of the Precinct is shown in **Figure 2.1**.

- **Figure 2-1 Location of Marsden Park Precinct**

The primary current land use in the Precinct is agriculture with a variety of mixed businesses located along Richmond Road. The total area of the precinct is approximately 1,800 hectares and is expected to accommodate up to 10,000 dwellings. The Precinct also includes approximately 600 hectares of the Air Services Australia Site, in the south, which is intended to be set aside for conservation and open space.

2.2. Study Objectives

The study objectives are as follows:

- Identify, investigate and confirm any air pollutant sources, in particular odour on or in the vicinity of the Precinct, including from any ongoing agricultural activities.
- Investigate the implications of any existing odours for the staging of the land development.
- Recommend management strategies to maximise development opportunities both under the existing odour situation and into the future.
- Make recommendations for controlling impacts from odour generating activities in proposed residential areas and associated land uses.
- Develop land use recommendations that provide adequate buffers or transitional zones between residential and employment/industrial areas, both proposed and existing.

2.3. Project Scope

The scope of work is divided into two stages. Stage 1 involves the preparation of a Level 1 Odour Impact Assessment in accordance with the OEH *Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005) and *Technical Framework – Assessment and Management of Odours from Stationary Sources* (DEC 2006a) and associated *Technical notes* (DECC 2006b). The findings of Stage 1 (refer to **Appendix B**) recommend that a Level 3 Odour Impact Assessment be undertaken.

This assessment forms Stage 2 of the odour impact assessment. The scope of work required for Stage 2 includes:

- Description of the existing environment and discussion of applicable OEH odour goals.
- Summary of the findings in Stage 1 report.
- Identify specific odour management strategies including any appropriate management or structural changes to the odour generating operation.
- Review of meteorological data and preparation of a file suitable for air dispersion modelling.
- Estimation of odour emissions from nearby sources.
- Dispersion modelling of odour emissions using CALPUFF model including prediction of odour impacts on the future development in light of the management recommendations.
- Analysis of model results and comparison against relevant air quality criteria and discussion of limitations.
- Preparation of an air quality assessment report, providing the methodology, results and discussion.

Note: The CALPUFF model has been used in place of the regulatory model AUSPLUME, as it is considered better able to assess odour impacts from multiple sources spread over a large area. CALPUFF has also been used for similar odour assessments associated with the nearby Marsden Park Industrial Precinct and the Schofields Precinct.

3. Odour Legislation and Guidelines

3.1. Overview

This section of the report provides an overview of odour legislation in NSW and associated guidelines that set odour criteria and provide an approach to odour assessment.

3.2. Legislation

3.2.1. Protection of the Environment Operations Act 1997 (POEO Act)

The *Protection of the Environment Operations Act 1997* (NSW) (POEO Act) is the key piece of environment protection legislation administered by OEH. The POEO Act introduces the concept of 'offensive odour' for regulating odour from OEH scheduled activities (listed in Schedule 1 of the Act). This framework emphasises the importance of managing 'offensive odour' where a new development is being undertaken. The 'offensive odour' provision in the POEO Act does not apply to non-scheduled activities (which are regulated by local councils), however avoiding odour impacts from non-scheduled activities is just as important and the principles of the framework are equally applicable. Both scheduled and non-scheduled activities are required to prevent or minimise air pollution (including odour) using best management practices. The objectives of reducing odour annoyance are regulated by the POEO Act. Section 129(1) of this Act states:

> *"The occupier of any premises at which scheduled activities are carried on under the authority conferred by a licence must not cause or permit the emission of any offensive odour from the premises to which the licence applies"*

The Act then defines an "offensive odour" as: that, by reason of its strength, nature, duration, character, or quality, or the time at which it is emitted, or any other circumstances:

> *"a) is harmful to (or is likely to be harmful to) a person who is outside the premises from which it is emitted, or*
>
> *b) interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted."*

As relevant to the Precinct, a key consideration of Section 129(1) of the POEO Act is that where land is rezoned in proximity to existing odour sources such as poultry farms and odour issues arise from people living within the rezoned land, then the industry which is the source of odour could be found to be in breach of Section 129(1) if it is a scheduled premise.

3.2.2. Other Legislation

Other relevant legislation for preventing and controlling odour in NSW includes:

- The *Environmental Planning and Assessment Act 1979 (NSW)* (EP&A Act) associated with land-use planning, development, assessment and approvals
- The *Local Government Act 1993* (NSW) (LG Act) which under Section 125 gives local councils the power to abate a public nuisance or order a person responsible for a public nuisance, including odour, to abate it.

3.2.3. Roles and Responsibilities

A number of government agencies are responsible for assessing and managing odour from both scheduled and non-scheduled activates. These responsibilities are summarised in **Table 3-1**.

Table 3-1 Odour Assessment and Management Responsibilities

Odour Assessment and Management Responsibilities	Responsible Organisation
Land Use-Planning ▪ Planning and development control ▪ Considering existing land use and the likely impacts on these uses, if a change in the preferred land use is proposed in the area (including assessing the likelihood of conflict if rezoning or subdivisions are proposed in an area). ▪ Developing strategic approaches to ensure that new developments and redevelopment areas take into account odour from new and existing developments	▪ DPI and Local Councils
Best Practice and Odour Control Strategies ▪ Development and review of best management practice guidelines for activities that emit odour. ▪ Development, implementation and review of general guidance about odour control strategies	▪ OEH, NSW Department of Trade and Investment, Regional Infrastructure and Services (TIRIS) (Department of Primary Industries), DPI, Local councils and industry
Assessment and Approvals ▪ Assessment and approval of proposals under relevant legislation to ensure activities are located, designed and operated in a manner that meets the requirements of the framework and best management practice ▪ The assessment should consider the likelihood of the proposed activity with the current land use in the area and the risk of change of land use in the short, medium and long term.	▪ Proponents/operators, TIRIS, DPI, Local Councils and OEH
Compliance Regulation and Enforcement ▪ Use of confirmed complaints to indicate that action may be required. ▪ The OEH regulates scheduled activities that emit 'offensive' odour. These activities are regulated under Sections 124-126 and 128 of the POEO Act and Section 125 of the LG Act. ▪ Facilities with an approval under the EP&A Act which emit unacceptable levels of odour as a result of non-compliance with development consent conditions. These facilities would be regulated under s121B or s125 of the EP&A Act.	▪ Operators, OEH, Local councils and DPI.

3.3. Odour Assessment Criteria

The NSW OEH regulates air quality in NSW, with odour criteria objectives being set to minimise the adverse affects of odours emissions from odour-producing activities. Odour criteria are set out in the in the *Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW* (DEC 2005).

The level at which odour is perceived to be of nuisance depends on the combination of odour quality, the frequency and duration of the odour, and the characteristic of the source. Consequently, the odour performance criteria in the document are based on population density and these are displayed in **Table 3-2**. The NSW OEH odour impact assessment criteria has been designed to take into account the range of sensitivity to odours within the community and to provide additional protection for individuals with a heightened response to odours. This is achieved by using a statistical approach based upon population size. As the population density increases, the proportion of odour sensitive individuals are also likely to increase, indicating that more stringent criteria are necessary in these situations.

- **Table 3-2 Recommended Odour Assessment Criteria (DEC 2005)**

Population of Affected Community	Odour assessment criteria # (complex mixture of odorous pollutants) (OU
Urban area (≥ 2000) and/or schools and hospitals	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single Residence (≤ 2)	7.0

nose response time average, 99th percentile

The urban odour performance criterion of 2 odour units (OU) has been adopted for this assessment based on the layout of the Precinct shown by the four options, each of which contains low to high density residential and three public schools.

3.4. Assessment Methodology

The *Technical Framework for the Assessment and Management of Odour from Stationary Sources in NSW* (DECC, 2006a) (the Framework) and associates *Technical Notes* (DECC, 2006b) provides an approach for the assessment and management of odour generating activities. Typically, the Framework is used by the industry that is required to assess the potential odour impact of its operations. In addition to traditional applications the Technical Framework may be used by land developers as a prudent approach to avoid future land use conflicts; and as such is used in this assessment to assess future land use conflicts within the North West Growth Centre.

The framework establishes three levels of impact assessment so the appropriate level of odour investigation can be carried out depending on the specific characteristics of the proposal and the likelihood of operational impacts. The three levels of odour assessment adopted include:

- **Level 1** is a screening-level technique based on generic parameters for the type of activity and site. It requires minimal data and uses simple equations to provide a broad estimate of the extent of any odour impact. It may be used to assess site suitability and odour mitigation measures for new or modified activities;
- **Level 2** is a screening-level dispersion modelling technique, using worst-case input data (rather than site-specific data). It is more rigorous and more realistic than a Level 1 assessment. It may be used to assess site suitability and odour mitigation measures for new modified or existing activities; and
- **Level 3** is a refined-level dispersion modelling technique using site-specific input data. This is the most comprehensive and most realistic level of assessment available. It may be used to assess site suitability and odour mitigation measures for new, modified or existing activities.

4. Existing Environment

4.1. Existing Odour Sources

The Stage 1 Odour assessment (refer to **Appendix B**) identifies a number of odour sources within and surrounding the Precinct, including poultry and dairy operations. During the Stage 1 Assessment, a Level 1 screening odour assessment was undertaken in accordance with the OEH Technical Guidelines. This assessment identifies relevant separation distances for significant odour sources within and surrounding the precinct. Odour sources with a separation distance that encroaches onto Marsden Park Precinct (specifically where sensitive land uses have been proposed) where then subjected to the Level 3 Odour Impact Assessment.

A total of seven poultry farms including six broiler farms and one duck farm are identified as requiring further assessment. The location of odour sources is presented in **Table 4-1**. The location of each poultry farm is shown in **Figure 5-1** in **Section 5** to follow.

Table 4-1 Location of Poultry Farms

Farm	Stock Type	No. of Sheds
47-51 Argowan Rd, Schofields	Broilers	3
45 Farm Rd, Riverstone	Ducks	6
138 Clifton Rd, Marsden Park	Broilers	4
1148 Richmond Rd, Marsden Park	Broilers	2
264A South St, Marsden Park	Broilers	3
306 South St, Marsden Park	Broilers	5
1132 Richmond Rd, Marsden Park	Broilers	4

It is noted that none of the identified odour sources (poultry farms) are scheduled premises under the POEO Act (as discussed in Section 3.2.1), and as such Blacktown City Council would have primary responsibility for regulating environmental impacts including odour from these operations.

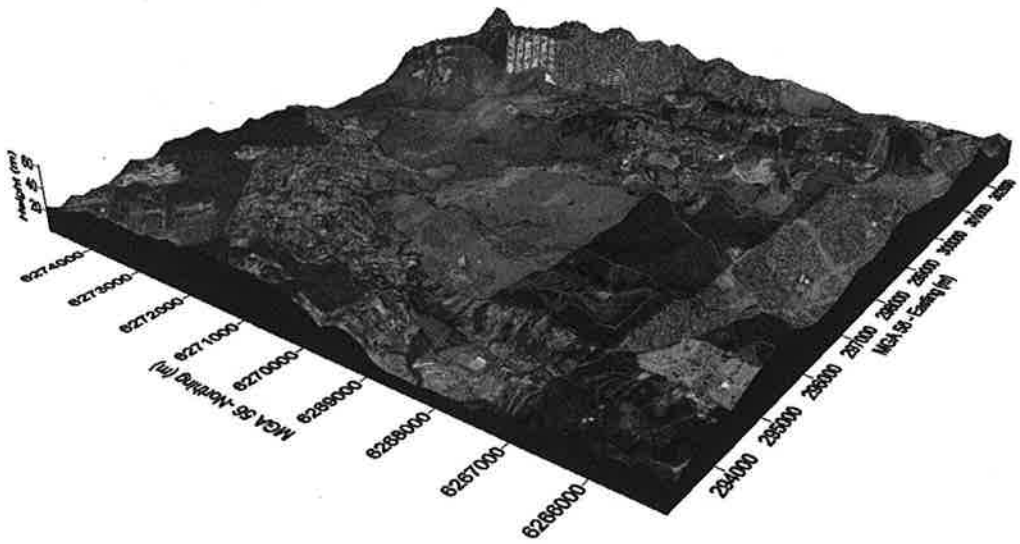
With the exception to duck farm at 45 Farm Road, Riverstone the odour impacts associated with poultry farming operations have been modelled previously by Heggies (2009) and Holmes (2011) to determine the impacts on the MPIP and Schofields Precinct respectively. Chicken farms located on Richmond Road were modelled by both studies, while farms on South Street were modelled by Heggies (2009) and farms on Clifton Road and Aragwan Road were modelled by Holmes (2011).

4.2. Terrain

Terrain data was captured from NASA's Shuttle Radar Topography Mission (SRTM), which produces terrain information for the entire globe. For Australia, terrain data are available at approximately 90 m resolution (3-arc seconds).

The undulating terrain surrounding the Precinct is presented in **Figure 4-1** with elevations ranging between 2 and 63 metres. Ground-level odour emissions have been predicted over an area of 10 km by 10 km with gridded receptors located at located at 200 m spacing's.

- **Figure 4-1 Terrain**



The terrain is not of sufficient resolution to identify all localised topographic features eg. barrier screening that may separate some of the poultry farms from immediate surrounding areas. This is of no consequence to the model assessment, as such barrier will have minimal affect on the dispersion of odours, particularly over the large are covered by the assessment.

4.3. Dispersion Metrology

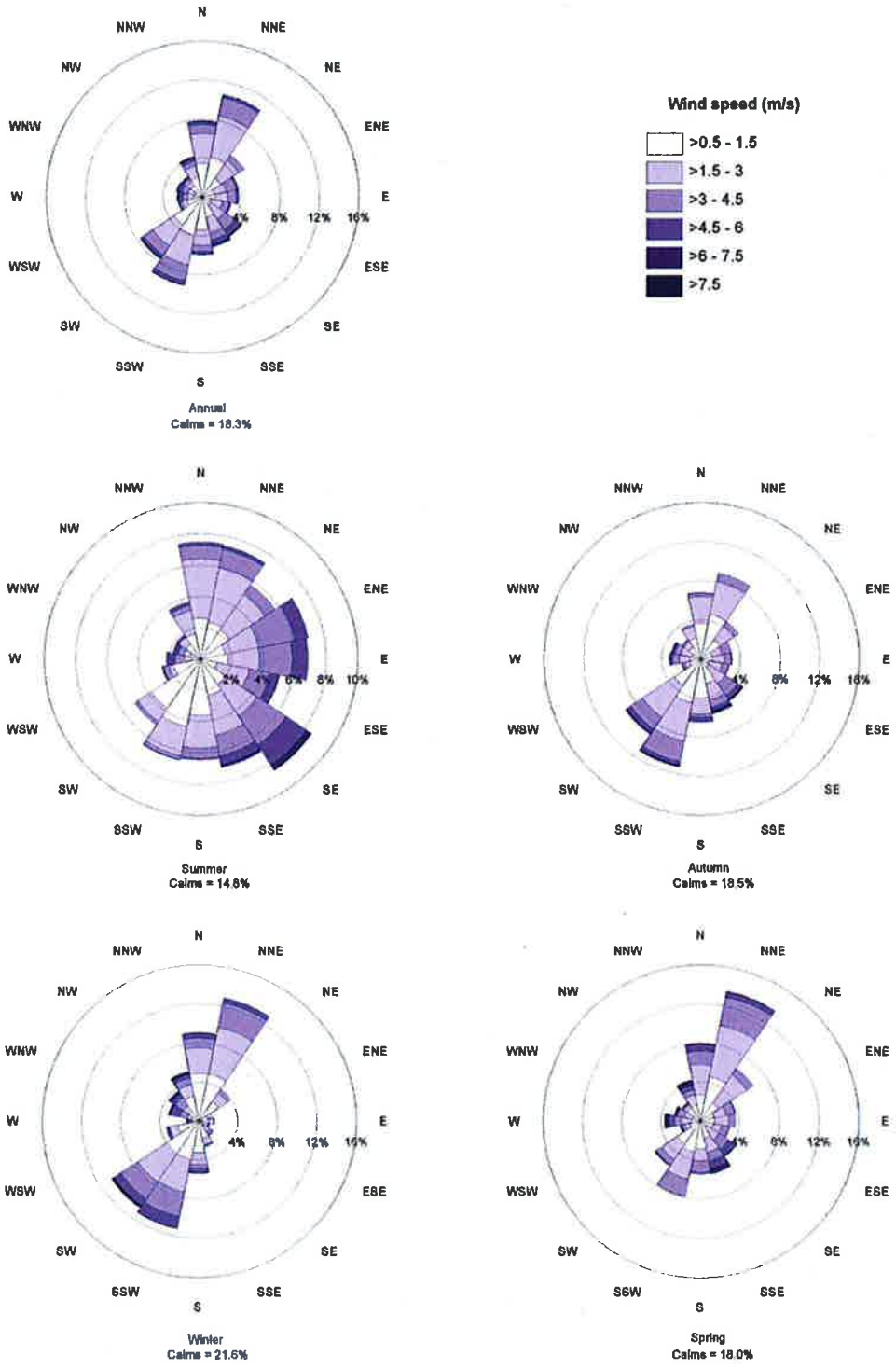
The effects of meteorology have been incorporated into the assessment by considering data from the automatic weather station at Riverstone Sewage Treatment Plant (located at Vineyard) and extrapolating these data to other areas using a wind-field model. The result is a three-dimensional, time-varying wind-field.

On a relatively small scale, local winds are largely affected by the topography. At larger scales, winds are affected by synoptic scale winds, which are modified by convective processes in the daytime and also by a complex pattern of regional drainage flows, caused by sloping terrain that can develop overnight. In the modelling undertaken for this study, it is not necessary to document the complex mechanisms that affect air movements in the area. It is simply necessary to ensure that these air movements are incorporated into the dispersion modelling studies that are conducted.

This assessment has made use of the CALPUFF dispersion model. The CALPUFF model, through the CALMET meteorological processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics are accounted for by this model.

Surface meteorological data for 1998 from weather station at Vineyard have been used for development of the meteorological wind field (refer to **Appendix C**). Annual and seasonal wind roses for 1998 at the Precinct are shown in **Figure 4-2.** The annual average wind speed is 1.9m/s with winds dominating from the south southwest and north northeast.

Figure 4-2 Vineyard Wind Roses (1998)



5. Odour Impact Assessment

5.1. Overview

This Section of the report sets out the odour dispersion modelling results, a discussion of results and consideration of odour management measures.

5.2. Odour Emission Rates

For the dispersion modelling of existing broiler chicken farms, an emission rate of 200 OUm^3/s per 1000 birds was adopted as per previous published studies for poultry farms (Holmes 2011). With respect to the duck farm, odour emissions are generally less intensive than from chicken farms, with ammonia being one of the main odour constituents (Jiang and Sands 2000).

The *National Pollution Inventory Emissions Estimation Technique Manual for Intensive Livestock – Poultry Raising* (NPI 2002) provides default emission factors for ammonia emissions for intensive poultry raising facilities, with the default emission factor set for duck farms at 70% of the broiler shed emission factor. As such, a scaling factor of 0.7 has been applied to odour emissions for the duck farm located at 45 Farm Road, thus an emission factor of 140 OUm^3/s per 1000 birds was adopted.

A conservative approach was adopted for all poultry farms whereby all operations are assumed to be naturally ventilated. The odour emission rates for each process unit are presented in **Table 5-1**.

For the purpose of comparing model results with odour assessment criteria, the emission rates in **Table 5-1**, have been multiplied by peak to mean factors, which provide a relationship between the model's 1-hour averaging time predictions to nose-response (say, 1 second) averaging times. A peak-to-mean factor of 2.3 has been applied for all volume sources.

- **Table 5-1 Odour Emission Rates**

Location and Stock Type	MGA 56 Coordinates		Shed Length (m)	Shed Width (m)	Estimated No. of Birds[1]	Emission Rate (OU m^3/s)	Peak Emission Rate (OU m^3/s))
	Easting	Northing					
47-51 Argowan Rd, Schofields	302202	6268827	110	14	22587	4517	11293
	302221	6268841	106	14	21765	4353	10883
Broiler farm with three sheds	302223	6268884	62	17	15459	3092	7729
45 Farm Rd, Riverstone	299736	6271293	66	13	12584	1762	4404
Duck farm with six sheds	299735	6271322	66	13	12584	1762	4404
	299740	6271351	66	13	12584	1762	4404
	299744	6271381	66	13	12584	1762	4404
	299748	6271412	66	13	12584	1762	4404
	299752	6271443	66	13	12584	1762	4404
138 Clifton Rd, Marsden Park	300157	6269361	62	14	12731	2546	6365
Broiler farm with four sheds	300186	6269368	59	14	12115	2423	6057
	300165	6269427	46	16	10795	2159	5397
	300201	6269417	62	17	15459	3092	7729
1148 Richmond Rd, Marsden Park	298131	6268890	55	15	12100	2420	6050
	298172	6268898	68	15	14960	2992	7480
Broiler farm with seven sheds	298207	6268911	60	50	44000	8800	22000
	298070	6268976	62	15	13640	2728	6820
	298122	6268974	95	15	20900	4180	10450
	298155	6268996	95	15	20900	4180	10450
	298167	6269046	62	15	13640	2728	6820
264A South St, Marsden Park	298886	6268197	125	15	27500	5500	13750
Broiler farm with three sheds	298881	6268223	125	15	27500	5500	13750
	298875	6268254	125	14	25667	5133	12833
306 South St, Marsden Park	298495	6268050	90	15	19800	3960	9900
Broiler farm with 2 sheds	298531	6268057	90	15	19800	3960	9900
	298459	6268161	62	16	14549	2910	7275
	298540	6268168	120	15	26400	5280	13200
	298551	6268131	140	20	41067	8213	20533
1132 Richmond Rd, Marsden Park	298578	6269130	120	15	26400	5280	13200
	298607	6269125	120	15	26400	5280	13200
Broiler farm with 4 sheds	298675	6269204	33	14	6776	1355	3388
	298712	6269207	56	12	9856	1971	4928

[1] Estimated number of birds was calculated on the assumption that a chicken shed with an area of $1500m^2$ houses 22,000 birds (Scorgie et al. 2007)

5.3. Modelling Methodology

Odour concentrations due to poultry farming within and surrounding the Marsden Park Precinct have been predicted using the air dispersion model known as CALPUFF (Version 6.267). CALPUFF is a Lagrangian dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs emitted sequentially. Provided the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap and the serial release is representative of a continuous release.

The CALPUFF model differs from traditional Gaussian plume models (such as AUSPLUME) in that it can model spatially varying wind and turbulence fields that are important in complex terrain, long-range transport and near calm conditions. It is the preferred model of the United States Environmental Protection Agency for the long-range transport of pollutants and for complex terrain (TRC, 2007). CALPUFF has the ability to model the effect of emissions entrained into the thermal internal boundary layer that forms over land, both through fumigation and plume trapping.

The modelling has been performed using the meteorological information provided by the CALMET model (described in **Section 4.3** and **Appendix C**) and the odour emission information described in **Section 5.1**. The model used in this study to predict the pollutant concentrations at a set of ground-level receptors covering a region of 9.2 km by 9.2 km. Gridded receptors with spacing of 200 metres were used for the entire model domain. Dispersion coefficients have used turbulence computed from micrometeorology and partial plume path was used for terrain adjustment.

Contour plots showing the distribution of predicted concentrations and the results compared with the odour criteria are set out in **Section 3.3**

5.4. Discussion of Odour Modelling Results

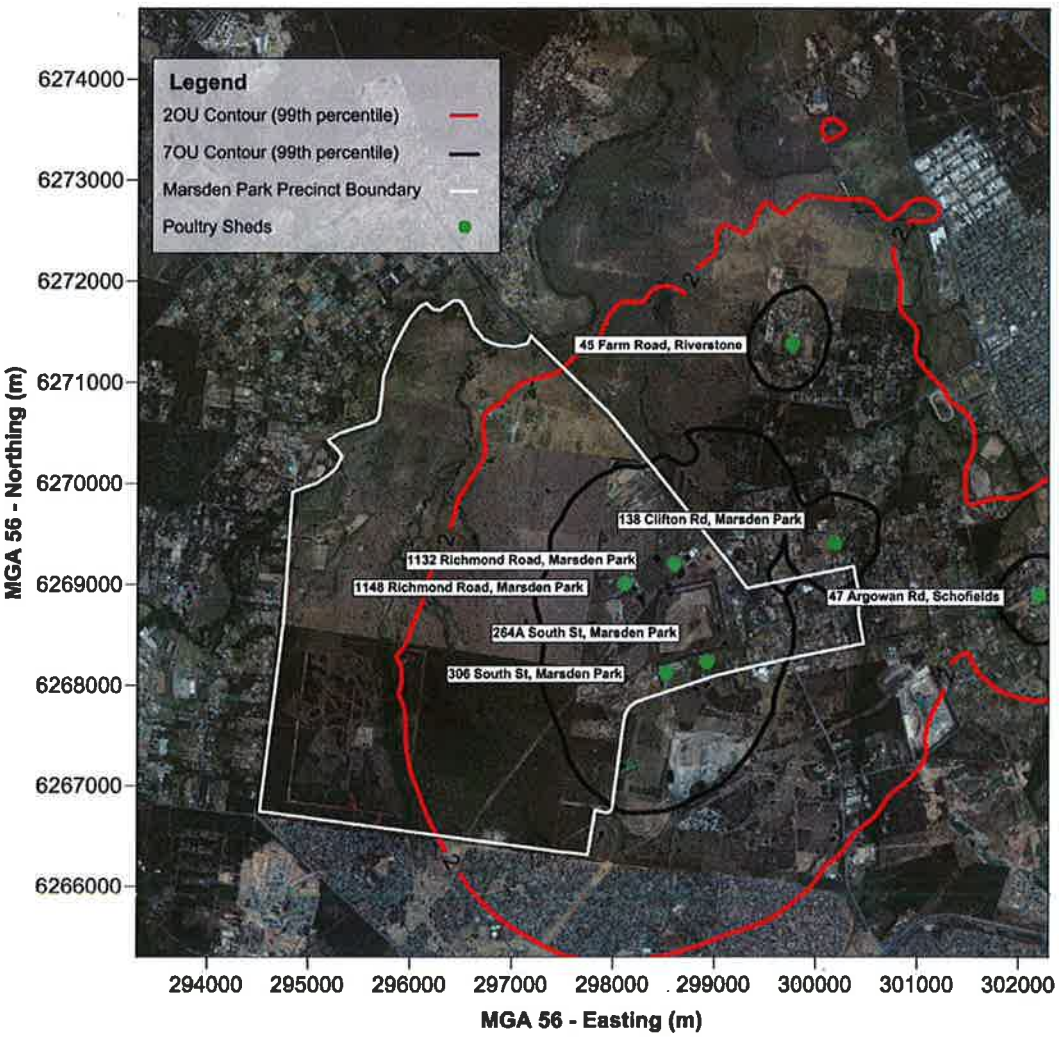
The results of the odour modelling are shown in **Figure 5-1**. In this figure, the red contour represents the predicted 2 OU criterion level at the 99th percentile[2]. This criterion is applicable to any proposed residential land use development within the Precinct. The Precinct boundary is indicated by a white line.

The following points should be noted when reviewing **Figure 5-1**:

[2] The 99th percentile criteria, refers to to the odour level (2 OU) that is exceeded for 1 % of the year on an annual basis, that is 88 hours in one year.

- A worst case scenario is assumed for all scenarios in which all poultry sheds are operating on the same cycle, with the highest emission rates generated from poultry farm operations occurring at the same time;
- The extent of odour emissions from poultry farming operations is based on observed number and size of sheds on each farm, with assumptions made regarding the number of birds likely to be housed in each shed; and
- More detailed assessments will be undertaken at the Development Application Stage (DA) for the Marsden park precinct.

- **Figure 5-1 Predicted Odour Concentrations at the 99th percentile**



The results of the modelling indicate that the 2 OU criterion contour (nose-response times, 99th percentile) extends across the eastern side of the precinct. The plume encroaches a number of

proposed sensitive land uses for all plan options (refer to **Appendix A**), including land zoned for low, medium and high density residential, schools, commercial use and the proposed centre area.

5.5. Odour Management Measures

The odour modelling indicates the potential for odour impacts above pre-determined criteria in areas where sensitive land uses are proposed for development in close proximity to poultry farms. As such, consideration should be given to odour management and mitigation measures to reduce the odour concentrations within the Precinct.

It is noted that the two farms in South Street Marsden Park, which are large contributor of total odour, are located within the area proposed for high and medium density residential development. It is extremely unlikely that residential development would be granted for residential development in co-location with these farms.

Where it is still proposed for residential development to occur and poultry farming to co-exist within and surrounding the site, it is suggested that a review of odour mitigation measures currently operating in all poultry sheds within or adjacent to the site covered by this Level 3 Assessment be undertaken by the relevant authority. During this review, additional measures should be identified for implementation (assuming they are not already in place) such as suggested by Dunlop (2009):

- Measures to prevent or reduce odours being generated including through dietary manipulation or by altering conditions to reduce the activity of malodour producing microbes (by using litter/feed additives or controlling moisture, temperature, pH or aeration of the litter);
- Technologies that capture, contain or treat odours and dust before being released to the atmosphere, such as:
  - **Biological processes**, such as biofilters and bio-scrubbers where microbial action converts odorous compounds into less odorous compounds;
  - **Chemical processes**, used in technologies such as chemical scrubbers or ozone treatment systems where chemicals in the scrubbing liquid remove or convert odorous compounds from the air stream; and
  - **Physical processes, which** include thermal or catalytic incineration, UV treatment, active oxygen non-thermal; plasma, dry filtration or wet filtration (for dust). These processes either remove the contaminant or use energy to destroy or convert contaminants.
- Technologies that enhance dispersion or disguise odours which include windbreak walls, or short stacks.

A detailed analysis of potential odour reductions due to each measure(s) proposed for implementation should be undertaken to assess cost effectiveness, physical and practical limitations, and performance of the control technology.

Additionally, near the boundary of the predicted 2OU contour, the design stage for the Precinct should consider the layout of the building and aim to overcome any odour impacts by:

- Facing windows and doors of more sensitive land uses away from the odour source; and
- Landscaping including fences and tall vegetation.

6. Conclusion

6.1. General Conclusions

This report provides an assessment of potential odour impacts from poultry farms that have the potential to impact on the proposed Marsden Park Precinct. This assessment will inform an Indicative Layout Plan (ILP) as part of the Precinct Planning and will be one of the supporting background studies for the Marsden Park Precinct planning package, to be prepared as part of the precinct planning process.

A Level 3 Odour Impact Assessment was conducted in accordance with the OEH *Technical Framework – Assessment and Management of Odours from Stationary Sources* (DEC 2006a) for the Precinct. Computer-based odour dispersion modelling has been used to assess impacts of the project against the urban odour performance criterion of 2 OU adopted for this assessment based on the proposed layout of the Precinct and predicted population size. The results of the modelling indicate that the 2 OU criterion contour (nose-response times, 99th percentile) well into the eastern side of the precinct.

6.2. Recommendations

Consideration should be given to odour management and mitigation measures which may reduce the odour concentrations from poultry farms within the Precinct. It is noted that the two farms in South Street Marsden Park which are large contributors of total odour are located within sufficiently close proximity to areas that are proposed for high and medium density residential development to be of concern. Significant odour impacts could be expected to occur within these areas while ever the poultry farms are operational. This is notwithstanding the fact that odour producing poultry farms within the Precinct are likely to be replaced by other land uses following the rezoning.

Where it is proposed for development to occur and poultry farming to co-exist within and surrounding the site, it is suggested that a review of odour mitigation measures currently operating in all poultry sheds within or adjacent to the site be undertaken. During this review additional measures should be identified for implementation such as (Dunlop 2009), assuming they are not already in place:

- Measures to prevent or reduce odours being generated including through dietary manipulation or by altering conditions to reduce the activity of malodour producing microbes);
- Technologies that capture contain or treat odours and dust before being released to the atmosphere such as: biological, chemical and physical air treatment processes;
- Technologies that enhance dispersion or disguise odours which include windbreak walls, or short stacks.

A detailed analysis of potential odour reductions due to each measure(s) proposed for implementation should be undertaken to assess cost effectiveness, physical and practical limitations, and performance of the control technology. The funding for such works should be negotiated between poultry farm owners and the DP&I. Notwithstanding this recommendation, it is acknowledged that the existing operations at the farms may already be of an acceptable industry standard and that they have limited opportunity to change practices aimed at odour reduction.

Additionally, near the boundary of the predicted 2OU contour, the design stage for the precinct should consider the layout of the building and aim to overcome any odour impacts by:

- Facing windows and doors of more sensitive land uses away from the odour source; and
- Landscaping including fences and tall vegetation.

It is also recommended that the Development Control Plan (DCP) for the Precinct include a map of existing odour sources (poultry farms), showing the extent of the possible odour impact as determined by the Level 3 odour assessment.

References

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Jiang, J. and Sands, J. (2000), *Odour and ammonia emission from broiler farms, RIRDC Project UNS-11A*, Rural Industries Research and Development Corporation, Canberra.

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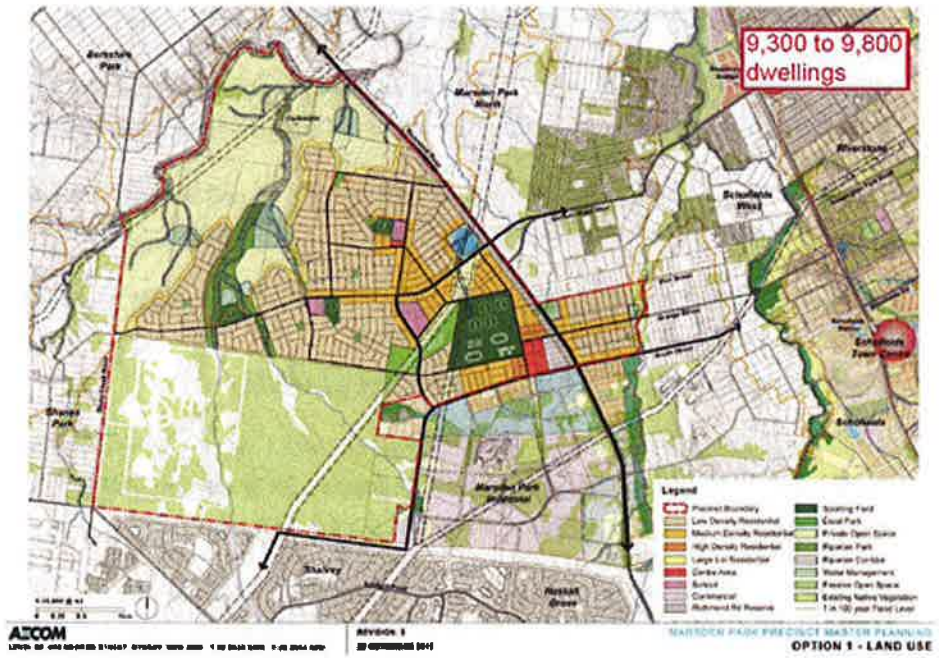
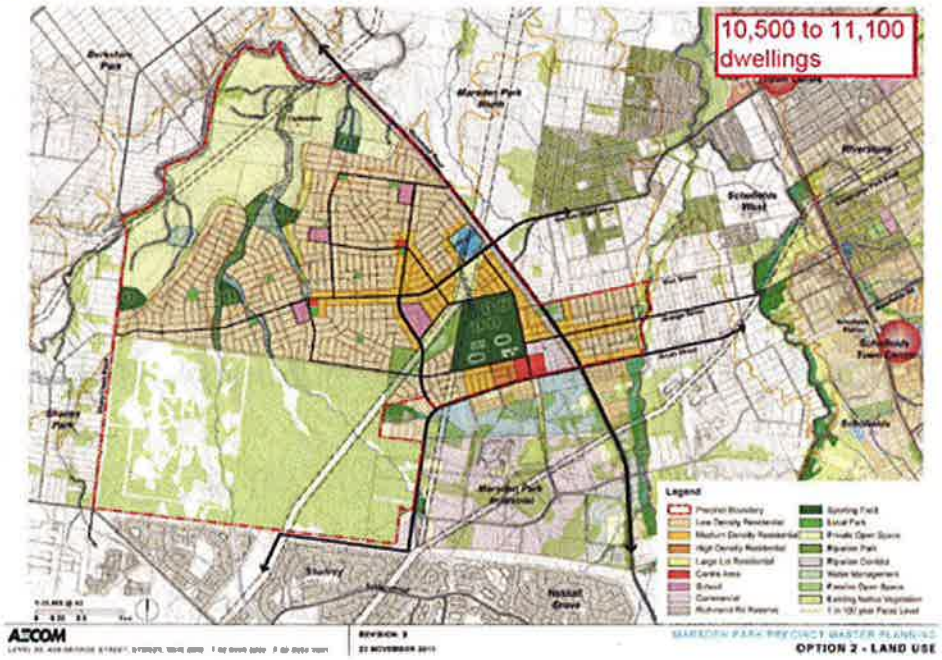
TRC (2007) CALPUFF model web-site (http://www.src.com/calpuff/regstat.htm) – June 2009.

Appendix A Layout Plans

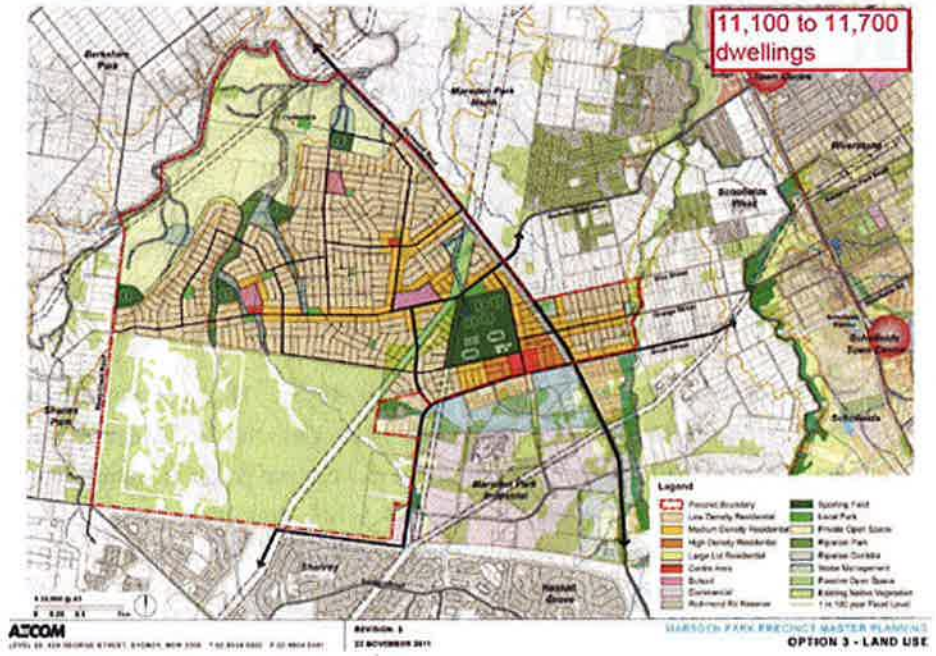
- **Figure A1 Marsden Park Structure Plan - Option 1**



- **Figure A2 Marsden Park Structure Plan - Option 2**



- **Figure A3 Marsden Park Structure Plan - Option 3**



- **Figure A4 Marsden Park Structure Plan - Option 4**

Appendix B Level 1 Odour Assessment

B.1 Introduction

Sinclair Knight Merz (SKM) have been commissioned by the Winten Property Group (WPG) to conduct a Level 1 Odour Impact Assessment in accordance with the NSW Office of Environment and Heritage (OEH) *Technical Framework – Assessment and Management of Odours from Stationary Sources* (DEC 2006) for the Marsden Park Precinct (the Precinct). This assessment will inform an Indicative Layout Plan (ILP) as part of the Precinct Planning and will be one of the supporting background studies for the Marsden Park Precinct planning package, to be prepared as part of the precinct planning process.

The scope of works has been divided into two stages. This assessment memo provides the preliminary results of Stage 1 of the odour impact assessment. Stage 2 is dependent on the outcomes of the Final Stage 1 report. Stage 1 involves the preparation of a Level 1 Odour Impact Assessment in accordance with the OEH *Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005) and *Technical Framework – Assessment and Management of Odours from Stationary Sources* (DEC 2006) and associated *Technical notes* (DECC 2006).

B.2 Potential Odour Generating Activities

Potential odour generating activities within and surrounding the proposed Precinct have been identified through review of the following sources:

- OEH Environmental Protection Licence (EPL) Database;
- Level 3 Odour Impact Assessment for Schofields Precinct (Holmes 2011);
- Level 3 Odour Impact Assessment for Marsden Park Industrial Precinct (Heggies 2009)
- Site visit undertaken on the 8th December 2011
- Review of Satellite imagery

Odour generating activities to the east of the precinct mainly identified in the Holmes (2011) and Heggies (2009) assessments are presented in **Table B1**and **Table B2** of this report. These were further confirmed by further site investigations. **Table B1** also lists potential poultry farms to the west of the precinct identified by a site visit conducted on 8th December 2011 and satellite imagery.

Preliminary investigations have revealed that some operating facilities are located at a significant distance from the project study area and are very unlikely to have any impact. Locations (near or within the precinct) at which odour generating activates have the potential to impact on the proposed Precinct include:

- 47-51 Argowan Rd, Schofields;
- 45 Farm Rd, Riverstone;
- 138 Clifton Rd, Marsden Park;
- 1148 Richmond Rd, Marsden Park;
- 264A South St, Marsden Park;
- 306 South St, Marsden Park;
- 1132 Richmond Rd, Marsden Park

Four of these Poultry Farms (refer to **Table B1**) are located within the south western portion of the precinct; adjacent to the Marsden Park Industrial Precinct. Land within this area is proposed to be used for high density residential and commercial use and a town centre (refer to **Appendix A** of the Odour Impact Assessment)

The location of these sources and associated separation distances are presented in **Appendix A** of this report. The methodology for calculating separation distances for each odour source is described in **Attachment B** of this report. As can be seen from **Table B1** that odour dispersion modelling has been previously been conducted for a number of these sources. The results of odour dispersion modelling with regards to the Office of Environment and Heritage 2OU criterion contour at the 99th percentile are also shown in **Attachment A**.

Based on conservative separation distances calculated in accordance with Section 5 of the Technical Framework (DECC 2006) all potential odour generating activities to the west of the precinct are unlikely to impact on the proposed Precinct (refer to **Attachment B** of this report). With the exception to a small section of low density residential these sources are generally located near land proposed for non-sensitive land uses such as open space and native vegetation (refer to **Appendix A** of the Odour Impact Assessment).

A number of waste services are also located within the study area including the Blacktown Waste Services located to the south within Marsden Park Industrial Precinct and the former WSN Grange Avenue Waste and Recycling Centre located within the Precinct.

Table B1 Recommended Separation Distances from Poultry Farms (Level 1 Assessment)

Address	Coordinates		Bird Type	Sheds	Est. Total Birds	Separation Distance		Distance from the project (m)	Reference	Modelled
	Easting	Northing				(m)	+20% (m)			
100 Worcester Rd, Rouse Hill	305789	6271771	Layer	4	32,000	851	1,021	5,895	Holmes (2011)	No
21 Terry Rd, Box Hill	305075	6273892	Broiler	3	61,050	1,346	1,615	6,617	Holmes (2011)	No
181 Cudgegong Rd, Rouse Hill	305137	6271315	Layer	2	7,000	289	347	5,163	Holmes (2011)	No
89 Schofields Rd, Rouse Hill	306333	6270046	Layer	3	400	38	45	5,955	Holmes (2011)	No
68 Schofields Farm Rd, Schofields	303393	6269913	Layer	3	20,000	677	813	3,190	Holmes (2011)	No
73 Boundary Rd, Schofields	303818	6270037	Layer	2	3,000	176	211	3,486	Holmes (2011)	No
20 Clarke St, Riverstone	304058	6271607	Broiler	5	70,000	2,106	2,528	4,379	Holmes (2011)	Yes
16 Clarke St, Riverstone	303981	6271724	Broiler	2	10,000	373	447	4,364	Holmes (2011)	No
31-33 Boundary Rd, Box Hill	303692	6274767	Layer	4	87,662	1,740	2,088	6,473	Holmes (2011)	No
466 Windsor Rd, Vineyard	300769	6275445	Layer	3	44,956	1,203	1,444	5,359	Holmes (2011)	No
54 Pelican Rd, Schofields	303628	6268322	Broiler	3	37,574	1,059	1,271	3,147	Holmes (2011)	Yes
2 Pelican Rd, Schofields	303541	6267968	Broiler	2	39,422	1,096	1,315	3,114	Holmes (2011)	Yes
93 Hambledon Rd, Schofields	304653	6268685	Broiler	3	53,000	1,353	1,623	3,162	Holmes (2011)	No
98 Hambledon Rd, Schofields	304969	6268665	Broiler	5	73,000	1,528	1,834	4,484	Holmes (2011)	No
96 Hambledon Rd, Schofields	304938	6268595	Duck Farm	6	13,000	449	539	4,433	Holmes (2011)	No
25 Schofields Rd, Schofields	303673	6269406	Broiler	3	75,000	1,731	2,077	3,231	Holmes (2011)	Yes
26 Schofields Farm Rd, Schofields	303866	6269598	Broiler	4	42,837	1,163	1,395	3,417	Holmes (2011)	Yes

Address	Coordinates		Bird Type	Sheds	Est. Total Birds	Separation Distance		Distance from the project (m)	Reference	Modelled
	Easting	Northing				(m)	+20% (m)			
34-36 Schofields Rd, Schofields	303816	6269036	Duck Farm	2	15,916	576	691	3,338	Holmes (2011)	No
37-39 Boundary Rd, Schofields	304505	6269530	Layer	1	8,000	353	424	4,069	Holmes (2011)	No
47-51 Argowan Rd, Schofields	302175	6268953	Broiler	3	80,000	1,812	2,174	1,687	Holmes (2011)	Yes
					59,532				Heggies (2009)	Yes
45 Farm Rd, Riverstone	299863	6271392	Duck Farm	6	150,000	2,831	3,397	1,862	Holmes (2011)	No
169 Clifton Rd, Marsden Park	299743	6269492	Layer	2	10,500	429	514	447	Holmes (2011)	No
1148 Richmond Rd, Marsden Park	298766	6269349	Broiler/Layer	7	60,000	1,477	1,773	Within Study Area	Holmes (2011)	No
					129,920				Heggies (2009)	Yes
264A South St, Marsden Park	298946	6268217	Broiler	3	75,000	1,731	2,077	Within Study Area	Holmes (2011)	No
					75,166				Heggies (2009)	Yes
306 South St, Marsden Park	298493	6268099	Broiler	5	142,571	2,731	3,277	Within Study Area	Holmes (2011)	No
					120,707				Heggies (2009)	Yes
1132 Richmond Rd, Marsden Park	298565	6269076	Layer	4	60,000	1,477	1,773	Within Study Area	Holmes (2011)	No
				2	52,800				Heggies (2009)	Yes
25 Whites Road, Shanes Park Lot: 77 DP 28847	293770	6267975	Broiler	4	84,949	1891	2269.2	885	NA	No
35 Whites Road, Shanes Park Lot: 78 DP 28847	293689	6268001	Broiler	3	79,640	806	967.2	896	NA	No
141 South Creek Road Shanes Park Lot 116 DP 28847	293345	6268225	Broiler	3	68,200	1618	1941.6	1,340	NA	No
99-105 Third Road Berkshire Park Lot 1 DP 217352	295111	6271779	Broiler	4	67,672	1607	1928.4	971	NA	No
92-98 Second Road Berkshire Park Lot 65 DP 975322	295656	6272272	Broiler	2	46,346	1230	1476	670	NA	No
59-65 First Road Berkshire Park Lot 29 DP 748101	295518	6272603	Broiler	3	48,693	1274	1528.8	1,017	NA	No

- **Table B2 Recommended Separation Distances from other Odour Sources (Level 1 Assessment)**

Address	Coordinates		Operation	Sheds	Separation Distance		Distance from the project (m)	Reference	Modelled
	Easting	Northing			(m)	+20% (m)			
21 Gordon Rd	304253.	6269937	Piggery	3	845	1,014	3,859	Holmes (2011)	Yes
101 Hambledon Road	304724	6268955	Piggery	4	867	1,040	4,242	Holmes (2011)	Yes
1106 Windsor Rd, Riverstone	305119	6272450	Meat rendering plant	NA	1,000	1,200	5,716	Holmes (2011)	No
Mile End Road, Rose Hill	306740	6266592	Quakers Hill STP	NA	400	480	6,165	Holmes (2011)	Yes
Bandon Road, Vineyard	300462	6274033	Riverstone STP	NA	400	480	4093	Holmes (2011)	No

B.3 Preliminary Findings and Recommendations

The preliminary results indicate:

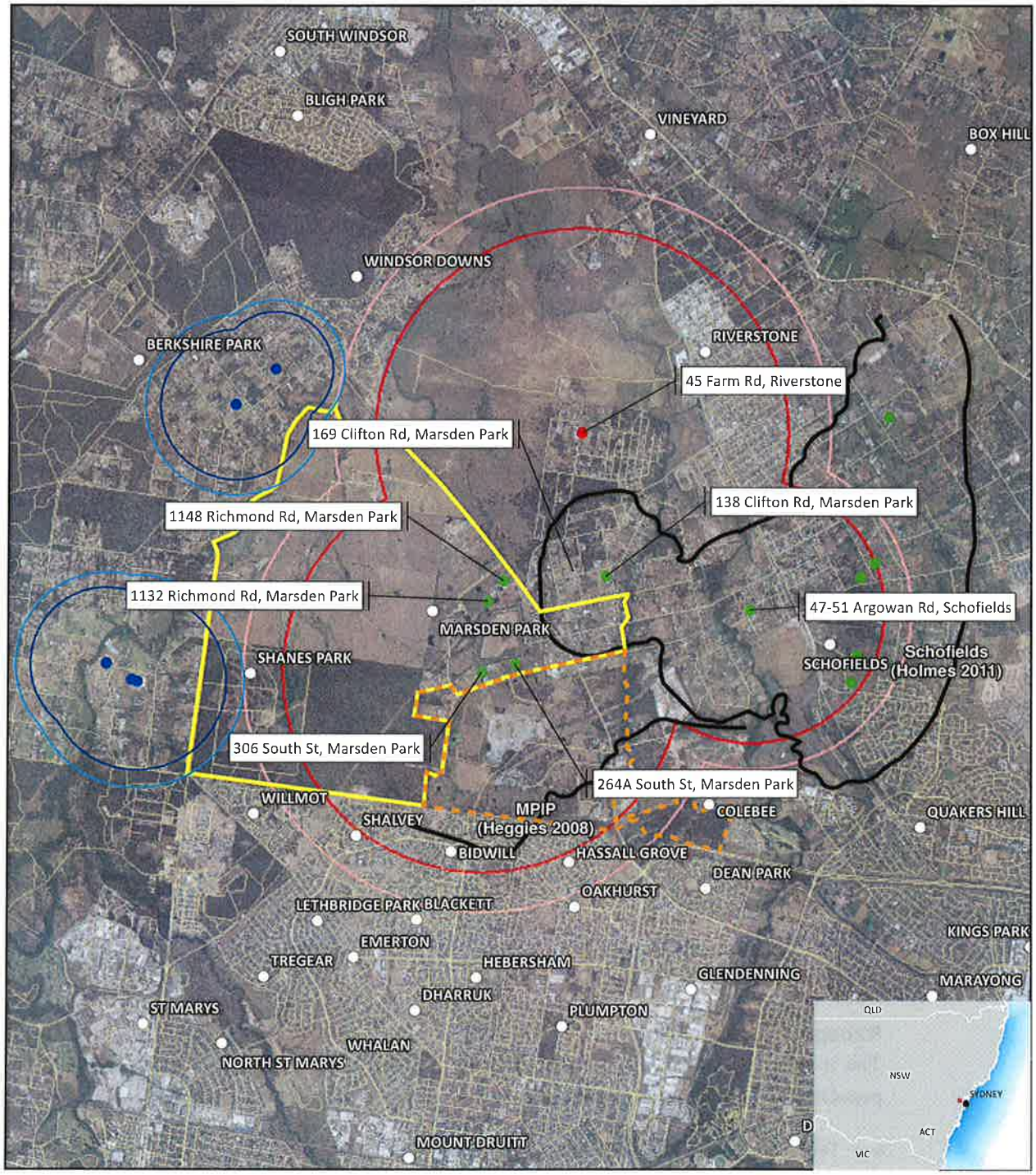
- The 2OU criterion contour at the 99th percentile predicted as a worst case scenario for poultry farms within close proximity to the Schofields infringes on the south-eastern boundary of the Precinct, proposed to be zoned for high density residential land use;
- Buffers identified for 45 Farm Road, Riverstone and 169 Clifton Road, Marsden Park overlap the Precinct Boundary and odour dispersion modelling should be undertaken to predict the impacts on proposed land uses from these sources including low and high density residential and commercial uses and public schools;
- Further odour dispersion modelling is required to extrapolate the predicted 2OU criterion contour at the 99th percentile for the Heggies 2009 assessment for poultry farms to determine onsite impacts of :
  - 1148 Richmond Rd, Marsden Park;
  - 264A South St, Marsden Park;
  - 306 South St, Marsden Park;
  - 1132 Richmond Rd, Marsden Park

  Alternatively Heggies could be approached to provide the results of their modelling, assuming their model domain extends into the Marsden Park development area.

  Based on the preliminary results, the Level 1 assessment indicates that separation distances associated with existing agricultural activities encroach over much of the Marsden Park site including all areas proposed for sensitive land use development. A Level 3 odour assessment is likely to reduce the extent of impacts, however, it is anticipated that much of the sensitive development area would remain within the buffers established by the results of air dispersion modelling.

Attachment A: Level 1 Odour Assessment Constraints Mapping

Figure 1 | Separation Distances and Potential Odour Impacts for Nearby Odour Generating Activities



LEGEND

- Locality
- Road network
- Marsden Park precinct boundary
- Marsden Park industrial precinct
- 2 OU contour

Odour source
- Not modelled
- Modelled
- Unconfirmed

- Separation distance (confirmed)
- Separation distance +20% (confirmed)
- Separation distance (unconfirmed)
- Separation distance +20% (unconfirmed)

0 2
Kilometres

DATA SOURCES
AUSIMAGE, LPI, Holmes (2011), Heggies (2008)

SKM

Attachment B: Methodology

Section 5 of the framework outlines the methodology for calculating separation distances for broiler chicken farms. The following equation is used to calculate the separation distance for broiler farms:

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

Where:

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

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

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

All poultry farms that are included in the assessment have been assessed using the Level 1 Odour impact assessment methodology for broiler chicken farms as described above.

Shed Factor (S1)

The shed factor (S1) is dependent on shed ventilation and is determined as follows:

- **Table B3 Calculation of Shed Factor (S1)**

Shed Type	Value
Controlled fan ventilation without barriers	980
Controlled fan ventilation with barriers	690
Natural Ventilation	690

A conservative approach has been adopted for this assessment whereby all poultry sheds are assumed to be naturally ventilated.

Receptor Factor (S2)

The receptor factor (S2) varies depending on the likely impact area and associated surrounding population. The receptor factor is based on the following receptor types:

- **Table B4 Calculation of Receptor Factor (S2)**

Receptor Type	Population	Value
Large Towns	>2000	1.05
Medium Towns	500-2000	0.75
	125-500	0.55
Small Towns	30-125	0.45
	10-30	0.35
Single Rural Residence	Single residence	0.3

Receptor Type	Population	Value
Public Area	occasional use	0.05[3]

Given that the precinct is expected to accommodate up to 10,000 dwellings for the purpose of this assessment a receptor factor of 1.05 has been adopted.

The precinct is expected to accommodate up to 10,000 dwellings primarily situated in the upper eastern portion of the precinct. As such for the purpose of this assessment poultry farms within or to the east of the Proposed Precinct have been assigned a receptor factor of 1.05. With exception to a small portion of land zoned for low residential use the eastern portion of the Marsden Park Precinct is zoned for non residential or commercial use, as such a receptor factor of 0.75 has been assigned to poultry farms west of the Precinct.

Terrain Factor (S3)

The terrain factor (S3) varies according to topography and its ability to disperse odours and is determined from the table below.

- **Table B5 Calculation of Terrain Factor (S3)**

Terrain Type	Description	Value
Valley Drainage Zone	Topography at low relief with significant confining sidewalls.	2.0
Low Relief	Terrain which is generally below the 2% falling slope from the broiler chicken sheds. Thus the receptor will be downhill from the broiler chicken sheds.	1.2
Flat	Less than 10% upslope, 2% down slope and not in a valley drainage zone	1.0
Undulating Hills	Terrain where the topography consists of continuous rolling, generally low level hills and valleys with minimal vegetation cover, but without sharply defined ranges, ridges or escarpments.	0.9
High Relief	Upslope terrain or a hill that projects above the 10% raising slope from the broiler chicken sheds. Thus the receptor location will be either uphill from the broiler chicken sheds, behind a significant obstruction or have significant hills and valleys between the sheds and the receptor	0.7

Local topography within the area varies from relatively flat to slightly undulating, low level hills. As such for the purpose of this assessment poultry farms were assigned a terrain factor of between 0.9 and 1.0.

[3] 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.

Vegetation Factor (S4)

The vegetation factor (S4) varies according to the density of surrounding vegetation and is determined from the table below.

- **Table B6 Calculation of 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

A conservative approach has been adopted for the purpose of this investigation whereby vegetation factor of 1.0 was assigned, indicating no tree cover.

Wind Frequency Factor (S5)

Wind speed and direction varies both annually and diurnally. Although there is generally one direction that is most frequently observed, the wind direction usually blows from all directions at some time.

High frequency winds refer to winds blowing towards a receptor (± 40 degrees) for at least 60% percent of the time for all hours over a whole year.

Low frequency winds refer to winds blowing towards a receptor (± 40 degrees) for at less than 5% of the time for all hours over a whole year.

- **Table B7 Wind Frequency Factor (S5)**

Wind Frequency	Value
High frequency towards receptor (>60%)	1.5
Normal wind conditions	1.0
Low frequency towards receptor (<40%)	0.7

Based on local meteorology, winds are considered to be normal thus a wind frequency factor of 1.0 has been assigned.

Appendix C Meteorological Modelling

This assessment has made use of the CALPUFF dispersion model. The CALPUFF model, through the CALMET meteorological processor, simulates complex meteorological patterns that exist in a particular region. The effects of local topography and changes in land surface characteristics can be incorporated into the model.

In the absence of suitable surface or upper air data sources, these data were generated by the CSIRO's prognostic model known as TAPM (The Air Pollution Model). TAPM is a prognostic model which has the ability to generate meteorological data for any location in Australia (from 1997 onwards) based on synoptic information determined from the six hourly Limited Area Prediction System (LAPS).

A summary of the data and parameters used as part of the meteorological component of this study is shown below in **Table C1**.

Table C1 Summary of meteorological parameters used for this study

TAPM (v 4.0.3)	
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Number of grids point	35 x 35 x 25
Year of analysis	January 1998 to December 1998, with one "spin-up" day. The spin-up day allows the meteorological variables to adjust to the model terrain and landuse.
Centre of analysis	Marsden Park Precinct (33° 41.5'S, 150° 49.0'E)
Meteorological data assimilation	None
CALMET (v 6.327)	
Meteorological grid domain	10 km x 10 km (50 x 50 x 10 grid dimensions)
Meteorological grid resolution	0.2 km
Surface meteorological stations	One surface station sites: - Wind speed, wind direction and temperature from Vineyard weather station. - Relative humidity, barometric pressure, cloud cover and ceiling height data generated for the Precinct by the TAPM simulation.
Upper air meteorological station	No upper air stations. The 3-dimensional meteorological output from TAPM was used as the initial guess wind-field for CALMET.
Simulation length	8760 hours (January 1998 to December 1998)