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Vipac Engineers & Scientists

Planit Consulting Pty Ltd

Catherine Hill Bay

Waste Water Treatment Plant (WWTP)

Odour Assessment

29N-13-0053-TRP-515935-0

31 March 2014

Report Title: Odour Assessment **Job Title: Catherine Hill Bay**	
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KEYWORDS:

EXECUTIVE SUMMARY

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Planit Consulting Pty Ltd on behalf of Solo Water Pty Ltd to conduct an Odour Impact Assessment of a proposed Wastewater Treatment Plant (WWTP) at Montefiore Road, Catherine Hill Bay, NSW.

To predict the odour concentration, local meteorology at the site was generated using TAPM for five consecutive years (2002-2006). The CALPUFF dispersion model has been used to simulate the impacts from the WWTP. Odour emissions from all sources were derived using typical (i.e. average) emission rates provided by Frechen (2002). These emission rates assume normal operating conditions and do not include any mitigation measures.

A peak to mean correction factor was applied in accordance with the method described in the *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in New South Wales, August 2005.* The policy states that odour should be modelled with a one-second averaging period equivalent to "nose response time". To derive this one-second average period, the method prescribes that a one-hour averaging period should be used, and a peak to mean correction applied. The correction factor for area sources is 2.3, and this has been used for the sources modelled in this study. The assessment criterion for this assessment is 2 OU/m3 at a 99th percentile. To be conservative and to account for any uncertainty in the emission rates the 99th percentile concentrations have been modelled.

The one-second contour concentrations for the MBR and evaporation Pond 1 show that the 99.9th percentile concentration is below 2 OU/m^3 with the highest concentration at a sensitive receptor predicted to be 0.9 OU/m^3 at the boundary of the lot to the north east of Pond 1. For the MBR and evaporation Pond 2 the 99.9th percentile concentration at a sensitive receptor is predicted to be 1.2 OU/m^3 at the boundary of the lot to the south east of Pond 2.

The results show that the criterion of 2 OU/m^3 will not be exceeded at any location and the highest concentration at the boundary of the proposed residential properties is significantly below the criterion, therefore odour nuisance from the WWTP is not expected. It should be noted that no mitigation measures were modelled as they are not required.

TABLE OF CONTENTS

1 INTRODUCTION

Vipac Engineers and Scientists Ltd (Vipac) was commissioned by Planit Consulting Pty Ltd on behalf of Solo Water Pty Ltd to conduct an Odour Impact Assessment of a proposed Wastewater Treatment Plant (WWTP) at Montefiore Road, Catherine Hill Bay, NSW.

The purpose of this report is to assess the odour impacts from the wastewater treatment plant. The odour assessment criteria used in this case has been taken from the NSW-EPA *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in New South Wales, August 2005.*

Wastewater Treatment plants emit odour as a result of a range of different treatment steps and each process will generate odour at different rates and with different characteristics. The overall amount of odour emitted from the plant will therefore depend on the sum of the individual processes conducted therein. Whether or not odour impacts will occur at a particular location will depend upon the combination of a number of factors, including emission rate, source type, meteorology, distance from source and topography.

2 REFERENCES

Frechen, 2002, *Odour Abatement Strategies at Wastewater and Waste Facilities in Germany*, Clean Air and Environmental Quality, Volume 36, No. 3, August 2002, pp 34-37.

NSW-EPA, Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in New South Wales – August 2005.

NSW-EPA, Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW. November 2006.

3 SITE LOCATION & PROJECT DESCRIPTION

The proposed Catherine Hill Bay Wastewater Treatment Plant (WWTP) will be located at Montefiore Street near Catherine Hill Bay approximately 30 km south of Newcastle. The location of the WWTP site is shown in ***Figure 3-1***.

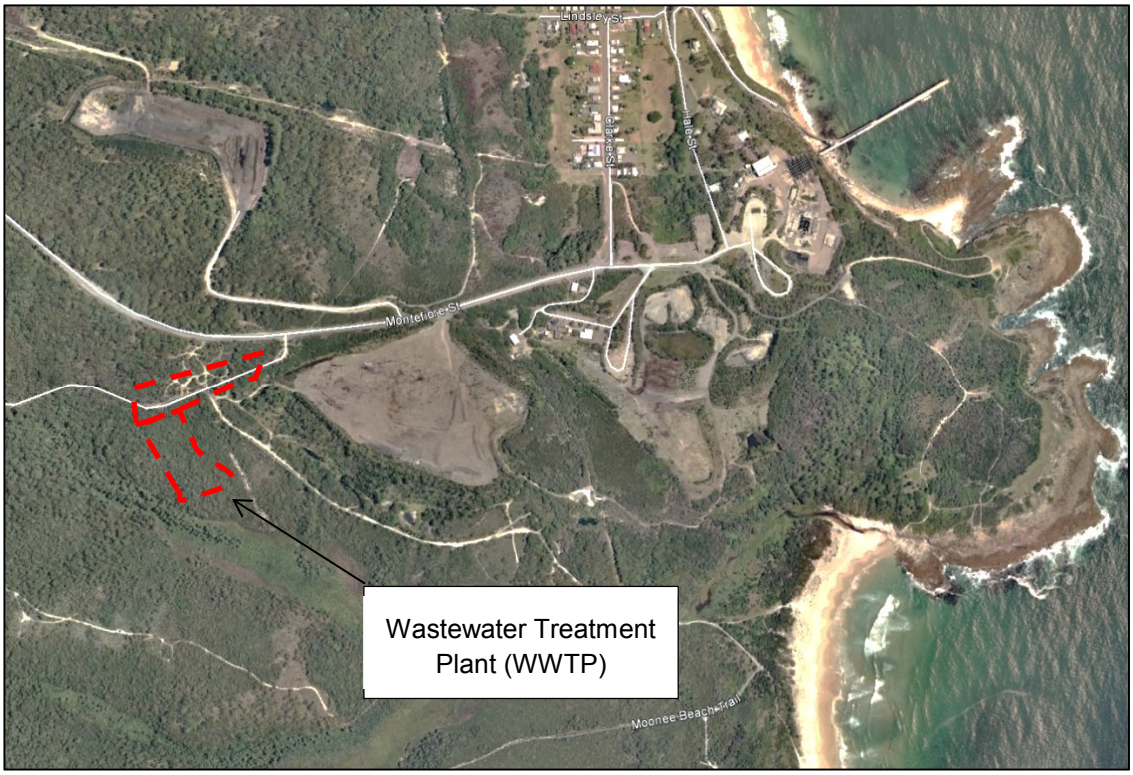


Figure 3-1: Site Location [Google Earth]
31 March 2014

The site of the proposal is identified as 95 Flower Drive & Clarke Road, Catherine Hill Bay. The site provides a total area of 72 hectare and is located within the Lake Macquarie Council local government area (LGA).

The site is bordered by the Munmorah State Conservation Area to the south and west and by the Munmorah State Conservation Area and Pacific Ocean to the east. The site is adjoined to the north by the village of Catherine Hill Bay.

The works are proposed in order to service a subdivision approved by the NSW Planning Assessment Commission under Project Approval MP10_0204 dated 13th May 2011 which includes 550 residential lots, 1 retail lot, 9 reserves and 2 heritage lots. This existing approval is to be modified to consolidate a number of existing approved residential allotments to provide a dedicated lot for the STP. The STP would be located within this dedicated lot. The location of the STP in relation to the approved subdivision is identified in ***Figure 3-2***.

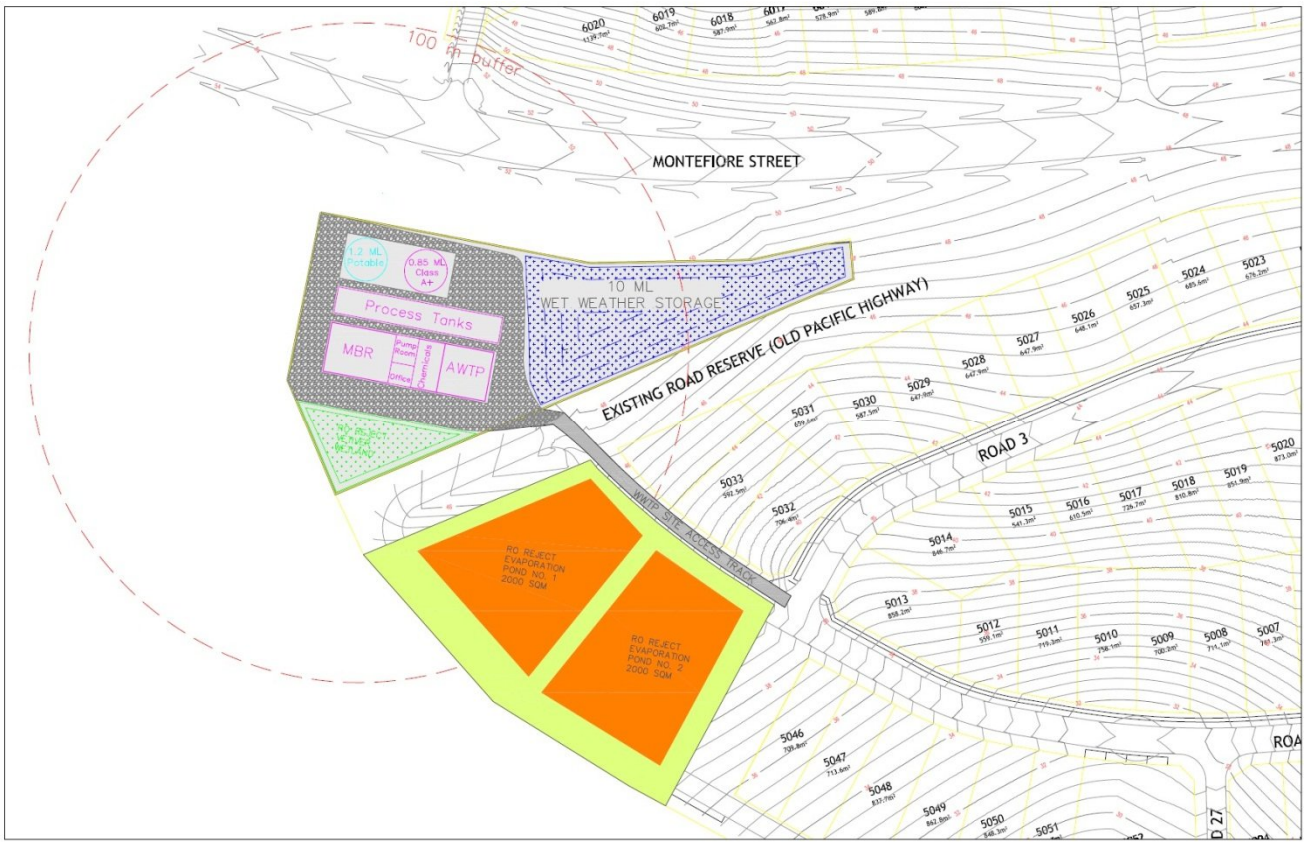


Figure 3-2: Elements of the Proposed Plant [Solo Water]

Stage 1 of STP operation would include a temporary restricted access area of 10.75 ha to be irrigated with MBR and UV treated waste water; while Stage 2 of the proposal will see 8.38 ha of open space areas irrigated with class A+ recycled water.

4 ODOUR DESIGN CRITERIA

The sense of smell is a subjective human response to the presence of a chemical compound or "odour" in air. The sensitivity to a particular odour can vary from one individual to another by up to two orders of magnitude. Differences in sensitivity to an odour are due to a variety of factors, including age, health, prior exposure to the odour and natural variation within the population.

The factors that are commonly recognised as influencing whether an odour will result in a complaint or not depend on a number of factors referred to as the FIDOL factors.

- Frequency - how often the odour is detected,
- Intensity - how strong the odour is,
- Duration - how long the odour persists for,
- Offensiveness - how the odour smells, and
- Location – where the odour occurs.

Dynamic olfactometry involves taking samples of air that contain an odourant and presenting the odour to a panel. The odour is diluted with "clean" air until 50% of the panel can detect the presence of the odour. This concentration is the threshold concentration and is deemed to be 1 odour unit (OU). The number of dilutions required to achieve this level determines the odour concentration of the original sample.

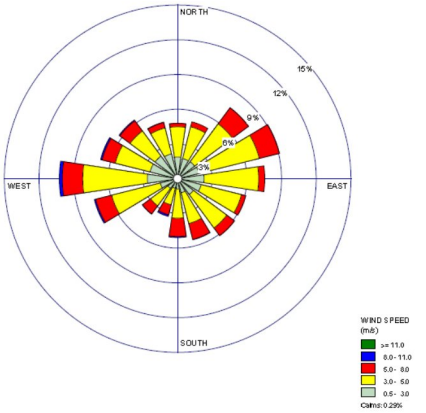
This science in conjunction with dispersion modelling has been shown to the best available method of predicting odour nuisance on a community over long periods. It is the accepted approach in most developed countries.

The current New South Wales (NSW) odour policy presented in the *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in New South Wales, August 2005* is now a regulatory document. In this document a method is provided for determining an odour impact criterion based upon the number of people likely to be impacted by an operation, ranging from 2 OU/m^3 to 7 OU/m^3.

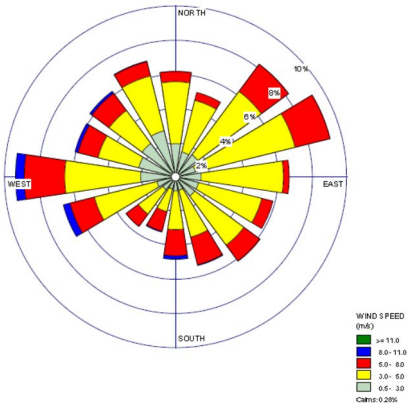
As per the *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in New South Wales, August 2005* the nose response time average (i.e. on a one-second average) which is the 99th percentile of 2 OU/m^3 for a community with a population of 2000 or more people. This one-second average criterion has been used in this assessment.

5 METEOROLOGY

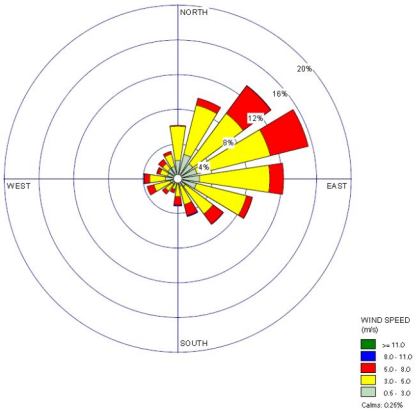
The local meteorology at the site will affect odour dispersion. Wind roses are a means of presenting a summary of wind speed and directional data for a particular time and location. Wind roses were generated for 2002-2006 using met data generated by The Air Pollution Model (TAPM). Seasonal wind roses are presented in ***Figure 5-1*** and ***Appendix A***. The annual wind rose clearly shows that wind blows predominately from the west and north east.



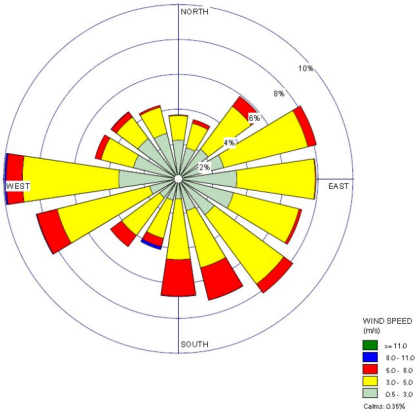
Annual (Calm 0.29%)



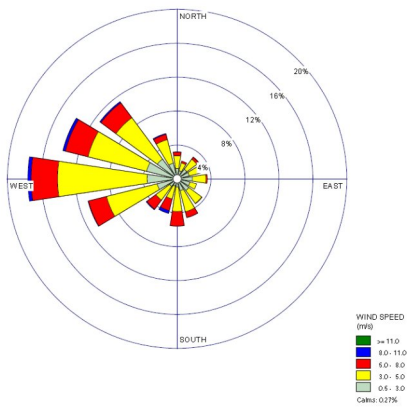
Spring (Calm 0.28%)



Summer (Calm 0.25%)



Autumn (Calm 0.35%)



Winter (Calm 0.27%)

Figure 5-1: Seasonal Wind Roses for Catherine Hill Bay WWTP [2002-2006]

6 MODELLING METHODOLOGY

6.1 Model

A 3-dimensional dispersion wind field model, CALPUFF, has been used to simulate the impacts from the WWTP. CALPUFF is an advanced non-steady-state meteorological and air quality modelling system developed and distributed by Earth Tech, Inc. The model has been adopted by the U.S. Environmental Protection Agency (U.S. EPA) in its 'Guideline on Air Quality Models' as the preferred model for assessing near-field applications involving complex meteorological conditions such as calm conditions.

6.2 Emission Rates

Many studies of various area, volume and stack sources have already been performed using dynamic olfactometry to determine odour emission rates, including wastewater treatment plants. Emission rates used in this assessment are based on information presented by Frechen (2002) for typical sewage and wastewater treatment plant processes. This publication presents odour emission rates emitted from various processes involved in wastewater treatment. The treatment processes considered to be the most representative of the activities at the Catherine Hill Bay WWTP have been used in this study.

The odour emissions estimation methodology for the Catherine Hill Bay WWTP is discussed below. Odour emissions from all sources were derived using typical (i.e. average) emission rates provided by Frechen (2002). Note that these emission rates apply to the WWTP under normal operating conditions. It should be noted that no mitigation measures were modelled as they are not required.

There is one Membrane Bio-Reactor (MBR) room containing one influent tank, one anaerobic tank, one anoxic tank, and one aeration tank. The emissions are expelled from the room through two 0.2 m diameter vents at 5 m above ground. The emissions data is summarised in ***Table 6-1***.

Table 6-1: MBR Emissions

Process Unit	Emission Factor (OU/m^2/s) [a]	Surface Area (m^2)	Emission Rate (OU/s)
Influent	0.39	4.91	1.91
Anaerobic	0.42	3.15	1.31
Anoxic	0.20	4.91	1.00
Aeration	0.03	15.92	0.54
		Total (per vent)	2.38

a Source: Clean Air and Environmental Quality Journal, Volume: 36, Number: 3, August 2002- "*Odour Abatement Strategies at Wastewater and Waste Facilities in Germany*".

There will be two reverse osmosis (RO) evaporation ponds, although only one will be active at a time. The emission factors for the RO ponds are summarised in ***Table 6-2***.

Table 6-2: RO Pond Emissions

Process Unit	Emission Factor (OU/m^2/s)[a]	Surface Area (m^2)	Emission Rate (OU/s)
RO Evaporation Pond 1	0.033	2000	68.95
RO Evaporation Pond 2	0.033	2000	69.82

a Source: Clean Air and Environmental Quality Journal, Volume: 36, Number: 3, August 2002- "*Odour Abatement Strategies at Wastewater and Waste Facilities in Germany*".

A peak to mean correction factor was applied in accordance with the method described in the *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in New South Wales, August 2005.* The policy states that odour should be modelled with a one-second averaging period equivalent to "nose response time". To derive this one-second average period, the method prescribes that a one-hour averaging period should be used, and a peak to mean correction applied. The correction factor for area sources is 2.3, and this has been used for the sources modelled in this study.

7 RESULTS

The criterion used for the assessment of odour is the NSW-EPA *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in New South Wales, August 2005.* The one-second averaged odour criterion from the NSW-EPA policy is 2 OU/m^3 at a 99th percentile which is considered to be the 'buffer zone'. To be conservative and to account for any uncertainty in the emission rates the modelling has been conducted at the 99.9th concentration.

7.1 Evaporation Pond 1

The one-second contour plots for the MBR and evaporation Pond 1 are shown in **Figure *7-1***. It can be seen from **Figure *7-1*** that the 99.9th percentile concentration is below 2 OU/m^3. This highest concentration at a sensitive receptor is predicted to be 0.9 OU/m^3, at the boundary of the lot to the north east of Pond 1.

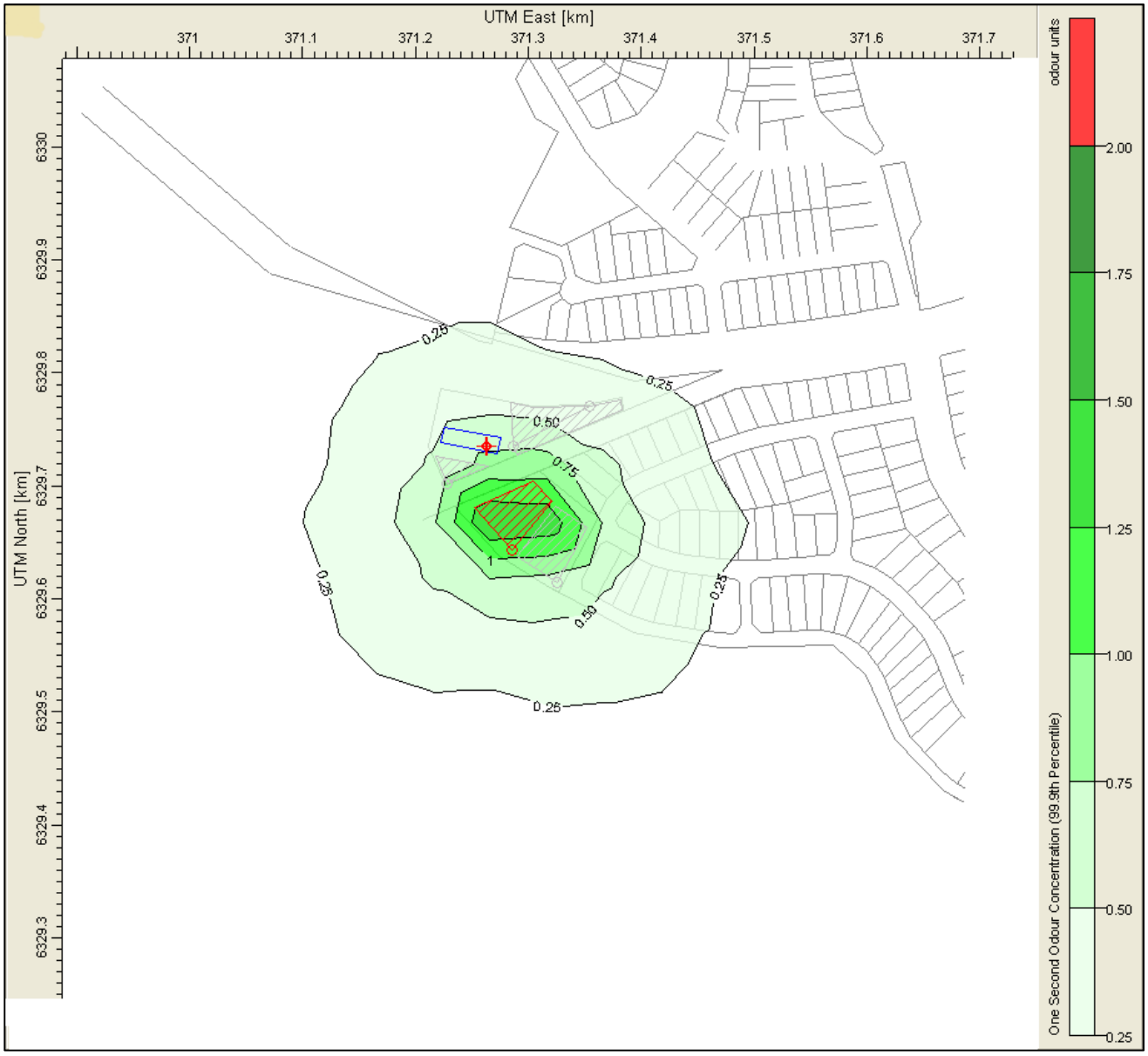


Figure 7-1: 99.9th Percentile One-Second Odour Concentrations from MBR and Pond 1 (OU/m^3)

7.2 Evaporation Pond 2

The one-second contour plots for evaporation Pond 2 are shown in ***Figure 7-2***. It can be seen from ***Figure 7-2*** that the 99.9th percentile concentration is below 2 OU/m^3. This highest concentration at a sensitive receptor is predicted to be 1.2 OU/m^3, at the boundary of the lot to the south east of Pond 2.

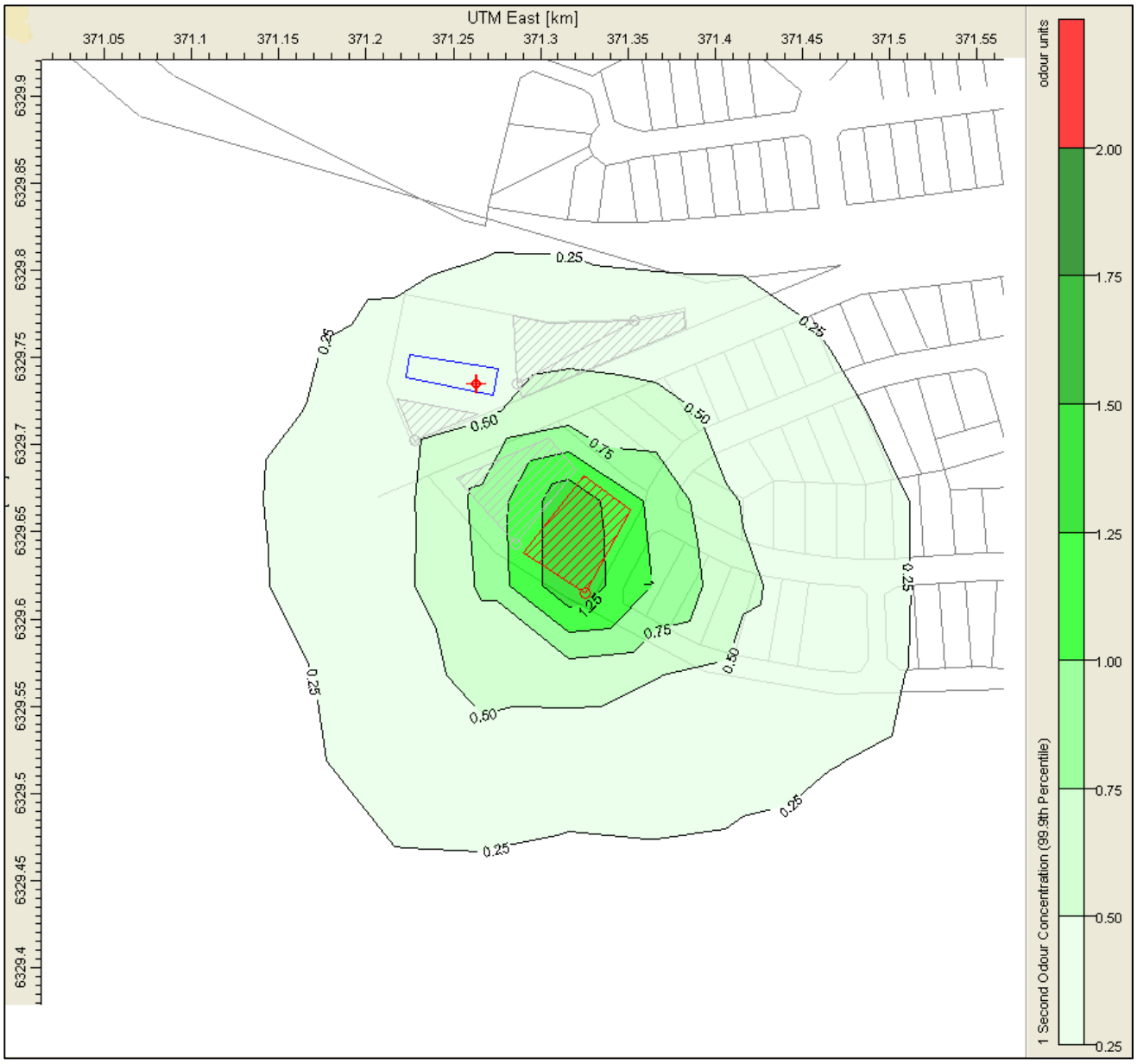


Figure 7-2: 99.9th Percentile One-Second Odour Concentrations from MBR and Pond 2 (OU/m^3)

The contours of the 99.9th percentile one-second concentration show that the criterion of 2 OU/m^3 will not be exceeded at any location and the highest concentration at the boundary of the proposed residential properties will comply with the criteria, therefore odour nuisance from the WWTP is not expected. It should be noted that no mitigation measures were modelled as they are not required.

8 CONCLUSION

Vipac Engineers and Scientists Ltd (Vipac) were commissioned to conduct an Odour Impact Assessment of the Wastewater Treatment Plant (WWTP) on Montefiore Street near Catherine Bay Hill, NSW.

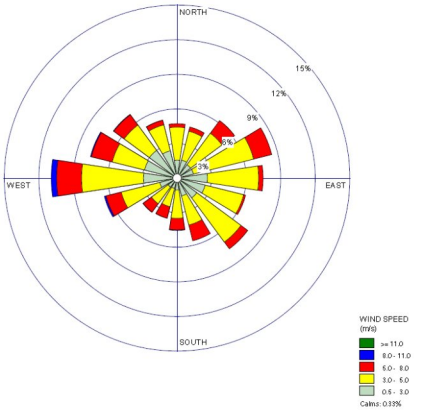
To predict the odour concentration, local meteorology at the site was generated using TAPM for five consecutive years (2002-2006). The CALPUFF dispersion model has been used to simulate the impacts from the WWTP. Odour emissions from all sources were derived using typical (i.e. average) emission rates provided by Frechen (2002). These emission rates assume normal operating conditions and do not include any mitigation measures.

A peak to mean correction factor was applied in accordance with the method described in the *Approved Methods and Guidance – For the Modelling and Assessment of Air Pollutants in New South Wales, August 2005.* The policy states that odour should be modelled with a one-second averaging period equivalent to "nose response time". To derive this one-second average period, the method prescribes that a one-hour averaging period should be used, and a peak to mean correction applied. The correction factor for area sources is 2.3, and this has been used for the sources modelled in this study.

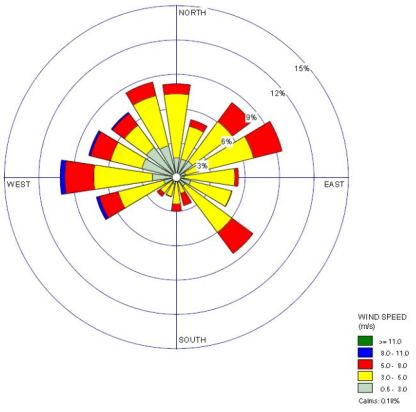
The one-second contour concentrations for the MBR and evaporation Pond 1 show that the 99.9th percentile concentration is below 2 OU/m^3 with the highest concentration at a sensitive receptor predicted to be 0.9 OU/m^3, at the boundary of the lot to the north east of Pond 1. For the MBR and evaporation Pond 2 the 99.9th percentile concentration at a sensitive receptor is predicted to be 1.2 OU/m^3, at the boundary of the lot to the south east of Pond 2.

The results show that the criterion of 2 OU/m^3 will not be exceeded at any location and the highest concentration at the boundary of the proposed residential properties is significantly below the criterion, therefore odour nuisance from the WWTP is not expected. It should be noted that no mitigation measures were modelled as they are not required.

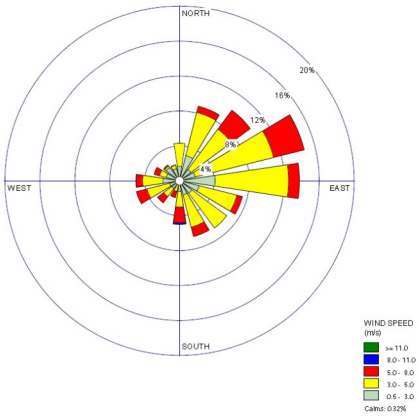
Appendix A: WIND ROSES 2002-2006



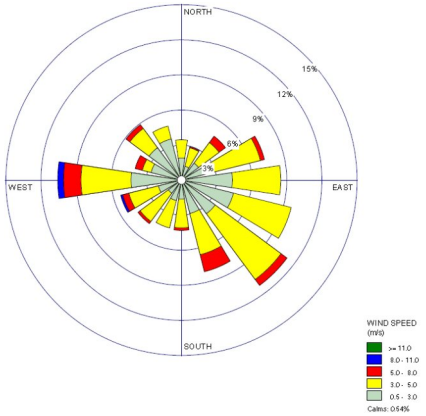
Annual (Calm 0.33%)



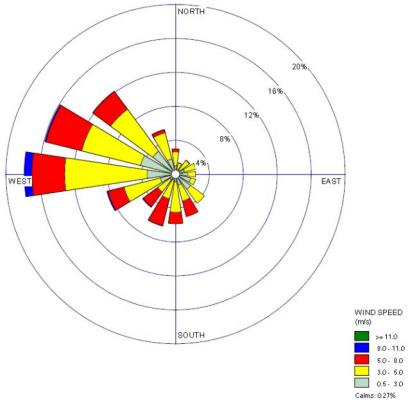
Spring (Calm 0.18%)



Summer (Calm 0.32%)

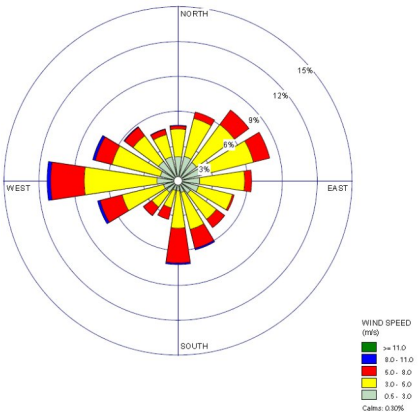


Autumn (Calm 0.54%)



Winter (Calm 0.27%)

Figure 8-1: Wind Roses for 2002



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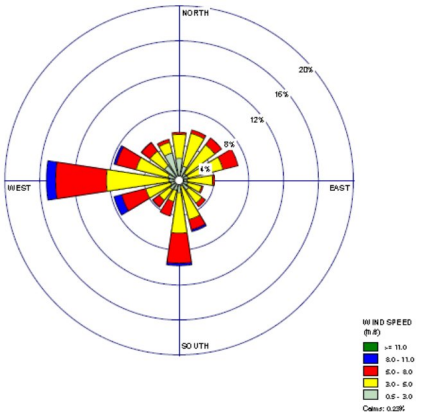
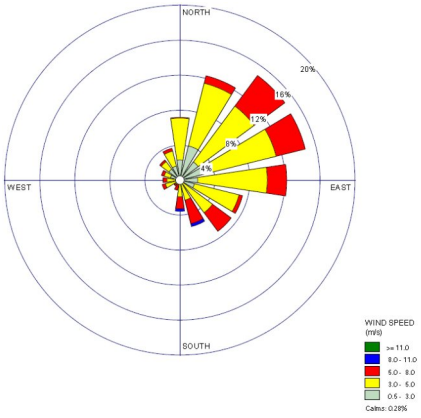
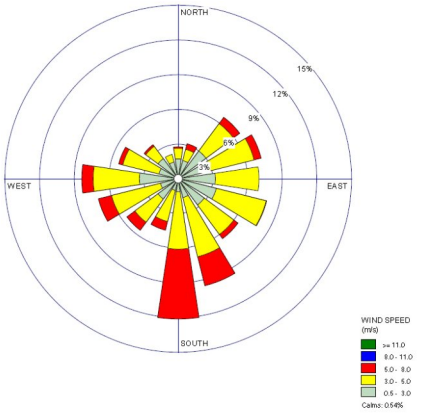


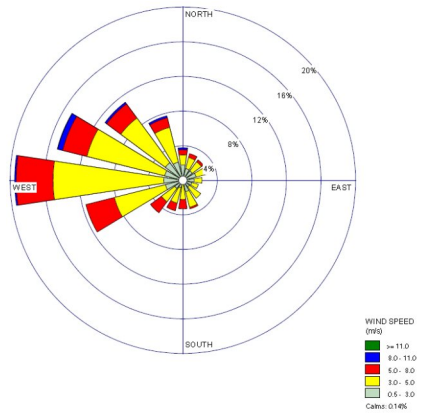
Spring (Calm 0.23%)



Summer (Calm 0.28%)

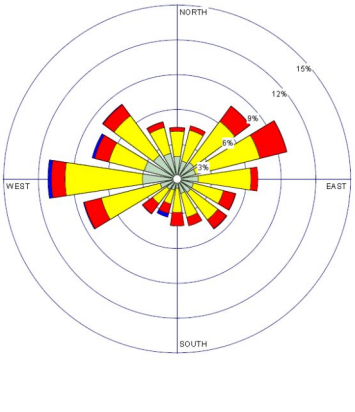


Autumn (Calm 0.36%)

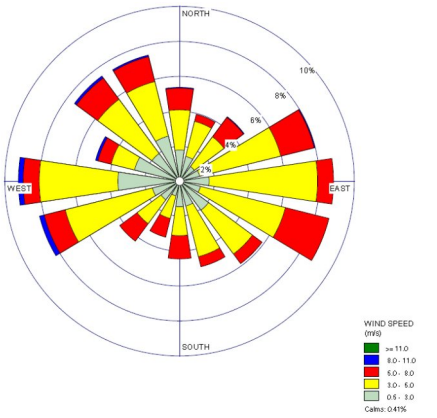


Winter (Calm 0.14%)

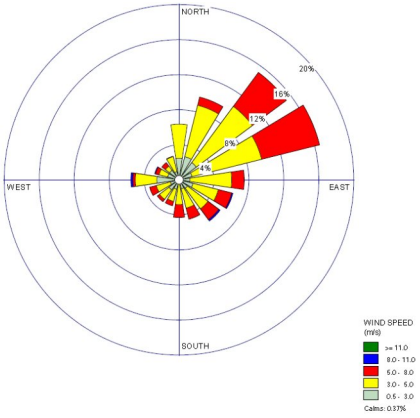
Figure 8-2: Wind Roses for 2003



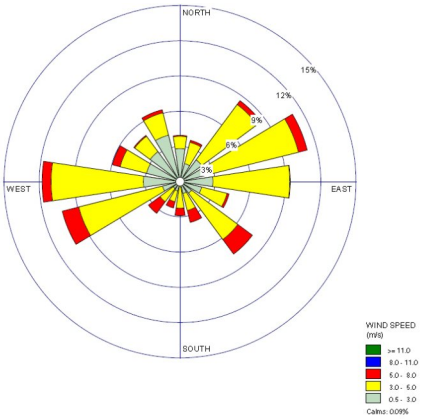
Annual (Calm 0.25%)



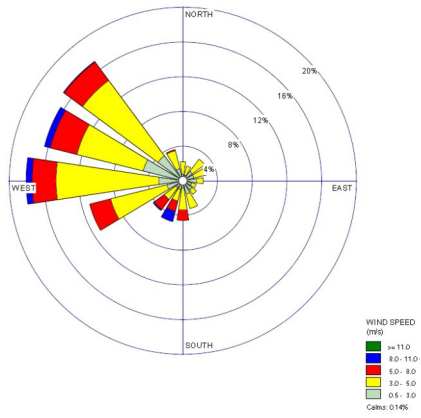
Spring (Calm 0.69%)



Summer (Calm 0.37%)

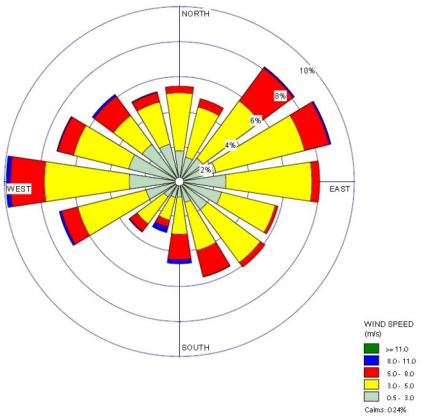


Autumn (Calm 0.09%)



Winter (Calm 0.18%)

Figure 8-3: Wind Roses for 2004



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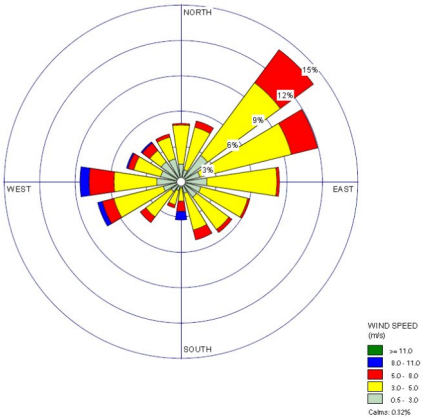
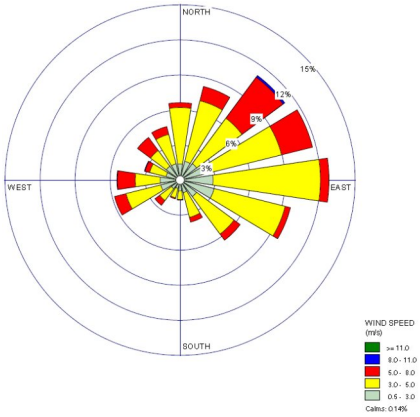


Spring (Calm 0.32%)



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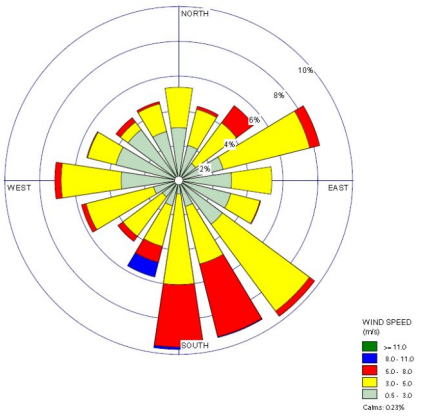
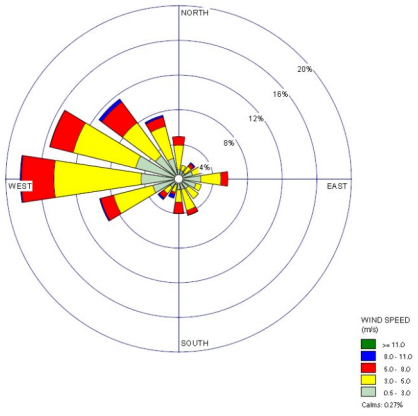
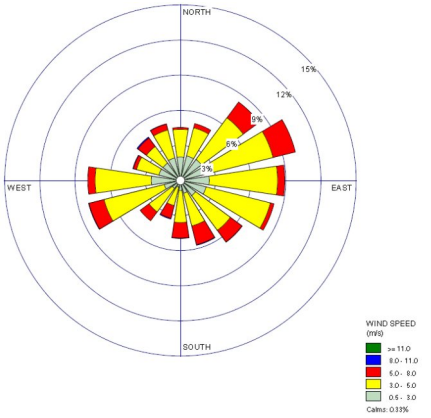


Autumn (Calm 0.23%)

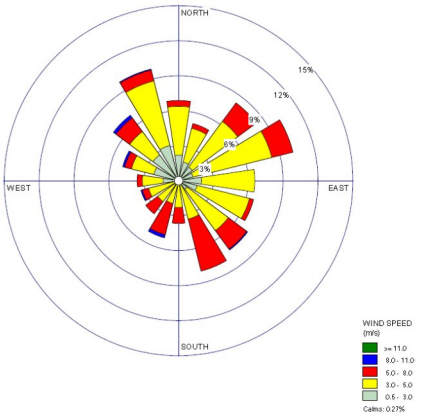


Winter (Calm 0.27%)

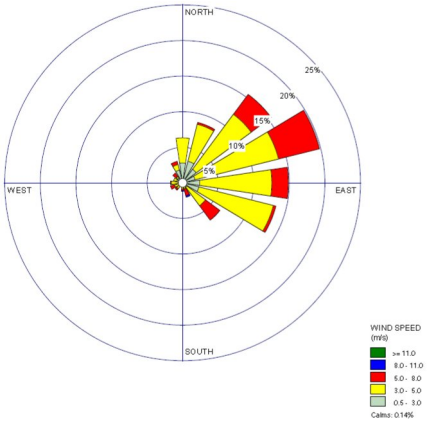
Figure 8-4: Wind Roses for 2005



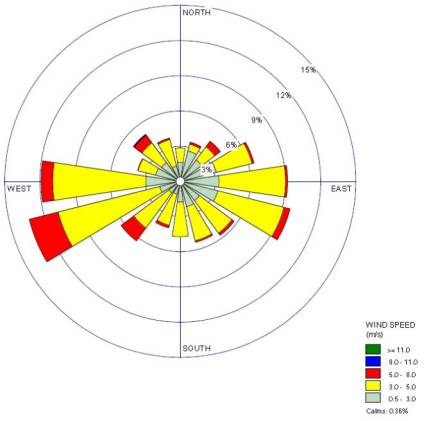
Annual (Calm 0.33%)



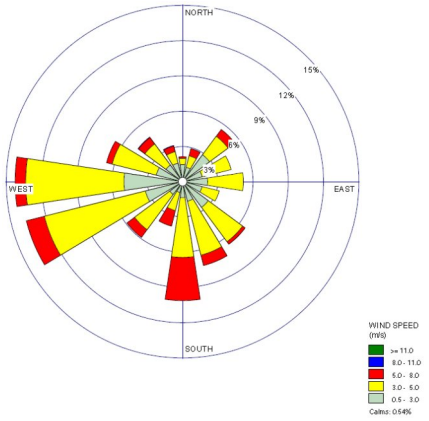
Spring (Calm 0.27%)



Summer (Calm 0.14%)



Autumn (Calm 0.36%)



Winter (Calm 0.54%)

Figure 8-5: Wind Roses for 2006