Wyong Shire Council

ORDINARY MEETING

ENCLOSURES

Wednesday
24 November 2010

WYONG SHIRE COUNCIL

ENCLOSURES TO THE

ORDINARY MEETING

TO BE HELD IN THE COUNCIL CHAMBER,
WYONG CIVIC CENTRE, HELY STREET, WYONG
ON WEDNESDAY, 24 NOVEMBER 2010 ,
COMMENCING AT 5:00 PM

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SITE PLAN

PARTIAL SITE PLAN

HOUSE PLAN

SITE ANALYSIS

BUILDING STANDARDS

BASIX CERTIFICATE REQUIREMENTS

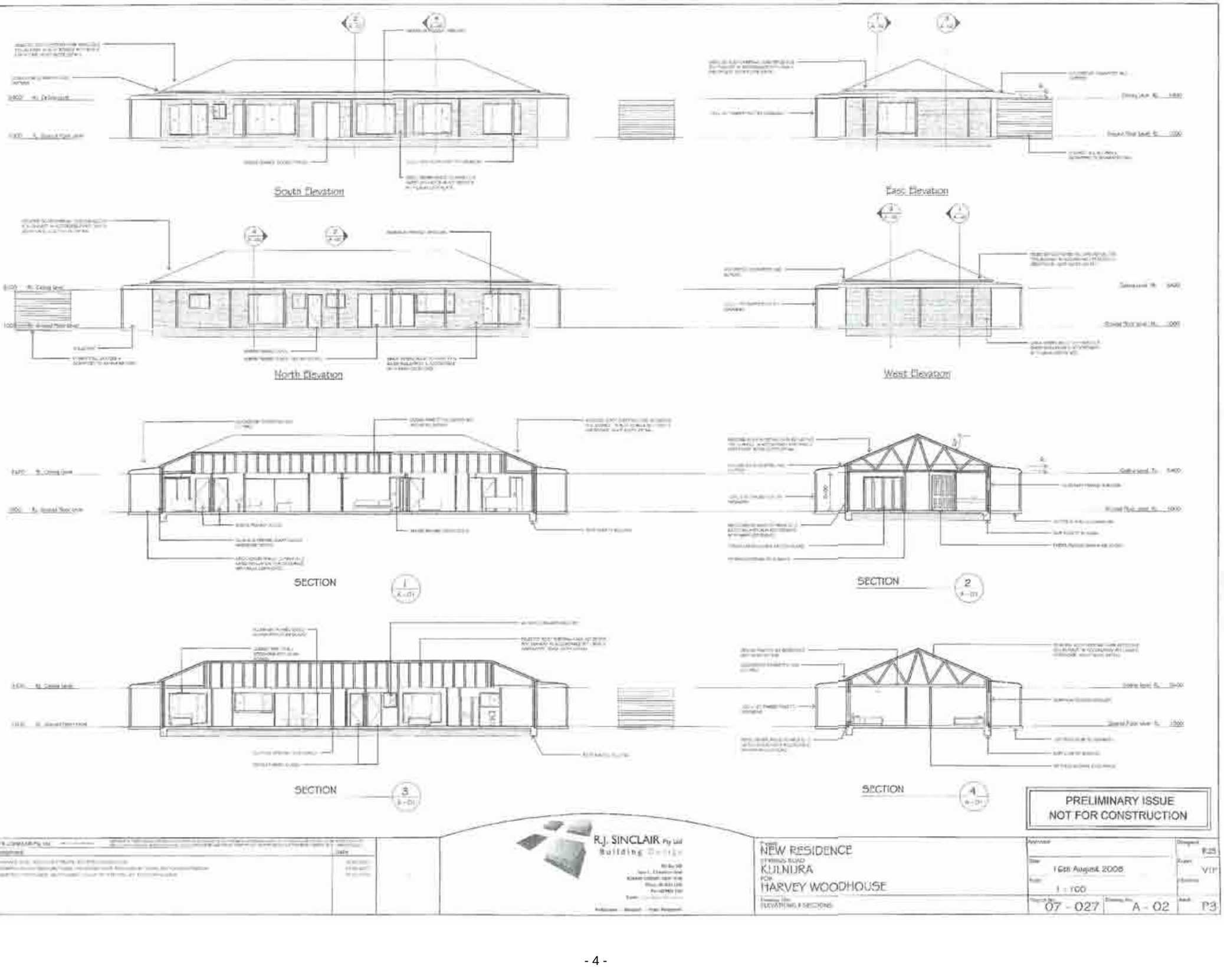
ITEM	REQUIREMENT

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

R.J. SINCLAIR Pty Ltd
Building Design

NEW RESIDENCE
KULNURA
FOR
HARVEY WOODHOUSE

14th August 2008
As indicated
07 - 027
A - 01
P4


South Elevation
East Elevation
North Elevation
West Elevation
SECTION 1
SECTION 2
SECTION 3
SECTION 4
PRELIMINARY ISSUE
NOT FOR CONSTRUCTION
R.J. SINCLAIR Pty Ltd
Building Design
NEW RESIDENCE
KULNURA
FOR
HARVEY WOODHOUSE
16th August 2006
1 : 100
07 - 027
A - 02
P3

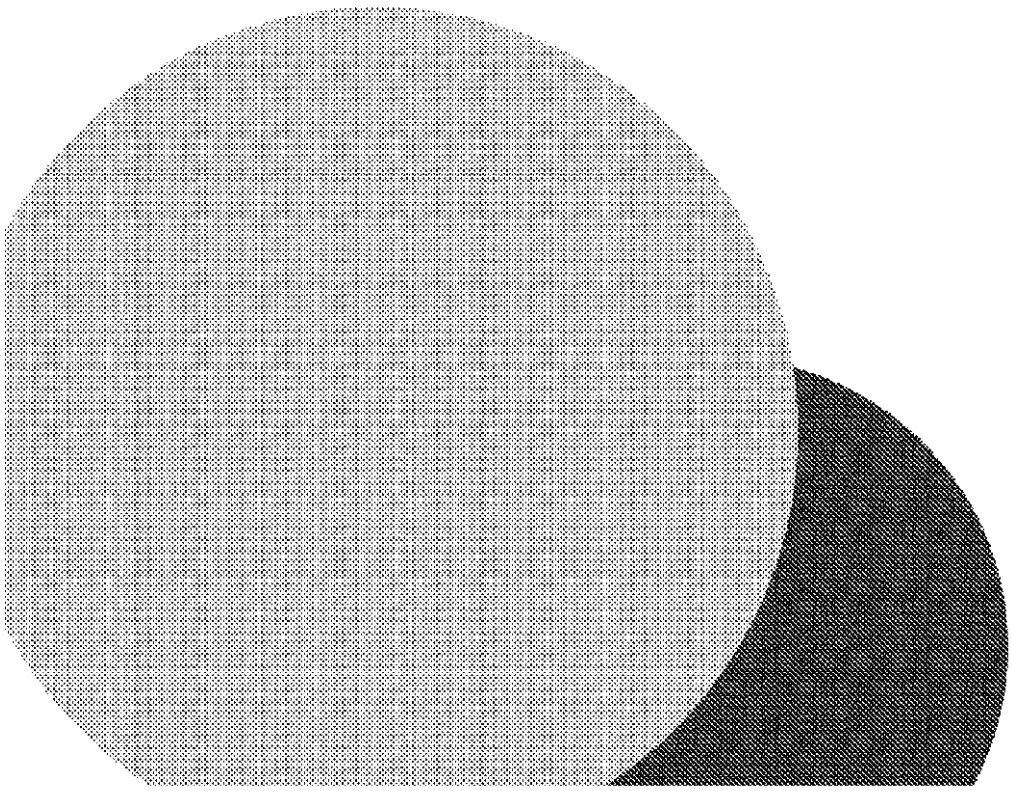
REPORT

SCHEMBRI FARMS SEPARATION DISTANCE

AconsulT

Job No: 2176b

10 September 2010



A PEL Company

PROJECT TITLE:	**SCHEMBRI FARMS SEPARATION DISTANCE**
JOB NUMBER:	**2176B**
PREPARED FOR:	Lorelle Fitzpatrick **ACONSULT**
PREPARED BY:	**R ORMEROD**
QA PROCEDURES CHECKED BY:	NA
APPROVED FOR RELEASE BY:	R Ormerod
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DOCUMENT CONTROL

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EXECUTIVE SUMMARY

This report addresses concerns associated with potential residential development adjacent to the Schembri Poultry Farm at 2210 Springs Road, Kulnura.

The upgrading of the farm was subject to Land and Environment Court Proceedings Number 10145 of 2005. For that case, a joint expert report was prepared by Dr Kerry Holmes and Mr Robin Ormerod. The report included Figure 1 as reproduced in this report. It indicates the predicted odour concentration contours around the upgraded farm, in a format consistent with the odour guidelines set out by DEC (2006).

The report has considered aspects of the modelling, odour acceptability criteria, site design and management and separation distance recommendations that are relevant to consideration of future housing on adjacent land.

Models for predicting odour impact are not precise, even if inputs are perfectly accurate. Inputs in this case are also subject to uncertainty. In particular, analysis of 11 years of meteorological data for Mangrove Mountain shows that the 1999 year used in the assessment was very likely to underpredict impacts.

The NSW guidelines used to assess the acceptability of odour impact cannot guarantee the absence of odour or of annoyance, particularly when the criteria for small affected populations are applied. Recent separation distance guidelines (South Australia, for example) contain increased minimum separation requirements compared to older guidance.

In light of these factors, it is considered to be highly prudent in any situation, where the ability exists, to maximise separation from sources of odour, dust and noise emissions so that the risk of adverse effects is minimised. In this particular case, it would not be prudent to locate future residences on or extremely close to the predicted 5 ou odour contour in Figure 1 if it were at all possible to locate further away from the farm sheds. There is also a strong possibility that updated modelling based on more refined and detailed data on meteorology, terrain and odour emissions would predict a higher odour impact than that indicated in the Joint Statement.

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1 INTRODUCTION

This report addresses concerns associated with potential residential development adjacent to the Schembri Poultry Farm at 2210 Springs Road, Kulnura.

The upgrading of the farm was subject to Land and Environment Court Proceedings Number 10145 of 2005. For that case, a joint expert report was prepared by Dr Kerry Holmes and Mr Robin Ormerod. The report included Figure 1 below, which indicates the predicted odour concentration contours around the upgraded farm, in a format consistent with the odour guidelines set out by DEC (2006).

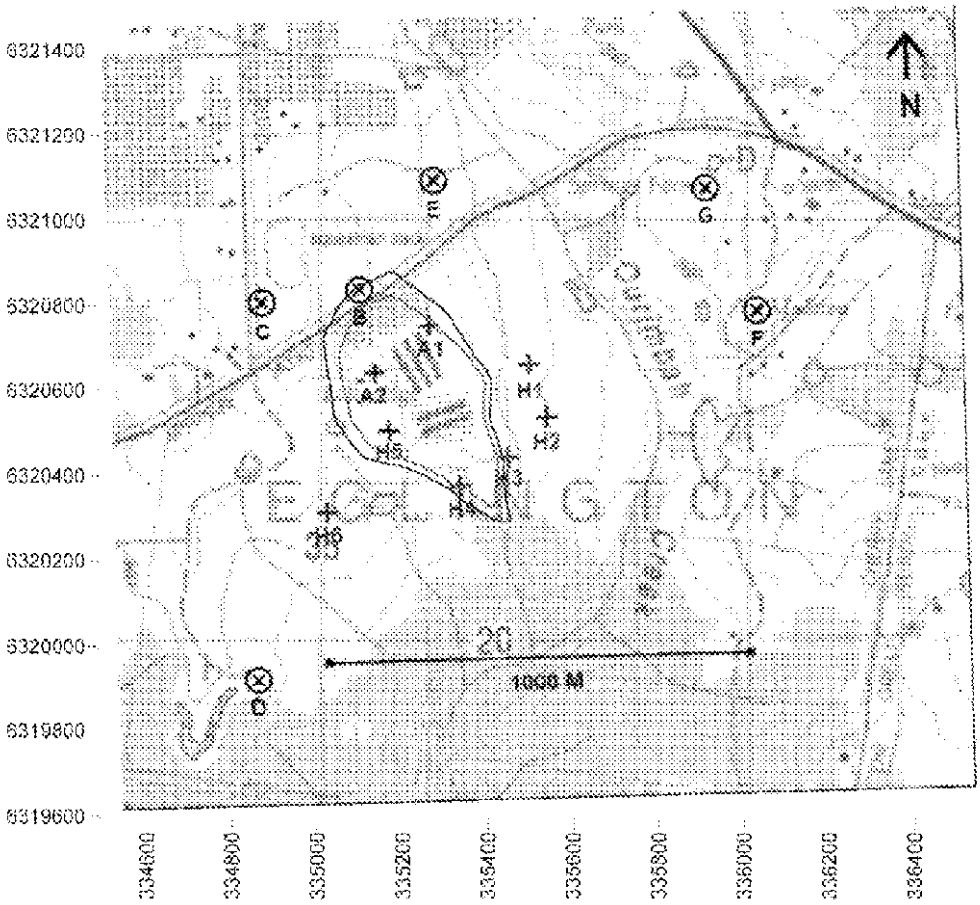

Figure 1: Odour contours from Land and Environment Court Proceedings Number 10145 of 2005, 'Joint Statement by Kerry Holmes and Robin Ormerod'. Predicted positions of the 5 ou (outer, blue) and 6 ou (inner, pink) contours. Solid rectangles indicate pre-existing sheds, transparent rectangles approved new sheds. H1 to H6 represent some possible future locations of residences on adjacent property.

It is understood that the owner of the adjacent property might now propose to erect residences at locations on or very close to the indicated odour contours. This report discusses the risks associated with pursuing that option.

This document takes the work done previously for the joint experts' report as the basis for the discussion that follows. This discussion examines more closely the implications for the specific proposed dwelling location and the scientific issues that arise for Council in making a determination.

As a preface to this discussion, it should be noted that the nature of modelling and impact assessment means that it is never precise, for reasons that will be explained. This lack of precision needs to be carefully considered when there may be 'line-ball' decisions based on lines on the map. The accuracy of those lines is usually far less than is suggested by their appearance, and so risks associated with the unavoidable uncertainty in those line positions ought be considered, given the long-term implications of any adverse impacts that might arise.

2 DISPERSION MODELLING ISSUES

2.1 Data needed for modelling

The dispersion model relied upon for the odour assessment is AUSPLUME, which is widely used in Australia and New Zealand.

AUSPLUME calculates the dispersion of plumes released from emission sources. AUSPLUME requires input data on:

- Emission rates of selected pollutants;
- Locations, dimensions and other relevant details of emission sources;
- Meteorological factors including wind direction, wind speed, temperature and turbulence;
- Land use type which determines the roughness of the land surface which in turn affects turbulence; and
- Receptor locations.

As with all models, AUSPLUME's accuracy is critically dependent on the quality and representativeness of the data used.

2.2 The problem of uncertainty

A dispersion model that is used to predict future air quality relies on what is known and available at the time to make those predictions. Only a detailed validation study in the future, after the development has taken place, can determine how accurate the predictions were.

There are several major sources of uncertainty in modelling, some driven by the quality of input data, others by the fact that a model is a mathematical simplification of the real world and others that are unavoidable consequences of how the atmosphere behaves. Table 1 is somewhat detailed but simply highlights the fact that there are many aspects of a model that can lead to inaccuracy or uncertainty.

Table 1: Sources of Uncertainty in Atmospheric Dispersion Models

Source	Effects
Simplification of the real world by translating to computer code	Complex atmospheric and emission source behaviours cannot be accurately simulated. This problem is greater in Gaussian plume models (e.g., AUSPLUME), which have a relatively simple formulation.
Errors in emissions data	Ground level concentrations (glcs) are proportional to emission rate. Plume rise and glcs are affected by source dimensions, temperature and exit velocity. Emissions from complex sources like poultry operations, which are highly variable, need to be estimated on the basis of data from other operations which may or may not be suitably representative. Research shows that odour emissions from poultry farms are extremely complex and cannot yet be predicted precisely.
Errors in wind data	Wind direction affects direction of plume travel. Wind speed affects plume rise and dilution of plume, resulting in potential errors in distance of plume impact from source, and magnitude of impact. The year(s) of met data used may not be representative. It is also often necessary to use met data from a weather station some distance from the subject site, which introduces uncertainty as well.
Errors in stability estimates	Gaussian plume models use estimates of stability class, determined by several methods that approximate in nature. All stability datasets contain errors caused by the simplicity of the estimation methods. These errors can cause either underprediction or overprediction of ground level concentrations.
Errors in temperature	Temperature affects plume buoyancy, with potential errors in distance of plume impact from source, and magnitude of impact. For some sources (e.g., poultry farms) temperature also affects the odour emission rates. Errors in temperature can therefore affect both emissions and the behaviour of the plumes.
Receptor spacing	Models calculate concentrations at points on the ground known as receptors, usually set out in a grid. The spacing of grid points directly affects the accuracy of results, especially if they are presented as contours.
Inherent uncertainty	Models predict 'ensemble mean' concentrations for any specific set of input data (say on a 1-hour basis), *i.e.* they predict the mean concentrations that would result from a large set of observations under the specific conditions being modelled. However, for any specific

Source	Effects
	hour with those exact mean hourly conditions, the predicted ground level concentrations will never exactly match the actual pattern of ground level concentrations, due to the effects of random turbulent motions and random fluctuations in other factors such as temperature. The inherent uncertainty in concentrations downwind of a stack has been estimated as 50-75% for a 1-hour average simulation (Stein & Wyngaard, 2001). Year-to-year changes in meteorology can also result in significant variation in ground level concentrations, especially high-end (e.g., maximum) concentrations which are normally associated with weather conditions that occur only infrequently.

Errors in maximum predicted concentrations of 10% to 40% (plus or minus) are found to be typical (US EPA, 2003). This level of uncertainty occurs even when emissions and meteorology are accurately known and described. Significant errors in the emissions and meteorology can increase the uncertainty in model predictions substantially.

The implications of model uncertainty for decision-making are evident: given that we cannot have 100% certainty about predicted impacts it is not prudent to take results at face value without some allowance for risk management. In other words, model contours are not compatible with 'hairline' acceptance/rejection decisions.

2.3 Meteorological data

Meteorological data is a key issue for this case and is discussed below. What follows does not invalidate the work done for the Land & Environment Court case but does elaborate on those results and provides more context to assist in decision-making.

Odour modelling for the Land & Environment Court case was presented in the Joint Statement by Kerry Holmes and Robin Ormerod. The modelling approach had already been instigated when Mr Ormerod became involved. Due to time pressures and precedent factors there was a need to make use of the available data. However, a major set of errors was found in the meteorological file being used by the experts up to that time. This was corrected and then became the meteorological dataset used for the case.

Weather data from Mangrove Mountain (the nearest meteorological station) for the year 1999 was used in the dispersion model. Although this was deemed to be reasonable, it should be recognised that the data are for a site that is 5.5 km distant from the Schembri farm. Conditions at the subject site will therefore differ to some degree: the extent of difference is unknown, but for the purpose of the assessment is was assumed that the data would be reasonably representative.

Further, and most importantly, variations in wind and other weather parameters occur from year to year. Although the 1999 dataset was accepted, this had not been tested by referring to a larger set of data. Recent best practice guidelines by DECCW and other regulators recommend

a 5-year meteorological dataset rather than a single year, to ensure that reliance on a single year does not introduce a bias that is not typical of the longer term.

To investigate further the meteorological issue, we have taken data from the Mangrove Mountain weather station (operated by the Bureau of Meteorology) for the period 1999 to 2009 and made some simple analyses of the year-to-year changes of key variables and how 1999 fits within that context.

Firstly, we have analysed the existing model results and determined the critical weather conditions associated with the highest 100 hours of odour, as predicted at the centre of the cleared area that marks the site currently being considered for a dwelling. The highest impacts are associated with winds from the sector between 310 and 340 degrees (roughly northwesterly). There are two sets of conditions within that sector: overnight with very light wind and stable atmosphere, and daytime with moderate wind and moderate turbulence. In any case, the frequency of occurrence of winds from the northwest is an important indicator of the odour impact at the site.

Figure 2 shows the percentage of hours with winds from the critical direction sector, each year from 1999 to 2009. It is clear that 1999 had an atypically low occurrence of the critical NW winds. This is a strong indicator that a more representative year, or series of years, would lead to predicted impacts at the site under consideration significantly higher than predicted in the Joint Statement.

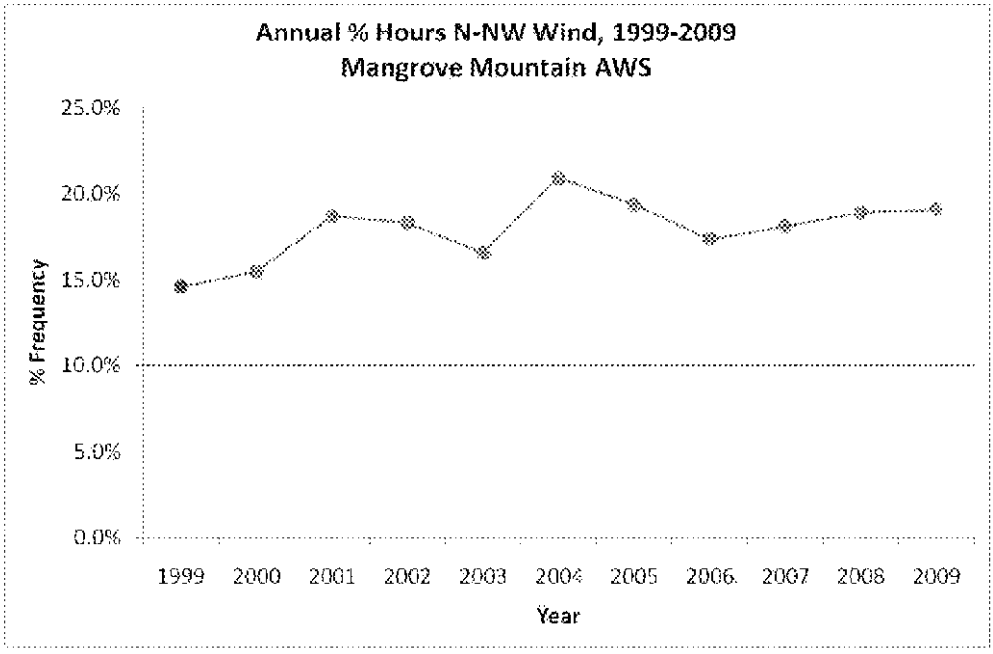

Figure 2: Annual frequency of NW winds 1999-2009

Another meteorological variables important to odour impacts is air temperature. Odour emissions from poultry farms are often higher during warm weather because of the need for higher rates of building ventilation to maintain internal temperatures at the correct level.

As well as leading to a propensity for higher emissions, warmer air temperatures also reduce the difference in temperature between plumes leaving the sheds and the outside air. This then leads to a reduction in plume buoyancy which also contributes to higher ground level concentrations.

Figure 3 shows the annual frequency of 'warm' temperatures (above 25°C) from 1999 to 2009. Again it is clear that 1999 was not typical of recent years and the lower frequency of warm weather will have created a tendency towards lower predicted odour impacts. Clearly, future climate warming will further exacerbate this issue.

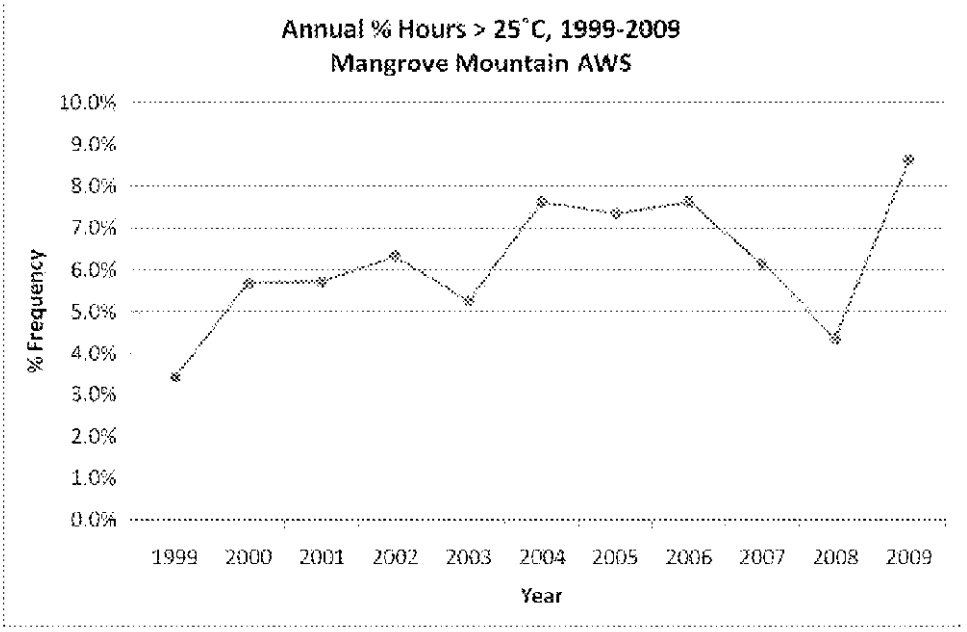

Figure 3: Percentage of hours with air temperature above 25°C, 1999-2009

In summary, it is evident that 1999 was not a representative year for meteorology and that odour impact predicted for the subject site would be higher if data for a more representative period were used.

2.4 Emissions

Odour emissions estimates used for the Joint Statement were derived from a model that has been developed from measurements at other meat chicken farms, mainly in Queensland, combined with some theory. As with all assessments that involve estimating future emissions, some room for risk and uncertainty is valid when interpreting model results.

More recent research conducted by the intensive livestock unit at the Queensland Department of Primary Industries (now renamed 'DEEDI') has demonstrated that odour emissions from poultry sheds are very complex and that the modelling assumptions used in current odour estimation models will require some revision. Hence, there is undoubted uncertainty in the odour emission rates.

Importantly, the actual performance of the Schembri operation has not been validated against the model predictions. It is very clear from the available data on poultry farms that there is significant variability from farm to farm, and this is often difficult to interpret. Although the emission estimation underlying the Joint Statement was best practice at the time, it nevertheless contained uncertainties that cannot be quantified at this stage.

2.5 Receptor grid

Another specific limitation in models is the spacing of the grid of receptor points used to predict ground level concentrations. The grid spacing used in the model for the joint report was in the order of 80 metres, i.e., grid points were set out 80 metres apart. Hence, the contours are based on interpolating data between points that are 80 metres apart. This necessarily introduces some inaccuracy in the locations of odour contours, especially when trying to determine position to within metres. In fact, such precision should not be assumed in any case, given the other sources of uncertainty as well.

2.6 What the odour predictions mean

The contours shown in Figure 1 mark the approximate limit of compliance with the NSW DECC odour guideline (depending on assumptions, hence two contours are shown). Assuming that the modelling uncertainties described above can be ignored for the moment, it does not signify that no odour will be experienced immediately beyond those contour positions.

The odour guideline is risk-based, i.e., it works on the basis that higher odour levels are more likely to be tolerated in smaller communities because fewer sensitive people are likely to be present. However, if it is desired to provide for a minimal risk of any odour problems, then the urban criterion of 2 ou ought to be considered, rather than the 5 ou or 6 ou criterion that was assumed for this site (as per the NSW odour policy and as agreed between experts). The position of the predicted 2 ou contour is given in Figure 4 below.

Our current experience on a project in northern NSW is that complaints are occurring in an area where predicted poultry odour levels are between 2 and 4 ou. Similar issues are arising in areas around Brisbane where urban expansion is occurring into traditional framing areas and a current Queensland Government initiative on planning guidelines for the poultry industry suggests that existing levels of odour criteria may not be adequate to protect against complaints and annoyance. This serves to illustrate that the odour criteria applied to the Schembri farm case are not a guarantee of protection against odour annoyance and complaints. Much depends on the expectations of any future resident on the level of amenity associated with odour. Almost certainly, distinct odour will be detected from time to time on the site.

Note also that meat chicken farms are dust sources and have been subject of complaints about dust in various areas. Dust was not assessed in the Joint Statement.

2.7 Odour performance criterion

The Joint Statement recognised the difficulty of determining an appropriate odour performance criterion in this case. Recent conformation with the DECCW is that the issue is indeed far from settled, and for that reason it is only sensible to consider some relevant factors:

- Future population in the 'affected community' is impossible to quantify precisely.
- There is growing evidence that 'rural residential' residents often have higher expectations of environmental quality (with respect to odour) than those in rural areas engaged directly in intensive livestock production, either as owners or employees.

- Where model contours are used to define an area that contains the 'affected community', it is evident from the foregoing discussion on model uncertainty that careful allowance ought to be made for 'fuzziness' in the contour lines.

On that basis, it would appear reasonable that more weight ought to be applied to the 5 ou criterion than the 6 ou criterion. Figure 4 shows the approximate position of the 2 ou contour used to define the affected population. We know now that the 1999 model data is not necessarily the best basis for defining g that population and there are additional houses not far outside the contour.

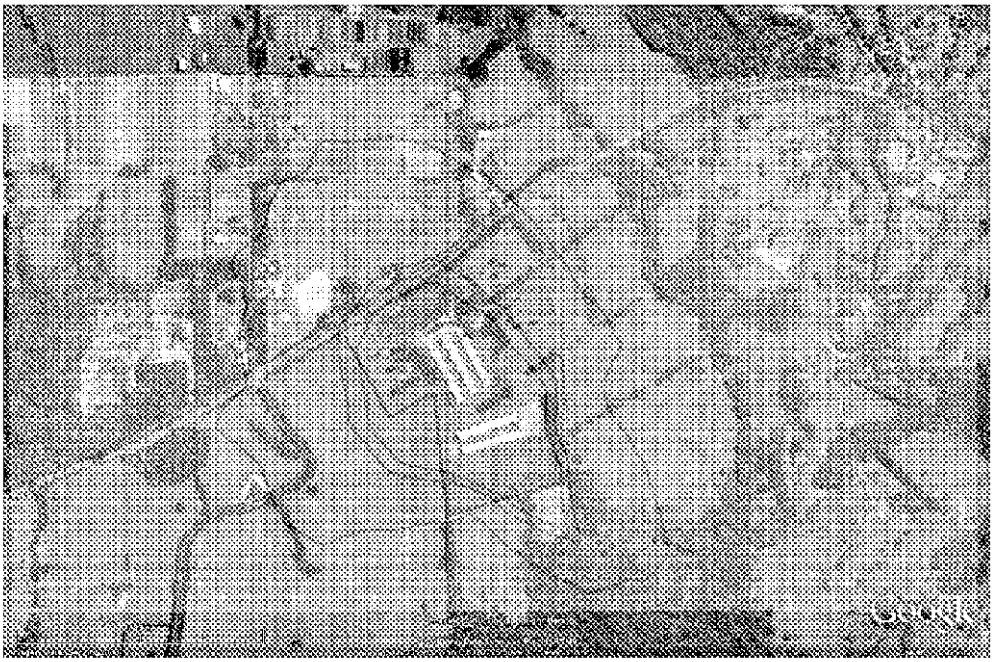

Figure 4: Approximate position of predicted 2 ou contour (outer contour line) overlain on Google map

The general population contains people with a wide range of abilities to detect odour. Sensitivity follows a so-called normal or Gaussian statistical distribution, otherwise known as the 'bell curve' (Figure 5 below). People at the most sensitive end of the spectrum may more than 10 times more sensitive to odours than those in the upper middle region of the range. Odour guidelines cannot necessarily address the odour sensitivity of the most sensitive in the population.

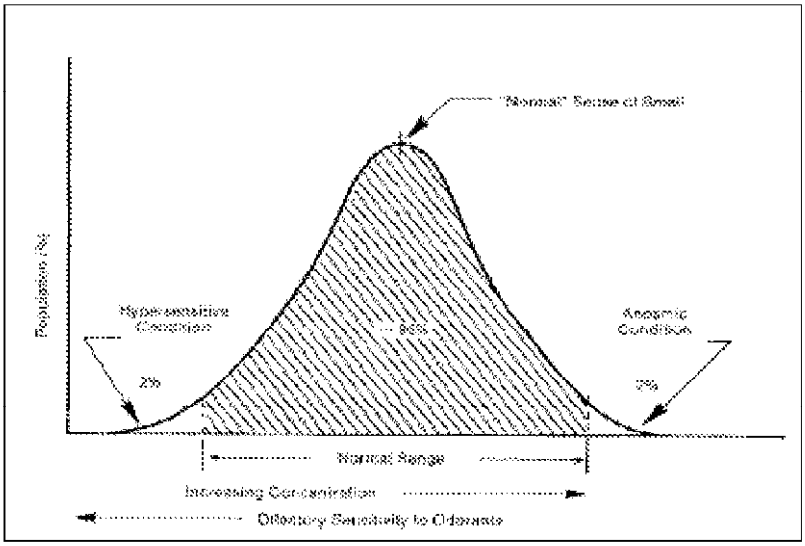

Figure 5: Diagram representing the frequency distribution of olfactory sensitivity (from UK Environment Agency, 2002)

Above and beyond the sensitivity of the physical sense of smell, as described above, is the importance of a person's perceptions and expectations about odour from a specific source. This brings into importance a range of so-called 'soft' or qualitative factors that cannot be accounted for in the odour assessment methods currently available. There are many possible 'soft' factors, including state of health, attitude towards the odour source, economic ties to the odour source, the perception of associated health risks, coping strategies, social pressures and so on (van Harreveld, 2002).

Research and case studies have shown that the level of odour annoyance and complaint in a community can be greatly affected by these soft factors (van Harreveld, 2002; Ormerod *et al.*, 2003).

2.8 More detailed model results

Figure 6 shows the predicted 5 ou contour position based on the existing 1999 model. The inner contour shows the position based on a fine grid of points (10 m spacing), with ground elevation taken into account. The outer line shows the position assuming the receptor point is at the same level as ground at the sheds. This outer level gives some indication that with higher levels above the ground, the odour impacts increase somewhat. This is often considered when impacts on buildings above ground level are considered.

It should be noted of course that these results are based only on the existing model using 1999 meteorological data and the existing emissions estimation method. Hence, it is likely that the contours using more representative data would extend significantly further to the south.

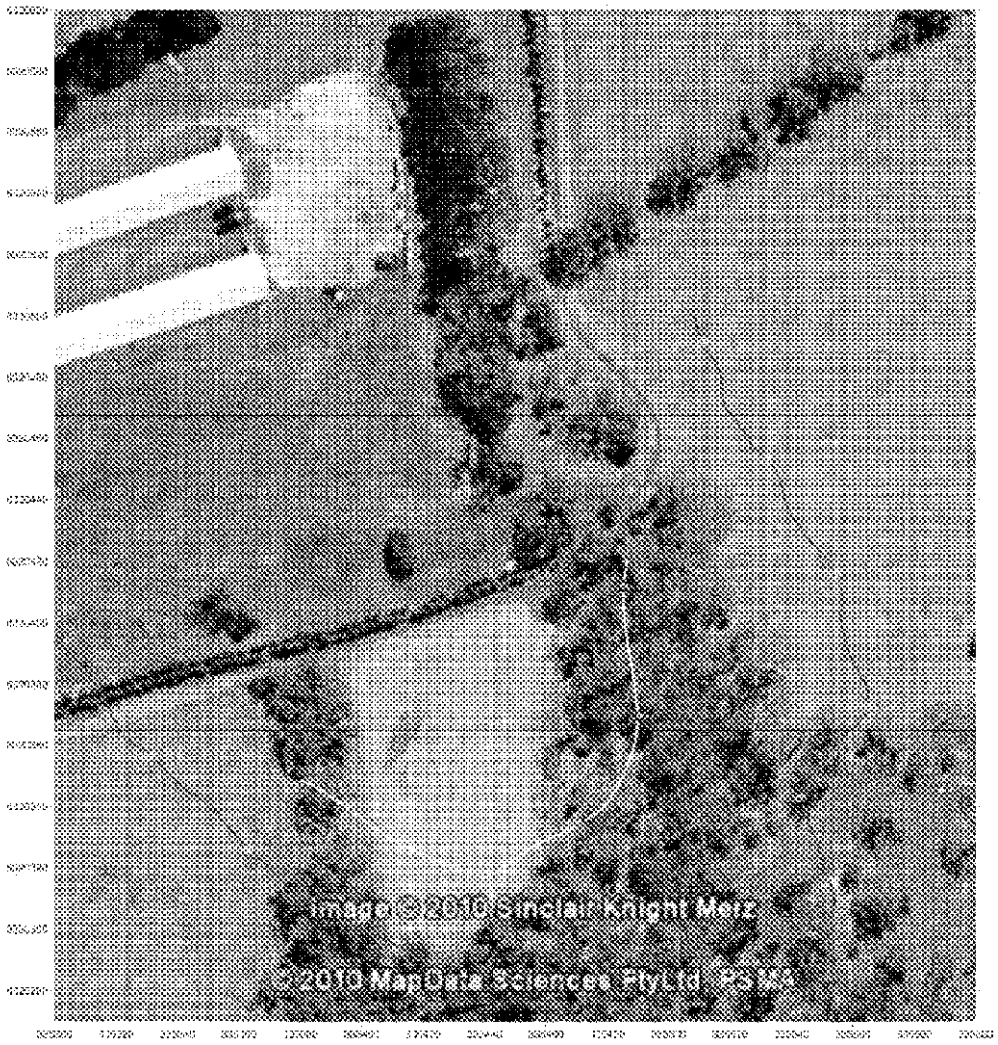

Figure 6: Detail of 5 ou contour on subject site, based on 1999 model data

3 SEPARATION DISTANCES

The *NSW Meat Chicken Farming Guidelines - Managing Planning, Development and Environmental Issues* (NSWA[a], 2004) note that not only odour, but also dust, bioaerosols and noise emissions from chicken farming operations could significantly affect community amenity. Buffer distances and vegetative screens are considered to be the primary means of reducing the impacts of these emissions. The guideline gives the following recommendation for buffer distances:

[a] New South Wales Agriculture

> *"A poultry farm development within 500 metres of a residential zone or 150 metres of a dwelling not associated with the development and likely to significantly affect the amenity of the neighbourhood is a designated development under the EP&A Act and will require an EIS to be lodged with the DA."*

The impact on visual amenity should also be taken into account when co-locating incompatible land uses. Hence, odour may not be the only impact to consider, particularly with relatively small separation distances.

Separation distance guidelines for poultry farms more recent than those for NSW have been developed in South Australia (SA EPA, 2007). Appendix A of the SA guideline sets out a minimum separation distance for a rural residential area of 500 metres and for a rural dwelling, 250 metres. The distance is taken from the 'activity boundary', which in this case would be the nearest shed wall.

Applying the SA guideline's separation distance formula, rather than the set distance indicated above, would result in a much larger buffer requirement around the Schembri farm.

4 SITE CONDITIONS

The Schembri farm is considered to be of a high standard in relation to odour management. The operator is well aware of the critical need for both design and operational standards to be maintained at a level of best practice. Operationally one of the most important aspects is the control of litter moisture to avoid the generation of excessive odours.

The maintenance and demonstration of best practice is not only important: it is the limit of what can be expected in terms of controlling the impacts of a farm. Hence, the opportunity for any significant reduction of the impact compared to those already approved and predicted is very limited.

5 CONCLUSION

Models for predicting odour impact are not precise, even if inputs are perfectly accurate. Inputs in this case are also subject to uncertainty. The 1999 meteorological year was not representative and very likely led to lower odour impacts being predicted at the subject site than would otherwise be obtained.

The NSW guidelines for assessing the acceptability of odour impact cannot guarantee the absence of odour or of annoyance, particularly when the criteria for small affected populations are applied. Recent separation distance guidelines (South Australia, for example) contain increased minimum separation requirements compared to older guidance.

In light of these factors, it is considered to be highly prudent in any situation, where the ability exists, to maximise separation from sources of odour, dust and noise emissions so that the risk of adverse effects is minimised. In this particular case, it would not be prudent to locate future residences on or extremely close to the predicted 5 ou odour contour.

There is also a real possibility that updated modelling based on more refined and detailed data on meteorology, terrain and odour emissions could predict a higher odour impact than that indicated in the Joint Statement.

6 REFERENCES

DEC (2006). *Assessment and management of odour from stationary sources in NSW.*

Ormerod, R.J., F. Turatti and P.C. D'Abreton (2003) Variations in community responses to odour: implications for policy and management. *Proc. CASN03 Clean Air Conference, Newcastle, November 2003*. Clean Air Society of Australia & New Zealand.

South Australian Environment Protection Authority (2007) *Guidelines for Separation Distances.* www.epa.sa.gov.au/xstd_files/Industry/Guideline/sepguidepcd.pdf

Van Harreveld, T. (2002) *Scent-Smell-Stink-Stench: How to Draw the Nuisance* Line. Proc. Enviro 2002 Odour Conference, Melbourne 7-12 April 2002.

UK Environment Agency (2002) Integrated Pollution Prevention and Control (IPPC) Draft Horizontal Guidance for Odour H4: Part 1 – Regulation and Permitting. http://www.ni-environment.gov.uk/ippc_h4_pt1.pdf

Attachment 1: Details of All Contract Variations

Construction of Northern Section of Link Road
CPA/160794 - Robson Civil Projects

Vary No.	Variation		Value	Description of Variation
1.0 Scope Changes				
107	Changes to Roundabout adjacent to Senior School entry	$	25,694.50	Amended design to delete landscaping and reduce future maintenance requirements
58	Additional earthworks	$	20,000.00	Additional excavation/reshaping required at headwall to improve footpath grades and stabilise ground around services
78a	Place mulch in lieu of concrete footpaths (September)	$	20,000.00	Deferred construction of sections of footpath to later stage as part of budget controls
60	Filling dayworks at Lakes Grammar Junior School	$	15,400.00	Reuse excess spoil materials from road excavations to raise level of footpath
61	Footpath in Albert Warner Drive	$	13,100.00	Additional section of footpath provided where identified need to encourage children to cross road safely
78	Replaced concrete with mulch in selected areas	$	7,663.60	Reviewed extent of concreting and replaced with mulched areas to reduce environmental impacts and costs
72	Adjustments to road verges	$	4,859.58	Further levelling and grade adjustments were required after deletion of concrete footpaths
82	Cost incurred due to scope of contract work deleted	$	4,375.25	Payment to Robson as 6 % of the loss of profit and overhead on deleted scope of work
104	Interest on unpaid variations (V025 & V083)	$	3,000.00	Interest cost incurred for non payment ot Robson while value of major variations for electrical conduits and temp fences was negotiated
105	Remobilisation costs for AC14 works to Sep Portion 2	$	2,500.00	Cost to remobilise Asphaltic Concrete crew after initial instruction to halt AC while cost savings were negotiated due to increase in cntract sum
63	Pricing of southern fill extension by contractor	$	1,800.00	Contractor was directed to prepare and cost quantities and rates for extending road formation south to incorporate anticipated good quality spoil from bulk earthworks - to mitigate excess material to be disposed from site
66	Footpath widening at Junior School	$	1,800.00	Existing access to school had to be demolished during works. This work reinstated the access.
59	Retrim batter at GPT	$	1,200.00	Ground levels around a large new permanent gross polutant trap were regraded to eliminate detention ponding considered unsafe imediately outside a junior school frequented by small children
84	Change turf type	$	610.00	Upgrade type of turf to stronger to resist scouring by water giving improved environmental performance
76	Credit for stencil concrete replaced with plain concrete	-$	3,167.66	Use of plain concrete in place of stencilled which was cosmetic and required an additional trade for a single item of work
	Subtotal:	**$**	**118,835.27**	
2.0 Design and Documentation Errors				
53	Pipeline 31/01 - 31/04 - 27/03 (May)	$	18,131.27	Error in documentation picked up on site during construction
42c	Kerb / Steelstone Interface Changes - July	$	14,498.97	Error in documentation picked up on site during construction
42	Kerb / Steelstone Interface Changes (May)	$	13,616.79	Error in documentation picked up on site during construction
69	600mm Pipeline + Altered Pit 25/06	$	12,775.00	Error in documentation picked up on site during construction
15	Extend 600mm and 300mm RCBC	$	12,259.13	Design and documentation error, length shownas 26.5 by coordinates which measured 39.4 in the field.
42b	Kerb / Steelstone Interface Changes - June	$	8,632.53	Error in documentation picked up on site during construction
42e	Profiler Hire to Complete	$	8,000.00	Error in documentation picked up on site during construction
35	Remove pipeline 28/5 - 28/6 & relay at 1% grade	$	6,696.77	Error in documentation picked up on site during construction
56	Correct/adjust level of low point in kerb and pit	$	5,400.00	Design and documentation error required level adjustments on site
85	Alteration to SO/SA connection at Ch2365	$	4,500.00	Error in documentation picked up on site during construction
53b	Pipeline 31/01 - 31/04 - 27/03 (July)	$	4,189.50	Error in documentation picked up on site during construction
57	Modify SA pit @ Junior School	$	4,000.00	Error in documentation picked up on site during construction
45	Pipeline 19 Changes	$	3,500.00	Error in documentation picked up on site during construction
101	Guard rail changes at box rail	$	3,500.00	Error in documentation picked up on site during construction
75	New SA Pit at Junior School Entrance & 375 Pipe 01/07/10	$	2,942.22	Error in documentation picked up on site during construction
89	Sawcutting to median islands	$	1,500.00	Error in documentation picked up on site during construction
71	Change in Concrete Jointing. Additional Mastics	$	722.10	Error in documentation picked up on site during construction
	Subtotal:	**$**	**106,733.01**	
3.0 Design and Document Omissions				
6	Relocation of school fence at Junior School access	$	85,340.46	Omitted from contract documents and subsequently included via variation
40	Deepen Pipeline 29/1-29/2	$	48,611.79	Omitted from contract documents and subsequently included via variation
39	Retaining wall on Albert Warner Drive to provide level footpath	$	17,432.00	Omitted from contract documents and subsequently included via variation
18	New gate and concrete footing to exclusion fence	$	16,012.07	Provision of fabricated double gates to access exclusion zone for monitoring groundwater. Installation of 520m of concrete strip footing also required to prevent fauna from burrowing under fence.
41	Additional Drainage changes & junior school	$	11,748.00	Omitted from contract documents and subsequently included via variation
06b	Relocation of school fence at LAGS junior school access (July)	$	8,693.58	Omitted from contract documents - part of Vary 6
06a	Relocation of school fence at LAGS junior school access (May)	$	8,689.09	Omitted from contract documents - part of Vary 6
51	Relocation of gate controller at Senior School	$	4,987.50	No allowance for existing electronic gate controller to be relocated to median island on Senior School access road
55	Provision of additional pram ramps	$	2,100.00	RTA identified need for 4 additional coloured pram ramps for public access

Attachment 1: Details of All Contract Variations

Construction of Northern Section of Link Road
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Vary No.	Variation		Value	Description of Variation
	Subtotal:	**$**	**203,614.49**	
4.0 Latent Conditions				
121	Increase in Schedule of Rates quantities	$	410,000.00	Additional quantities over original allowances for various earthworks items in the SOR due to large volume ground encoutered that was unsuitable for use in the road formation
112	Borrow pit costs - Stage 1	$	46,100.00	A borrow pit was created to to win good material when other site materials were found to be unsuitable. It was more cost-effective to backfill the borrow pit with unsuitable material. (See also V112a, 33a, 33b and 47)
111	Provision of additional stormwater pipes in Sparks Road	$	37,257.76	Extension of stormwater pipework to reduce hazard associated with deep headwall at RTA request
28a	Unsuitable material & test pits - 19/2/10 + Subsoils (May)	$	32,159.17	Pits and tests to determine extent of unsuitable ground
33	Borrow pit and ripping floor of cut	$	25,033.49	Borrow pit and ripping floor of cut
10	Deepening of stormwater pits for subsoil drainage	$	20,128.20	A number of stormwater pits were deepened to accept subsoil drains that were lowered due to site conditions
86	New grated surface inlet pit	$	18,772.23	Construction of new inlet pit to remove hazard from two additional headwalls and overland flows at Junior School entrance
112a	Borrow pit costs - Stage 2	$	18,000.00	Re-shaping embankment to dispose of excess mixed material instead of disposal off-site. (See also V112).
4	Additional geotechnical inspection and testing	$	15,223.08	Extra geotechnical investigation, lab testing and survey works were directed to accurately assess foundation conditions and ensure trench backfill was compacted to satisfactory standard especially in areas where pipeline was constructed under trafficable areas. More cost-effective for contractor to coordinate these works that were not specified in original contract.
36b	Combine stormwater & subsoil trenches (September)	$	12,274.92	Construction of combined stormwater and subsoil drainage where these services previously conflicted
46	Drainage for water ingress in southbound carriageway - Ch3030	$	8,363.69	Installation of foundation drain to intercept and divert groundwater to a drainage pit
116	Additional 600 drain Sparks Road (beside Link Road)	$	8,307.54	Stormwater drain extension to prevent scouring of embankment and existing services
36a	Combine stormwater & subsoil trenches (May)	$	7,806.71	Construction of combined stormwater and subsoil drainage where these services previously conflicted
47	Tesing of borrow pit materials	$	7,717.50	Additional quality testing of materials won from borrow pit (See also V112)
04a	Various Geotechnical inspections and testing (May)	$	6,804.87	Part of further work under Variation 04.
28	Investigations for extent of unsuitable ground	$	6,499.24	Contractor directed to undertake excavation of pits and extra testing to determine extent of unsuitable ground
102	Subgrade Changes in Sparks Rd (Incl 97,grass swale change to concrete)	$	6,470.20	Construction of concrete swale at relocated headwall
36	Combine stormwater & subsoil trenches	$	5,903.57	Construction of combined stormwater and subsoil drainage where these services previously conflicted
54	Lower Stockpiles for Junior School Internet	$	5,402.25	Lowering of stockpiles to allow better signal for school internet
9	Additional foundation testing to main embankment	$	2,802.80	Undertake further investigations and analysis into issues identified by the geotechnical engineer during site inspections. The investigation included testing of the foundation below the proposed embankment to determine the extent of the unsuitable material and assess the best treatment options for the area of works affected.
33b	Borrow pit - excavation of floor of pit (June costs)	$	1,176.00	Costs associated with borrow pit (See also V112)
33a	Borrow pit - excavation of floor of pit (May costs)	$	338.10	Costs associated with borrow pit (See also V112)
	Subtotal:	**$**	**702,541.32**	
5.0 Public Utilities				
25c	Increased Scope of V25 works and RCP costs and profit	$	79,851.47	Additional construction required to install electrical conduits under partially completed new road formation for future street lighting on the Link Rd, and to deepen those conduits that conflict with stormwater pipelines.
25	Electrical conduits - Interim Claim	$	77,000.00	Additional work required to install electrical conduits under partially completed road formation for subsequent installation of street lighting on Link Rd and Sparks Rd. Extent of required work was not detailed at tender time as Energy Australia requirements where not known and
87	Electrical trenches - additional filling	$	64,262.50	Robsons directed to undertake additional works to supply and install electrical conduits on southern side of Sparks Rd to facilitate future street lighting
94	Traffic signal price increases	$	58,810.00	Major changes requested by the RTA to the civil design of the two signalised Link Rd intersections. Costs not foreshadowed prior to calling tenders.
95	Loss due to Deleted work inc Deletion of AC 14 from pavement	$	52,085.47	Contractor is entitled to loss of profit where items are deleted from contract in Schedule of Rates ($868K deleted - loss of profit = 6%)
11	Additional works for provision of new gas main	$	48,343.03	Relocation and removal of the existing Jemena gas main within Albert Warner Drive pavement and removal of unsuitable materials
34	Pole works in Albert Warner Drive	$	43,911.35	WSC instructed RCP to engage an Approved Service Provider (ASP1) to carry out the pole relocation works.
79	Street lighting electrical conduits	$	22,657.14	Installation of electrical conduits for street lighting at Junior School intersection (southern side and along Albert Warner Drive)
25a	Electrical conduits - delay cost component for Variation 25	$	18,000.00	Cost of delays to Critical Path on program due to extra work for installation of electrical conduits
26c	Gas main works - Sparks Road - Ch480 (July) (Interim)	$	16,760.14	Additional construction works to facilitate relocation of Jemena gas main for north/south crossing of Sparks Rd
12	Dayworks for power & Telstra - LAGS junior school	$	14,672.44	WSC/PW requested that RCP engage Visionstream to view the excavation/removal of the unsuitable material

Attachment 1: Details of All Contract Variations

Construction of Northern Section of Link Road

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Vary No.	Variation		Value	Description of Variation
26	Gas main works - Sparks Road - Ch480	$	14,571.38	Additional construction works to facilitate relocation of Jemena gas main for north/south crossing of Sparks Rd
25b	Deepening to miss stormwater for V25 (Interim)	$	12,900.00	Additional excavation required for electrical conduits to avoid stormwater pipelines
2	Service locations	$	12,065.52	Additional works associated with the relocation of 2 new power poles.
113	Additional electrical conduits at Junior School (north side)	$	9,252.00	Additional work to extend electrical conduits to clear footpath and provide power to 2 light poles at Junior School
37	Temporary Works at power Pole (refer V034 Also)	$	7,800.00	Additional costs due to the presence of the existing power pole interfering with works
103	Protection of Telstra cabling and watermain north side of Sparks Rd in Stage 2 Works	$	5,600.00	Additional work associated with the potholing and protection of the existing watermain and Telstra cables.
100	Old Telstra AC cable conduit found in excavations	$	4,240.95	Costs associated with removal and disposal of old Telstra asbestos cable conduit.
81	Raise Telstra pit	$	3,550.00	Costs to relocate/raise Telstra pit to west of Link Rd near Junior School to allow filling of this area
119	Removal of Pram Ramp and AC widening/flares	$	2,400.00	RTA review of TCS design required removal of pram ramp at left turn lane from Sparks Road.
110	Alternative connection of power to traffic lights	$	2,000.00	Power to traffic light controllers was to be provided in conjunction with streetlighting, but alternative arrnagements were required due to late delivery of street lighting design.
26a	Gas main works - Sparks Road - Ch480 (May)	$	1,578.04	Additional construction works to facilitate relocation of Jemena gas main for north/south crossing of Sparks Rd
02a	Service locations (June)	$	1,327.90	Additional works associated with the relocation of 2 new power poles.
74	Tree Removal (3 Trees) at Junior School 01/07/2010	$	1,250.00	Removal of trees for relocation of gas main
90	Additional review of the alternative spray seal (AR450)	$	800.00	Additional effort to price and review the alternative spray seal (AR450) that was subsequently approved and shown on the RTA approved construction drawings
26b	Gas main works - Sparks Road - Ch480 (June)	$	498.33	Additional construction works to facilitate relocation of Jemena gas main for north/south crossing of Sparks Rd
68	Survey for gas main relocation on Sparks Road	$	300.00	Gas pipeline owner Jemena had no details of pipeline location. Robsons directed to locate new gas main to construct north side pavement of Sparks Road.
80	Electrical connection to TCS controller box	$	2,000.00	Original contract did not include connetion of electricity from Energy Australia pole to Traffic Control Signal controller box
	Subtotal:	**$**	**578,487.66**	
6.0 Environmental Management				
62	Additional materials testing	$	12,500.00	Additional testing required for VENM/ENM classification of soil stockpiles
3	Additional works associated with threatened frog species	$	3,449.36	Additional work associated with relocation of threatened frog species from existing creek near Junior School to comply with environmental provisions in ecologist report
1	Ecologist report for investigations for southern fill area	$	2,628.61	Contractor directed to engage ecologist to prepare environmental report for extension of road embankment to south of Link Road. Required to ensure compliance with environmental requirements.
92	Change to hydromulching over hydroseeding	$	2,212.50	Additional cost of hydromulching over tendered rate for hydroseeding to improve grass establishment
106	Additional erosion controls to Separable Portion 2 works	$	1,500.00	Additional erosion and sediment controls required due to changes to works under Separable Portion 2
70	Railway Crescent Inspection 29/06	$	900.00	Resident complaint regarding minor flooding instigated improvements to water and silt control in the South-East corner of RCP's site. It was later found that the source of water run off was a Council drain and not in fact the Robson site
115	Temp pipe drain under access to compound south limit of work	$	900.00	Installation of pipe under track to stockpile area to allow drainage from swales and road gutters due to change in levels after deletion of AC 14 pavement from southern extension area
117	Turf traffic signal area north side of Sparks Road -est ($4.65/m2)	$	465.00	Turf to stabilise road verge at pedestrian crossing north side of Sparks Road which was not required in tender docs but was necessary to manage erosion
50	Erosion & Sediment Report by Robson environmental consultant	$	400.00	Changes/modifications batters around the new borrow pit, entrance to LGAAS senior school and others areas) necessitated the need to review and report on the adequacy of the erosion control measures implemented on site
118	TREES report - 1/2 cost	$	250.00	50% of cost of final ecological report from Robson consultanton longer term sed and erosion management after Robson leave the site to manage run off
	Subtotal:	**$**	**25,205.47**	
7.0 Quality Management				
14	Benkelmen Beam pavement deflection testing during construction of pavement	$	6,517.80	Benkelman Beam deflection testing of road pavement was not specifically detailed and is required to comply with RTA specifications. Testing was for new works on Link Road and on existing bitumen on Albert Warner Drive
14a	Benkelmen Beam pavement deflection testing - May 2010	$	6,644.18	Benkelman Beam testing not specified and required to meet RTA requirements
14b	Benkelmen Beam pavement deflection testing - June 2010	$	14,153.60	Benkelman Beam testing not specified and required to meet RTA requirements
14c	Benkelmen Beam pavement deflection testing - July 2010	$	13,079.80	Benkelman Beam testing not specified and required to meet RTA requirements
14d	Benkelmen Beam pavement deflection testing - Sept 2010	$	6,930.00	Benkelman Beam testing not specified and required to meet RTA requirements
	Subtotal:	**$**	**47,325.38**	

Attachment 1: Details of All Contract Variations

Construction of Northern Section of Link Road
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Vary No.	Variation	Value	Description of Variation
8.0 Amended Designs for 2 Signalised Intersections			
120	Delay costs due to RTA approvals for work on Sparks Road	$ 50,000.00	Contractor costs for extension to contract period of 18 weeks until RTA approval received to start work on Sparks Rd
114	Concrete encasement of HV power conduits	$ 15,000.00	Concrete encasement of 11kV conduits uncovered during construction of Albert Warner Drive and associated footpath. 11KV was uncovered a depth much less than anticipate by available existing documentation
29	Additional tree removal in Sparks Road	$ 5,319.53	Removal of two trees to allow widening of Sparks Road in response to RTA requirements to lengthen merging lane, including additional clean up and provision of traffic control associated with tree removal
13	Additional survey work for new slip lane at Junior School	$ 1,975.00	Contractor directed to provide additional survey and set-out for addition of left turn slip-lane for traffic exiting Junior School following RTA design review
	Subtotal:	**$ 72,294.53**	
9.0 Amended Design of Pavement Treatment on Sparks Rd			
122	Additional schedule of rates work	$ 120,000.00	Additional works performed at schedule of rates
53	Pipeline 31/01 - 31/04 - 27/03 (May)	$ 18,131.27	Installation of additional stormwater pits and pipes in Sparks Road median as requested by RTA
98	Sparks Rd changes to final asphalt surface design levels	$ 9,976.89	Modification to final surface levels for new pavement treatments on Sparks Road as agreed with RTA
99	Sparks Rd levels Stage 2 works - north side	$ 3,010.80	Contractor required to undertake extra survey work on north side of Sparks Rd for redesign of tie-in design for Stage 2 works
88	Sparks Rd levels Stage 2 works - south side	$ 2,400.00	Contractor required to undertake extra survey work on north side of Sparks Rd for redesign of tie-in design for Stage 2 works
	Subtotal:	$ 153,508.16	
10.0 Safety Management			
30	Alteration to service road access to Senior School	$ 47,201.10	Additional works to address safety concerns and accommodate increased volume of traffic
109	Pool fencing at the dispersion bank	$ 33,200.00	Installation of pool fencing to make safe the dispersion pond in place of pedestrian fencing deleted from works.
83	Additional temporary fence hire	$ 29,207.50	Temporary fence hire to enclose work site to prevent unauthorised access by motor bikes and to ensure public safety
108	Footpaths to Senior School	$ 27,592.00	Installation of limited footpaths at Senior School to allow pedestrian access from Alderham Rd
52	Protective fencing around headwalls	$ 6,559.88	Fencing to prevent falls into headwall pits and not identified in tender documents
44	Additional Traffic Controller - Senior School	$ 2,932.65	Traffic control for works around roundabout undertaken under traffic while road was operational due to need to kmaintain access to school
65a	Additional Traffic Controller on Albert Warner Drive - July	$ 1,612.96	Traffic control for intersections July.
65	Additional Traffic Controller on Albert Warner Drive	$ 733.16	Traffic control for intersections.
	Subtotal:	**$ 149,039.25**	
11.0 Provision for Future Water and Sewer Services			
21	Additional road crossing conduits	$ 209,006.12	Installation of six road crossing conduits to accommodate future water mains or other services under Link Road. Opportunity to provide for future buried service road crossings providing cost savings and environmental, safety and quality benefits.
8	1050mm diameter sleeve under energy dissipator	$ 7,015.46	Installation of pipe sleeve under energy dissipator structure to facilitate future construction of new watermain. Works included additional survey, delivery cost and relocation of fence.
05a	Changes to 1050 mm diameter pipeline for future watermain	$ 3,250.00	Additional costs to lower 1050mm diameter pipeline to allow for gas main to be located between culvert and sleeve pipe for future watermain. Works include additional benching, excavation, compaction and testing of material and resurvey.
	Subtotal:	**$ 219,271.58**	
12.0 Water and Sewer Operations			
20	Relocation of 150mm watermain at Junior School	$ 19,914.93	Existing watermain conflicted with new access to Junior School - work not included in original scope of contract works.
21a	Additional stormwater pipe sleeve conduits (May)	$ 774.20	Installation of additional sleeve conduits for current watermains
21b	Additional stormwater pipe sleeve conduits	$ 50,815.00	Installation of additional sleeve conduits for current watermains to protect during construction activities and to carry load of future road
24	Watermain changes - 375mm & 600mm diameter	$ 37,105.86	Changes to concrete encasement detail to existing 375mm and 600mm dia watermains on Sparks Rd as existing sleevs did not extend the full width of the new road
49b	Watermain - Albert Warner Drive (revised plans price)	$ 850.00	Pricing of revised water main plans developed as ground conditiond were revealed
49a	Watermain - Albert Warner Drive	$ 1,500.00	Pricing of water main from WSC plans.
49c	Watermain - Albert Warner Drive (construction)	$ 12,817.63	Construction of section under 11kV EA conduits
64	Services Investigation re 375 & 200 mm water main Abert Warner	$ 18,000.00	Additional services investigation to facilitate the design of the 375/200 ND watermain
91	Extension to subsoil drain on Link Road	$ 7,174.00	Extension to subsoil drain on eastern side of Link Rd to collect water from nearby farm dam adversely affecting subgrade
124	AC watermain replacement and diversion	$ 330,000.00	Replacment of existing 150 mm asbestos main and diversion of existing 375 water main

Attachment 1: Details of All Contract Variations

Construction of Northern Section of Link Road

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Vary No.	Variation	Value	Description of Variation
	Subtotal:	**$ 478,951.62**	
13.0 Replacement of Hunter Connection Water Trunk Main			
38	Watermain repairs - April	$93,285.66	Repair/replacement of leaking Hunter Link pipeline.
38a	Watermain repairs - May	$ 177,563.24	Repair/replacement of leaking Hunter Link pipeline.
120a	Delay costs	$ 100,000.00	Work to reoplace 80m of the Hunter Connection Water trunk main prevented Robson from progressing the original road work under the contract by a significant period of time
38b	Watermain repairs - June	$ 64,689.49	Repair/replacement of leaking Hunter Link pipeline.
38c	Watermain repairs - July	$ 2,769.43	Repair/replacement of leaking Hunter Link pipeline.
	Subtotal:	**$438,307.82**	
14.0 Hunter Connection - Consequential Wet Ground			
123	Additional SOR work	$ 300,000.00	Additional earthworks due to unsuitable (wet) ground
120a	Delay costs	$ 100,000.00	Robson was prevented from carrying out work on the critical path whilst unsuitable wet ground was removed and replaced
17	Foundation drain to Sparks Road	$ 17,837.07	Construction of foundation drain to convey water away from the road foundation that was not included in tender douments as ground conditionsd were not anticipated to be as wet
32	Sparks Road unsuitable Ch680-780 + Geotech	$ 14,273.70	Geotech to inspect, test and determine extent of unsuitable material and extent of removal needed
	Subtotal:	**$ 432,110.77**	
124	Reduced quantity of schedule of rates work	-$ 845,472.33	Reduced costs due to actual quantities for various schedule of rate contract items not reaching the quantity nominated in the contract
	TOTAL:	**$ 2,880,754.00**	