



04 January 2012

Mr Glenn Druery
Senior Environmental Officer
Department of Environment & Resource Management
25 Yeppoon Road
Rockhampton, QLD 4701

Dear Mr Druery

Re: Complaints regarding ash storage dust and accelerated rusting of property

We refer to your correspondence dated 25 November 2011 in which the Department posed a number of questions and requested specific information in order to address two complaints pertaining to the Stanwell Power Station (SPS) ash storage area and stack emissions. Please find answers to these questions outlined below, as well as an overview of relevant studies. Specific reports as referenced in this letter and those requested by the Department are also attached.

Executive Summary

- **Drinking water** – Independent test results for drinking water samples showed that all metals tested are within the safe limits set by the Australian Drinking Water Guidelines. In particular, Mercury results are 10 times below the level set out in the Guidelines.
- **Dust** – Wind conditions on the day of the dust complaint, clearly demonstrate that this dust event did not pose a nuisance to any neighbouring properties.
- **Air** – Ambient air sampling shows that metal and particulate concentrations are significantly lower than the Queensland Air Quality Objectives and the National Environmental Protection Measure.
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The test Subject stated that a chemical analysis was performed as follows: the test Subject's hair samples were analyzed.

- Test Subject's hair samples were analyzed by Central Forensic Laboratory showing the absence of any drugs in the sample of the test Subject's hair. In addition, the test Subject's hair samples were analyzed by the test Subject's hair samples.

Accordingly, the test Subject's hair samples and the test Subject's hair samples were analyzed by the test Subject's hair samples and the test Subject's hair samples.

1. Response to information requests and questions on the ash storage area

1.1 Tests and associated results from drinking water tests

The test Subject's hair samples were analyzed by Central Forensic Laboratory showing the absence of any drugs in the sample of the test Subject's hair. In addition, the test Subject's hair samples were analyzed by the test Subject's hair samples and the test Subject's hair samples.

The test Subject's hair samples were analyzed by Central Forensic Laboratory showing the absence of any drugs in the sample of the test Subject's hair. In addition, the test Subject's hair samples were analyzed by the test Subject's hair samples and the test Subject's hair samples.

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Over the course of the test Subject's hair samples and the test Subject's hair samples were analyzed by the test Subject's hair samples and the test Subject's hair samples.

to this assertion and concern, therefore there is no need to conduct further water testing of this nature at this time.

1.2 Hi-Volume (Hi-Vol) ambient air monitoring

For completeness, a short-term ambient air monitoring study was also commissioned to supplement existing data from our ongoing monitoring programs. This monitoring included setting up a Total Suspended Particulates (TSP) Hi-Vol sampler at three separate locations over twelve days (12 – 29 October 2011). The filters and samples were all sent to ALSTOM, who prepared a report (**Annexure 2**) in which it was highlighted that:

- TSP concentrations measured during the sampling periods and the following metal concentrations – arsenic, cadmium, lead, manganese, nickel and vanadium – were significantly lower than the Queensland Air Quality Objectives
- the highest measured lead concentration of 0.0080 ug/m³ was significantly lower than the National Environmental Protection Measure (NEPM) maximum concentration of 0.50ug/m³.

1.3 Weather data

Stanwell owns and operates an automatic weather station located approximately two kilometres west-south-west (WSW) of SPS (23°31'8.29"S 150°18'7.90"E, elevation 60 metres). ALSTOM are contracted to download the data and prepare a monthly report tabulating all monitored weather parameters. The October 2011 Ambient Climatic Monitoring Report is attached (**Annexure 3**).

1.4 Previous dust complaints

A summary of complaints relating to dust as obtained from a review of SPS records for the past ten years is provided in Table 1 below.

Table 1: Summary of dust complaints

Date & Ref	Complainant	Nature of complaint	Comments
29 March 2019 INC28000	sch4p4(6) Personal information	Construction extension work being carried out on the east side of area 2 February 2019 to September 2019.	The construction company dug out an additional water track.
29 March 2019 INC28000		Complaint from the north-east of the area.	The complainant advised that there were significant dust emissions from the construction site. The complainant also advised that the dust was visible from the road.
29 March 2019 INC28000		Complaint from the north-east of the area.	The complainant advised that there were significant dust emissions from the construction site. The complainant also advised that the dust was visible from the road.

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1. A starwells view of the road and the associated complaint. The dust was visible from the road and the complainant advised that the dust was visible from the road. The dust was visible from the road and the complainant advised that the dust was visible from the road. The dust was visible from the road and the complainant advised that the dust was visible from the road.

Results from the dust monitoring station show that the average dust level for 8 days (24 hours) was 12 micrograms per cubic metre with the maximum wind speed 1000-1500 metres per hour (10-30 metres per hour). The dust level was 1000-1500 metres per hour (10-30 metres per hour). The dust level was 1000-1500 metres per hour (10-30 metres per hour).

Table 2: Hourly wind direction as recorded over 24-hours on 8 October 2011

Date & Time	WS30	WD30	WS10	WD10
	m/s	deg	m/s	deg
08/10/2011 01:00	2.9	108	2.6	42
08/10/2011 02:00	3.1	99	3	33
08/10/2011 03:00	2.7	89	3	25
08/10/2011 04:00	2.8	126	2.5	43
08/10/2011 05:00	2.7	140	2.2	53
08/10/2011 06:00	1.9	145	1.5	52
08/10/2011 07:00	1.6	145	1.3	56
08/10/2011 08:00	1.6	255	2.2	267
08/10/2011 09:00	2.4	223	3.8	292
08/10/2011 10:00	3	215	3.3	325
08/10/2011 11:00	4.1	196	3.5	280
08/10/2011 12:00	5.1	187	4	266
08/10/2011 13:00	6.1	226	5	266
08/10/2011 14:00	7.5	228	5.4	261
08/10/2011 15:00	6.7	229	5.2	261
08/10/2011 16:00	4.8	218	3.9	253
08/10/2011 17:00	2.6	88	4	187
08/10/2011 18:00	3	168	3.3	156
08/10/2011 19:00	4.8	269	3.7	93
08/10/2011 20:00	3.2	268	2.3	82
08/10/2011 21:00	1.9	236	1.4	71
08/10/2011 22:00	2.3	235	1.4	99
08/10/2011 23:00	0.3	168	0.6	224
08/10/2011 24:00	0.6	174	0.5	161
Minimum	0.3	88	0.5	25
MinDate	23:00	17:00	24:00	03:00
Maximum	7.5	269	5.4	325
MaxDate	14:00	19:00	14:00	10:00
Avg	3.2	185	2.9	160
Num	24	24	24	24
Data[%]	100	100	100	100
STD	1.8	56	1.3	101

Stanwell acknowledges the concern that some neighbours and community members may have around the potential dust risks from this area; however, Stanwell is of the view that the dust created on 8 October 2011 posed no risk or nuisance to any neighbouring properties. As demonstrated by the photos held by DERM, the dust pictured was highly localised to the northern side of the ash storage area and, given the wind conditions on the day (Table 2), was not blowing in the direction of the complainant's property.

Accordingly, there appears to be no credible evidence of ash escaping the SPS site, being deposited on the complainant's property or posing a risk/nuisance to any other neighbouring properties.

1.6 Dust management and associated practices

As outlined in the Department's letter, the fly ash that is pumped as a wet slurry into the constructed ash storage cells does not have the potential to generate dust. In addition, whilst the disturbance of this dry material as part of the processes used to create the next layer of ash containment cells does have the potential to generate dust, there is currently no evidence to suggest there is a risk or nuisance to any neighbouring properties

Nevertheless, as requested by the Department, Stanwell have assessed current ash storage area operational practices and identified potential methods that may reduce the likelihood of this ash becoming airborne, these include:

- restricting access/travel on the western road of the ash storage area.
- installing a windsock in suitable location to provide a quick and visible indication of wind direction to power station personnel and contractors
- reviewing the contract with the existing earthworks contractor to ensure this provides enough guidance to the contractor and that the contractor has enough resources to deliver upon Stanwell's expectations
- developing a procedure that clearly outlines the outcomes to be achieved and how ash storage area activities need to be managed to ensure these outcomes are achieved. This will include ash cell construction, capping and slurry coating
- obtaining a quote to carry out relevant minor earthworks on the western end of the ash storage area to seal/cover any exposed soil areas
- arranging the hire of a bobcat (or other suitable piece of plant) to assist with ash storage area activities, particularly the regular moving of the poly slurry pipe/s. This process will enable the ash being deposited to set quicker, thereby enabling the timely formation of a solid crust
- setting up short-term dust monitoring deposition gauges. Four dust deposition gauges were set-up to the south, south-south-west and south-west of the ash storage area on Wednesday 21 December 2011. Sample bottles will be submitted to ALSTOM on a monthly basis to conduct a full NATA suite analysis for total, soluble, insoluble, ash and combustible particulate matter
- determining the feasibility of installing a permanent, long-term dust monitoring station that will be suitable for ambient air monitoring.

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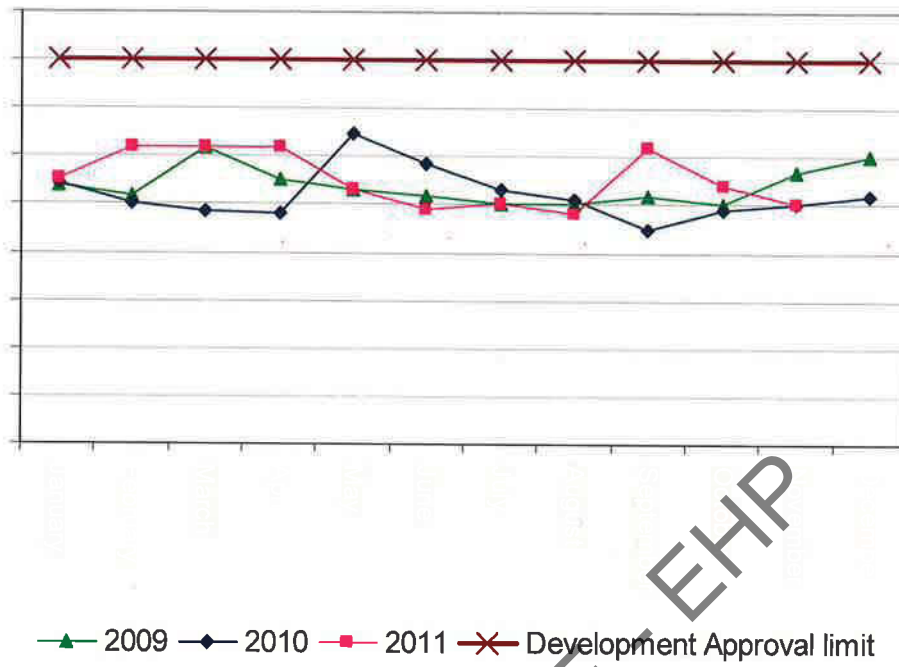
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Table 6: Test sites and their location with respect to power station stack

	Site	Compass Location	Approx Distance
1	Barnes	25 degrees to stack	2.5 kilometres
2	Brooks	90	3
3	Kalapa	75	5.5
4	Sowdens	85	8
5	Mercy	228	3.5
6	Stanwell Township	200	2
7	Ridgelands*	165	27.5
8	Brown's Lookout*	5	8

* control sites

In 1998, a resident of Kalapa North asked a question at a community meeting regarding the link between station emissions and problems he had experienced with his five-year-old zincalume roof (rapid dulling, white deposits, high zinc levels in tank water, foul tasting tank water). Investigation of his concern involved collecting tank water samples from his house and shed tanks, and scanning electron microscopy of a section of the zincalume and the deposits found on the roof. Whilst the tests did not establish a link with station emissions, no explanation as to what caused the rapid dulling of the zincalume could be determined.

A laboratory technician at Central Queensland University provided anecdotal comment regarding similar enquires from landholders in the Caves, Bouldercombe and Yeppoon areas regarding similar problems with zincalume roofs of around the same age. In November 1998, an employee of the Roofing Centre, Rockhampton phoned to advise that BHP had accepted liability for the Yeppoon resident's roof due to a manufacturing fault that resulted in no chromate being applied to the zincalume. The chromate is important for the corrosion protection mechanism of zincalume. The Kalapha resident was advised of BHP's action and it was recommended that he contact the Roofing Centre for advice.

4p3(3) Prejudice the protection of an individuals right to privacy

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Ref No: 1110-331F

JP



4 November 2011

Stanwell Corporation Limited
GPO Box 773
Brisbane, QLD, 4001

Attention: Mr. Kevin Swanepoel

Dear Sir,

DRINKING WATER QUALITY ANALYSIS

1. INTRODUCTION

On the 3rd October 2011, the Stanwell Corporation engaged ALS Laboratory Group to collect samples from two separate residential properties, and one farm. This sampling was conducted in response to concerns raised over heavy metal contamination of the local drinking water supply. The samples were received for analysis at ALS Laboratory Group's NATA accredited laboratory on the 4th October 2011

The results were compared with the heavy metal limits specified in the National Health and Medical Research Council's *Australian Drinking Water Guidelines (ADWG) 2011*.

The complete analytical results provided by ALS are attached in **Appendix A**.

Laboratory Services

- Water & Wastewater Analysis
- Microbiological Analysis
- Soil Analysis
- Corrosion Assessments
- Concrete & Aggregates
- Sludge Analysis

Scientific & Engineering Services

- Process Engineering
- Acid Sulphate Soils Investigations
- Blue-Green Algae Investigations
- Stormwater Management
- Contaminated Sites Investigations
- Environmental Plans & Programmes
- EASI Sampling
- Litigation Support

Training

- Sewage & Wastewater Treatment Plant Operator Training
- Drinking & Industrial Water Treatment Plant Operator Training
- Swimming Pool Operator Training
- Environmental Awareness
- Sampling &

2. SAMPLE LOCATIONS

Samples were collected from two residential properties, Lot 9 Warren Road, and 72 Brickworks Road, in Stanwell, QLD, 4702 (Figure 1). One sample was also collected from a nearby grape farm.



Figure 1. Residential Sample Locations in relation to Stanwell Power Station

Sample Location 1: Lot 9 Warren Road

This property contains two polyethylene rainwater tanks, as well as a white tank that is used as a reserve source (Figure 2), but is not connected to the house. The polyethylene tanks supply water to all the taps on the property. The water sample from this property was collected from an outside tap (Figure 3).



Figure 2. Polyethylene Tank, with White Tank behind.



Figure 3. Outside Tap, where sample was collected.

Sample Location 2: 72 Brickworks Road

This property contains two white concrete tanks, both of which provide water to the household's internal taps (Figure 4.). There is also a polyethylene tank that provides bore water to the exterior of the property. There are another two polyethylene tanks located next to a two bay shed, however these are not currently supplying water to the house and therefore sampling of these tanks was not required. The sample from this property was collected from the tap at the kitchen sink (Figure 5.).



Figure 4. Concrete Tanks that supply water to the internal taps.



Figure 5. Kitchen Sink Tap, where sample was collected.

Sample Location 3: Grape Farm

This property has two rainwater tanks that collect water from the roof of the house. One tank is polyethylene and one tank is concrete (Figure 6.). The sample from this property was collected from a tap at the bottom of the concrete water tank. (Figure 7.)



Figure 6. Polyethylene (left hand side) and Concrete tanks, where



Figure 7. Concrete water tank tap, sample was collected.

3. RESULTS

A summary of the analytical results in comparison with the *Australian Drinking Water Guidelines 2011 Health based guidelines* (except where indicated) is presented in table 1 below. Any exceedences of the guidelines have been shaded and emboldened.

Table 1: Total Metals In Compliance With Australian Drinking Water Guidelines 2011

Total Metals	Units	ADWG (2011)	Stanwell 1	Stanwell 2	Stanwell 3
Aluminium	mg/L	0.2*	0.03	0.12	0.17
Antimony	mg/L	0.003	<0.001	<0.001	<0.001
Arsenic	mg/L	0.01	<0.001	<0.001	<0.001
Barium	mg/L	2	0.081	0.004	0.003
Boron	mg/L	4	<0.05	<0.05	<0.05
Cadmium	mg/L	0.002	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.05	<0.001	0.005	<0.001
Copper	mg/L	1*	0.511	0.129	0.003
Iron	mg/L	0.3*	<0.06	<0.05	<0.05
Lead	mg/L	0.01	0.004	0.002	<0.001
Manganese	mg/L	0.1*	0.014	0.012	<0.001
Mercury	mg/L	0.001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.05	<0.001	<0.001	<0.001
Nickel	mg/L	0.02	<0.001	<0.001	<0.001
Selenium	mg/L	0.01	<0.01	<0.01	<0.01
Sliver	mg/L	0.1	<0.001	<0.001	<0.001
Tin	mg/L	-	<0.001	<0.001	<0.001
Uranium	mg/L	0.017	<0.001	<0.001	<0.001
Zinc	mg/L	3*	1.22	0.528	0.019

* Indicates use of an Aesthetic based guideline, which is often more conservative than the health based guideline

As indicated in table 1. the results from the three Stanwell properties are compliant with the *Australian Drinking Water Guidelines 2011*.

4. COMMENTS

The concentrations of aluminium, copper and zinc have noticeable differences between sites. The highest concentrations of copper and zinc are recorded at the Warren Street address. Inversely this property has the lowest recorded concentration of aluminium of all three sites. The Grape Farm has the lowest concentrations of copper and zinc, but the highest concentration of aluminium. This variation may be due to differences in the materials the tanks and pipes are constructed of.

The ADWG 2011 guideline encourages water authorities to keep acid soluble aluminium below 0.1 mg/L. The concentration of dissolved aluminium at the Grape Farm was above this encouraged limit. While the concentration of the two residential properties were below this limit.

5. CONCLUSION

The analytical results of the three Stanwell properties indicate that the heavy metal concentrations in the water samples **comply** with the *Australian Drinking Water Guidelines 2011*. The water samples from these properties are **safe for human consumption**.

We trust this summary is suitable for your requirements. Please do not hesitate to contact the undersigned should you have any enquires, or if we can be of further assistance to you.

Yours faithfully
SIMMONDS & BRISTOW PTY LTD

14p3(3) Prejudice the protection of an individuals right to privacy

Jenna Parsons *B Env Mgmt*
Environmental Scientist

enc: *Analytical Tables*

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APPENDIX A
Analytical Tables



ALS Laboratory Group

Environmental (Water Resources)

Stanwell Corporation (Rockhampton) - Water Sample Analysis 03/10/2011 - Report V3_FINAL

ALS	22/10/2011	Sample	ID 1			Stanwell 1	Stanwell 2	Stanwell 3
EB1120411	Results		Date Sampled			3/10/2011	3/10/2011	3/10/2011
			Order #			EB1120411001	EB1120411002	EB1120411003
Analyte	CAS #	Units	LOR	Lower Limit	Guideline Limit	WATER	WATER	WATER
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	mg/L	0.01	-	0.2	0.02	0.09	0.16
Antimony	7440-36-0	mg/L	0.001	-	0.003	<0.001	<0.001	<0.001
Arsenic	7440-38-2	mg/L	0.001	-	0.007	<0.001	<0.001	<0.001
Barium	7440-39-3	mg/L	0.001	-	0.7	0.072	0.005	0.003
Boron	7440-42-8	mg/L	0.05	-	4	<0.05	<0.05	<0.05
Cadmium	7440-43-9	mg/L	0.0001	-	0.002	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	mg/L	0.001	-	0.05	<0.001	0.004	<0.001
Copper	7440-50-8	mg/L	0.001	-	1	0.192	0.11	0.001
Iodine	7553-56-2	mg/L	0.1	-	-	<0.1	<0.1	<0.1
Iron	7439-89-6	mg/L	0.05	-	0.3	<0.05	<0.05	<0.05
Lead	7439-92-1	mg/L	0.001	-	0.01	0.002	0.002	<0.001
Manganese	7439-96-5	mg/L	0.001	-	0.1	0.009	0.011	<0.001
Molybdenum	7439-98-7	mg/L	0.001	-	0.05	<0.001	<0.001	<0.001
Nickel	7440-02-0	mg/L	0.001	-	0.02	<0.001	<0.001	<0.001
Selenium	7782-49-2	mg/L	0.01	-	0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	mg/L	0.001	-	0.1	<0.001	<0.001	<0.001
Tin	7440-31-5	mg/L	0.001	-	-	<0.001	<0.001	<0.001



ALS Laboratory Group

Environmental (Water Resources)

Uranium	7440-61-1	mg/L	0.001	-	0.02	<0.001	<0.001	<0.001
Zinc	7440-66-6	mg/L	0.005	-	3	1.19	0.508	0.011
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	mg/L	0.01	-	0.2	0.03	0.12	0.17
Antimony	7440-36-0	mg/L	0.001	-	0.003	<0.001	<0.001	<0.001
Arsenic	7440-38-2	mg/L	0.001	-	0.007	<0.001	<0.001	<0.001
Barium	7440-39-3	mg/L	0.001	-	0.7	0.081	0.004	0.003
Boron	7440-42-8	mg/L	0.05	-	4	<0.05	<0.05	<0.05
Cadmium	7440-43-9	mg/L	0.0001	-	0.002	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	mg/L	0.001	-	0.05	<0.001	0.005	<0.001
Copper	7440-50-8	mg/L	0.001	-	1	0.511	0.129	0.003
Iodine	7553-56-2	mg/L	0.1	-	-	<0.1	<0.1	<0.1
Iron	7439-89-6	mg/L	0.05	-	0.3	0.06	<0.05	<0.05
Lead	7439-92-1	mg/L	0.001	-	0.01	0.004	0.004	<0.001
Manganese	7439-96-5	mg/L	0.001	-	0.1	0.014	0.012	0.002
Molybdenum	7439-98-7	mg/L	0.001	-	0.05	<0.001	<0.001	<0.001
Nickel	7440-02-0	mg/L	0.001	-	0.02	<0.001	<0.001	0.002
Selenium	7782-49-2	mg/L	0.01	-	0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	mg/L	0.001	-	0.1	<0.001	<0.001	<0.001
Tin	7440-31-5	mg/L	0.001	-	-	<0.001	<0.001	<0.001
Uranium	7440-61-1	mg/L	0.001	-	0.02	<0.001	<0.001	<0.001
Zinc	7440-66-6	mg/L	0.005	-	3	1.22	0.528	0.019



ALS Laboratory Group
Environmental (Water Resources)

EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	mg/L	0.0001	-	0.001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	mg/L	0.0001	-	0.001	<0.0001	<0.0001	<0.0001
Applied Guideline:	ADWG (2004) (WATER) - Health plus Aesthetic							
Colour Key:	Within Guideline	Exceeds Guideline						

NOTE: The Limit Of Reporting (LOR) for Selenium equals the applicable guideline value; therefore an exceedance has been highlighted.

Stanwell Power Station

High Volume Sampling and Analysis for mercury and metals

Oct 2011



Prepared for	Stanwell Power Station
Attention	Lauren Keliher
Client Reference	541060
Report No.	R11/100-S1 (This report supersedes Report No. R11/100-S)
Date tested	12 th - 29 th Oct 2011
Date reported	7 th December 2011
Authorisation	Paul Chant



This document is issued in accordance with NATA's accreditation Requirements. Accredited for compliance with ISO/IEC 17025
Accreditation No: 16816



High Volume Sampling Report

Stanwell Power Station

To:	Lauren Keliher		
From:	Mohammad Roohi	Report date:	7 th December 2011
Test dates:	12 th - 29 th Oct 2011	Alstom job:	541060

From:	Alstom, 7 Terrace Place, Murarrie Qld 4172		
Telephone	07-3902 9900	File Ref:	Ambient Air Monitoring
Facsimile:	07-3902 9999	Date of issue:	7 th December 2011
Email:	Paul.chant@alstom.com	Project manager:	Paul Chant
Method reference:	<p>AS 3580.1.1 2007: Ambient air sampling and analysis, Guide for siting air monitoring equipment</p> <p>AS 3580.9.3 2003: Ambient air particulate matter, determination of total suspended particulate matter (TSP) – High volume sampler gravimetric method.</p> <p>USEPA 3005: Acid digestion of Dissolved metals for analysis by FLAA or ICP spectroscopy</p> <p>USEPA 6020A: Metals Analysis, Inductively Coupled Plasma-Mass Spectrometry</p> <p>NIOSH 7301/7303: Metals Analysis, Inductively Coupled Argon Plasma, Atomic Emission Spectroscopy (ICP-AES)</p> <p>OSHA ID-140: Mercury sampling and analysis in ambient air</p>		

Comment:	<p>Three monitoring sites s.73 Woodlands and Grape Farm) were selected to perform the sampling and analysis for total suspended particulates and metals (including mercury) levels using method - AS 3580.9.3 2003. Refer to the map in Appendix C showing the High Volume sampling site locations.</p> <p>The total suspended particulates concentrations measured during sampling periods listed in Table 1 and the following metal concentrations: arsenic, cadmium, lead, manganese, nickel and vanadium measured during sampling periods listed in table 2 were significantly lower than the Queensland Air Quality Objectives – Reference Part 3 of the Environmental Protection Policy (Air) listed in Appendix B – Table 3.</p> <p>The highest measured lead concentration of 0.0080 µg/m³ measured during the sampling period listed in table 2 (filter no. 810) was significantly lower than the National Environmental Protection Measure (NEPM) maximum concentration of 0.50µg/m³.</p> <p>Calibration of the High Volume sampler was performed in accordance with AS 3580.9.3 2003. Details of the calibration are presented in Appendix A.</p>
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M. Roohi

sch4p3(3) Prejudice the protection of an individuals right to privacy

7/12/2011

Reporting Officer

Approval

Date

Table 1 - Total Suspended Particulate (TSP) Results

Location	Filter No.	Start Date	Run Time	Total Particulate Matter
			hrs	$\mu\text{g}/\text{Nm}^3^{(1)}$
Grape Farm	000808	12/10/11	22.43	28.1
Grape Farm	000812	13/10/11	10.43	35.8
Grape Farm	000815	14/10/11	68.87	20.6
Grape Farm	000814	17/10/11	22.98	31.4
Grape Farm	000813	18/10/11	22.98	30.3
Wood Lands	000811	19/10/11	22.82	19.1
Wood Lands	000810	20/10/11	22.98	25.8
Wood Lands	000816	21/10/11	91.93	23.1

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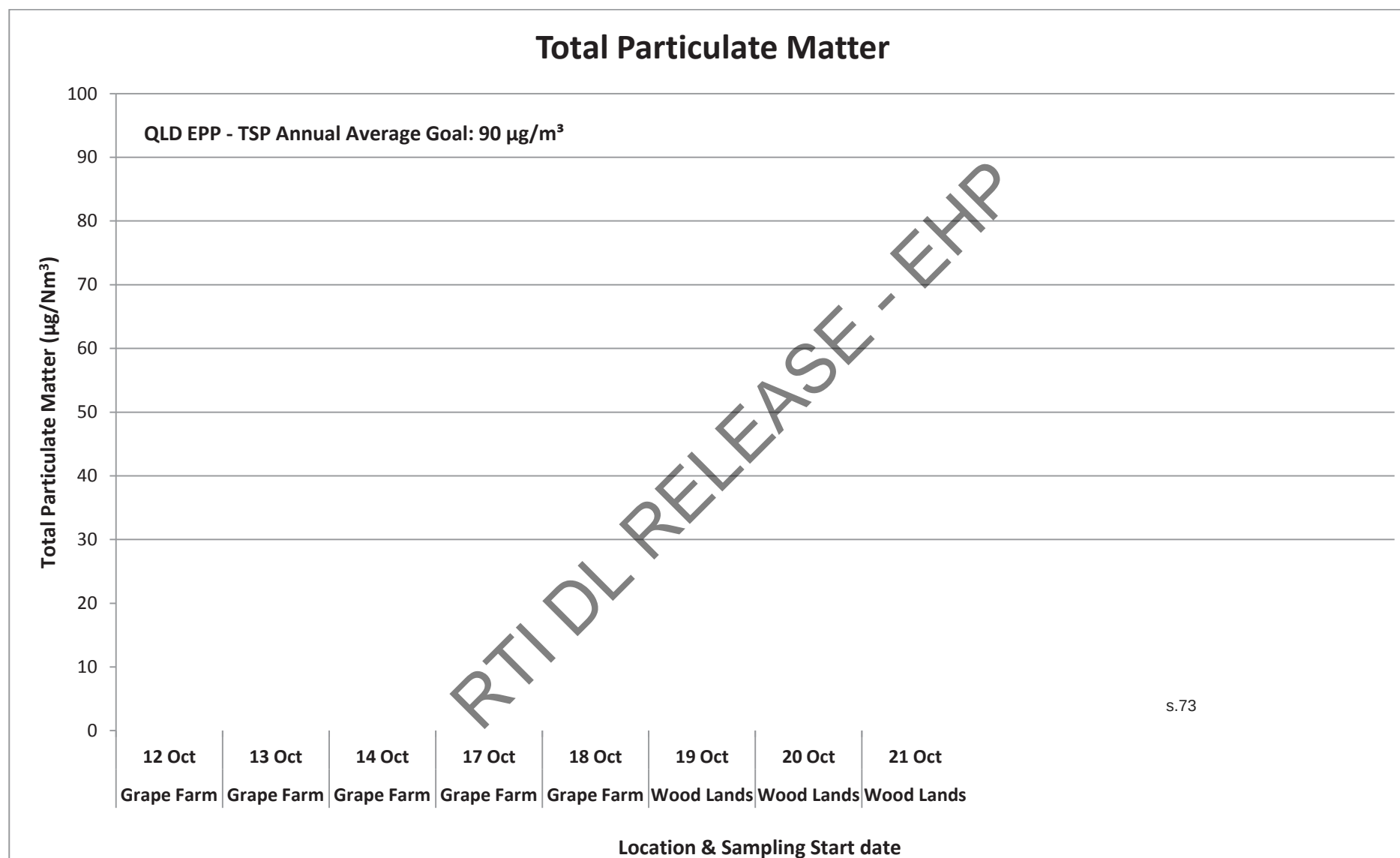
⁽¹⁾: Sample volumes were corrected to STP (0 °C and 1 atm)

Table 2 - Metals and Mercury Analysis Results

Location	Start Date	Filter No.	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	Mercury
			Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Ni	Se	Ag	Tl	V	Zn	Hg
				µg/Nm ^{3 (1)}															
Grape Farm	14 Oct	815	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0013	0.0055	< 0.001	< 0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Grape Farm	17 Oct	814	< 0.001	< 0.001	0.030	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0038	< 0.001	< 0.003	< 0.001	< 0.001	0.0011	0.0436	< 0.001
Grape Farm	18 Oct	813	< 0.001	< 0.001	0.163	< 0.001	< 0.001	< 0.001	< 0.001	0.0027	0.0024	0.0055	< 0.001	< 0.003	< 0.001	< 0.001	< 0.001	0.1180	< 0.001
Wood Lands	19 Oct	811	< 0.001	< 0.001	1.649	< 0.001	< 0.001	0.0028	< 0.001	< 0.001	0.0019	0.0045	0.0015	< 0.003	< 0.001	< 0.001	0.0015	1.1798	< 0.001
Wood Lands	20 Oct	810	< 0.001	< 0.001	5.790	< 0.001	< 0.001	0.0037	< 0.001	0.0035	0.0080	0.0064	< 0.001	< 0.003	< 0.001	< 0.001	0.0021	4.0961	< 0.001
Wood Lands	21 Oct	816	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0064	< 0.001	0.0033	0.0016	0.0039	0.0042	< 0.003	< 0.001	< 0.001	0.0012	< 0.001	< 0.001

s.73

(1): Sample volumes were corrected to STP (0 °C and 1 atm)



Appendix A

High Volume Sampler Calibration Report

PRE-DEPLOYMENT CHECK. SET TO 70 s m/h FOR TSP SAMPLING

ECOTECH HV3000 HI-VOL CALIBRATIONS ALSTOM					
Start Time <u>7:40</u>		Site code - location <u>MURADIE WORKSHOP</u>			
Finish Time <u>9:50</u>		Date <u>10/10/2011</u>		Serial Number <u>06-1081</u>	
Two-Monthly Flow Calibration <small>To be done after annual calibrations</small>					
	Hi-Vol Setpoint	Expected reading	Manometer Readings Initial Final		Standard serial numbers
Point 1	<u>60</u>	<u>123</u>	<u>168.3</u>	<u>125.4</u>	Orifice plate <u>ECOTECH 3.11</u>
Point 2	<u>70</u>	<u>167</u>	<u>207.9</u>	<u>166.9</u>	Manometer <u>92130</u>
Point 3	<u>80</u>	<u>218</u>	<u>267.1</u>	<u>219.4</u>	Thermometer <u>0158823510</u>
Barometer <u>D4950001</u>					
To adjust: go to the CALIBRATION menu, wait for motor to stabilise, and then select MOTOR, ADJUST					
Six-Monthly Timer Check					
	Start Time hh:mm:ss	Finish time	Elapsed time (s)	☒ Adjusted time (after test)	
Time standard	<u>8:45:38</u>	<u>9:46:53</u>	<u>3675</u>	☒ Passed test	
Hi-Vol	<u>8:42:51</u>	<u>9:44:05</u>	<u>3674</u>	Allowable difference: < ±0.3% e.g. ±10.8 seconds over 1 hour	
Annual Calibrations					
Ambient Temperature and Pressure Verification					
	Hi-Vol	Standard	Accepted?	Standard serial numbers	
Temperature	<u>19.855</u>	<u>20.4</u>	☒	Temp. <u>01588235/810</u>	
Ambient Pressure	<u>759.34</u>	<u>757.8</u>	☒	Pres. <u>D4950001</u>	
<small>To access the "hidden" coefficients menu, press the first "c" in the Ecotech Logo and the Select button at the same time</small>					
Temperature Sensor Calibration <small>(perform if Temperature Verification not accepted)</small>					
Temp adjustment factor (x) <u>0.02745</u> <small>[Actual temperature] / [Hi-Vol temperature]</small>					
	Initial	Final			
TEMP COEFF 0	<u>0.881</u>	DO NOT ADJUST	Do not adjust		
TEMP COEFF 1	<u>0.0185</u>	<u>0.0180</u>	Set to (TEMP COEFF 1) / x		
TEMP COEFF 2	<u>0.0006</u>	<u>0.0006</u>	Set to (TEMP COEFF 2) / x ² (1.05565)		
Pressure Sensor Calibration <small>(perform if Pressure Verification not accepted)</small>					
Pres adjustment value (y) <u>-1.54</u> <small>[Actual pressure] - [Hi-Vol pressure]</small>					
	Initial	Final			
PRES COEFF 0	<u>74</u>	<u>72.46</u>	Set to (PRES COEFF 0) + y		
PRES COEFF 1	<u>168.7</u>	DO NOT ADJUST	Do not adjust		
<small>If the Hi-Vol reading is > Standard, PRES COEFF 0 Final is < Initial</small>					
CONSULTANT <u>W. MANLEY</u>		SIGNATURE <u>[Signature]</u> Section 78B(2) RTI Act			

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Appendix B

Table 3 - Queensland Air Quality Objectives – Reference Part 3 EPP (Air) for TSP, Metals and Mercury

Indicator	Environmental Value	Air Quality Objectives $\mu\text{g}/\text{m}^3$ at 0°C	Period
Total suspended particles	Health/Wellbeing	90	1 Year
Inorganic mercury vapour	Health/Wellbeing	1.1	1 Year
Arsenic and compounds (measured as the total metal content in PM_{10})	Health/Wellbeing	0.006	1 Year
Cadmium and compounds (measured as the total metal content in PM_{10})	Health/Wellbeing	0.005	1 Year
Lead and compounds (measured as the total metal content in total suspended particles)	Health/Wellbeing	0.5	1 Year
Manganese and compounds (measured as the total metal content in PM_{10})	Health/Wellbeing	0.16	1 Year
Nickel and compounds (measured as the total metal content in PM_{10})	Health/Wellbeing	0.020	1 Year
Vanadium and compounds (measured as the total metal content in PM_{10})	Health/Wellbeing	1.1	1 Year

Appendix C

Map Exhibiting High Volume Sampler Site Locations

RTI DL RELEASE - EHP





Stanwell Corporation

Ambient Climatic Monitoring Report

October 2011

Stanwell Corporation
Climatic Air Monitoring Station
Monthly Report – October 2011

Prepared for Stanwell Corporation

Attention Lauren Keliher

Report No. 11 – 102

Job No. 740975

Prepared by David Boorer

Approved Paul Chant

Date 22 November 2011



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Accreditation No: 16816

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Stanwell Corporation
Climatic Air Monitoring Station
Monthly Report – October 2011

1. INTRODUCTION

Climatic monitoring was conducted on behalf of Stanwell Corporation during this monitoring period. The monitoring consists of an automatic weather station located approximately 2 kilometers West-South-West (WSW) of Stanwell Power Station (23°31'8.29"S 150°18'7.90"E Elevation 60 meters).

2. MEASURED PARAMETERS

The following meteorological parameters were measured continuously at the weather station site:

Table 1: Continuous Parameters

PARAMETER	DESCRIPTOR	UNITS	MEASURED
Horizontal Wind Speed – 10 metres	WS10	m/s	yes
Wind Direction – 10 metres	WD10	degrees	yes
Horizontal Wind Speed – 30 metres	WS30	m/s	yes
Wind Direction – 30 metres	WD30	degrees	yes
Temperature – 10 metres	TM10	°C	yes
Relative Humidity – 10 metres	RH10	%	yes
Temperature – 30 metres	TM30	°C	yes
Relative Humidity – 30 metres	RH30	%	yes
Solar Radiation	SOLRD	W/m ²	yes
Rainfall	RF	mm	yes

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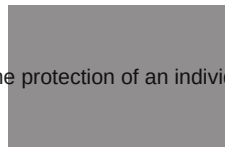
6. AUSTRALIAN STANDARDS

The following standards are the references used in the execution of the Stanwell Climatic Monitoring program.

AS 3580.1.1 - 2007	Ambient air - Guide for the siting of sampling units
AS 3580.14 - 2011	Ambient air – Meteorological monitoring for ambient air quality monitoring applications

7. WORKPLACE HEALTH & SAFETY & ENVIRONMENT

No reportable incidents.



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.....
Paul Chant
Environmental Manager

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WEATHER STATION

DATA SUMMARY

STANWELL POWER STATION

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Climatic Monthly Summary Report

DAILY AVERAGES – METEOROLOGICAL DATA

Stanwell Power Station

Date	Wind Speed 30m m/s	Wind Direction 30m deg	Wind Speed 10m m/s	Wind Direction 10m deg	Temperature 30m °C	Relative Humidity 30m %	Temperature 10m °C	Relative Humidity 10m %	Global Radiation W/m ²	Rain mm
1/10/2011	3.3	177	2.6	233	21.7	47	21.6	46	280	0.0
2/10/2011	1.8	234	2.0	218	17.1	29	16.8	33	253	0.0
3/10/2011	2.0	233	1.8	166	17.4	54	17.0	53	278	0.0
4/10/2011	2.7	194	2.3	92	17.8	74	18.1	65	227	0.0
5/10/2011	2.6	192	2.0	100	16.6	85	16.6	75	158	0.0
6/10/2011	2.6	170	2.3	91	17.9	85	18.4	72	140	0.0
7/10/2011	1.8	174	1.7	170	21.3	82	21.6	71	208	0.0
8/10/2011	3.2	185	2.9	160	23.2	62	23.7	63	260	0.0
9/10/2011	1.3	161	1.2	191	22.0	58	21.7	61	275	0.0
10/10/2011	1.4	143	1.3	188	22.0	62	22.1	63	190	0.2
11/10/2011	1.9	188	1.8	131	21.4	66	21.6	69	180	0.0
12/10/2011	2.4	185	2.0	136	21.8	76	22.1	76	224	0.0
13/10/2011	3.9	196	3.3	91	21.8	76	22.4	76	232	44.4
14/10/2011	2.2	171	2.0	124	21.2	79	22.1	78	245	1.2
15/10/2011	2.3	145	2.3	113	23.0	94	23.6	79	206	4.6
16/10/2011	1.7	200	1.6	169	23.9	73	24.0	65	257	0.0
17/10/2011	4.5	182	3.5	98	20.5	83	20.8	71	119	0.2
18/10/2011	5.3	201	4.3	104	18.1	76	18.5	65	126	0.0
19/10/2011	5.2	237	4.3	104	18.3	72	18.9	62	222	0.0
20/10/2011	3.9	223	3.2	117	17.1	85	17.4	73	114	0.0
21/10/2011	4.2	221	3.4	99	19.3	78	19.7	67	203	0.0
22/10/2011	3.7	206	2.8	118	19.2	89	19.2	77	186	0.0
23/10/2011	3.4	219	2.7	93	20.0	85	20.4	73	190	0.0
24/10/2011	2.5	179	2.0	88	20.7	83	21.3	70	241	0.0
25/10/2011	1.8	162	1.5	129	21.7	85	22.4	72	220	0.0
26/10/2011	2.3	171	2.0	115	22.4	88	23.3	73	254	0.0
27/10/2011	3.2	179	2.6	70	22.6	86	23.5	72	239	0.0
28/10/2011	3.4	220	2.7	83	21.3	92	21.8	78	116	0.0
29/10/2011	2.9	188	2.4	75	21.9	84	22.7	71	263	0.0
30/10/2011	2.4	169	2.0	97	21.7	89	22.4	74	206	0.0
31/10/2011	2.7	180.5	2.4	164	23.5	81	24.0	70	266	0.0
Minimum	1.3	-	1.2	-	16.6	29	16.6	33	114	0.0
MinDate	9/10/2011	-	9/10/2011	-	5/10/2011	2/10/2011	5/10/2011	2/10/2011	20/10/2011	1/10/2011
Maximum	5.3	-	4.3	-	23.9	94	24.0	79	280	44.4
MaxDate	18/10/2011	-	18/10/2011	-	16/10/2011	15/10/2011	16/10/2011	15/10/2011	1/10/2011	13/10/2011
Avg	2.9	190	2.4	127	20.6	76	21	68	212	1.6
Num	31	31	31	31	31	31	31	31	31	31
Data[%]	100	100	100	100	100	100	100	100	100	100
STD	1	25	0.8	42	2.1	14	2.2	10	49.4	-

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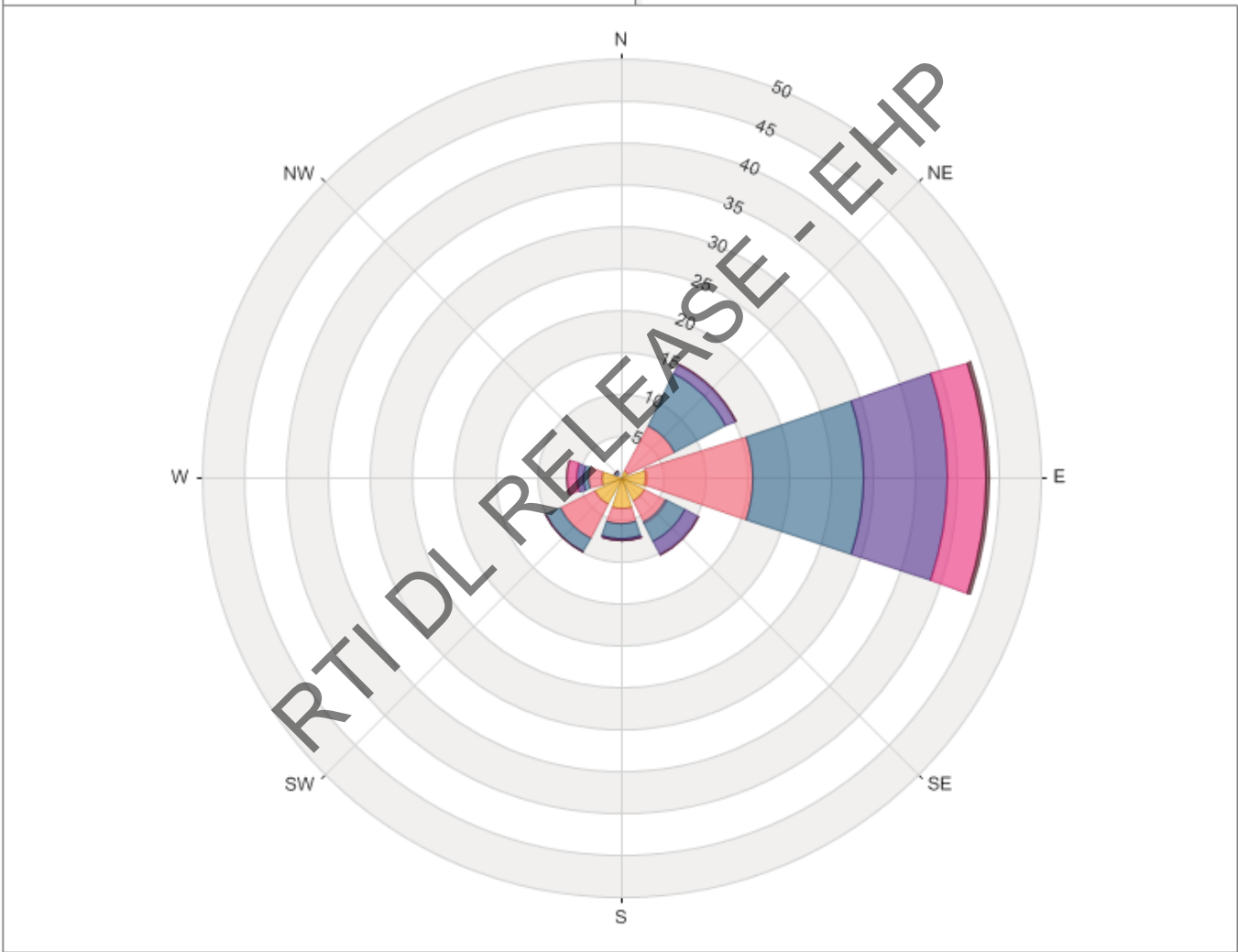
Climatic Monthly Summary Report

MONTHLY WIND ROSE (1 HOUR DATA)

(10 METRES)

Stanwell Power Station

Stanwell AWS 01/10/2011 01:00 - 01/11/2011 00:00 Calm: 5.8%



%	Icon	Classes (KM/H)	17		0.5-1.2	30		1.2-2.4	28		2.4-3.6	14		3.6-4.8	6		4.8-6.0	1		>6.0
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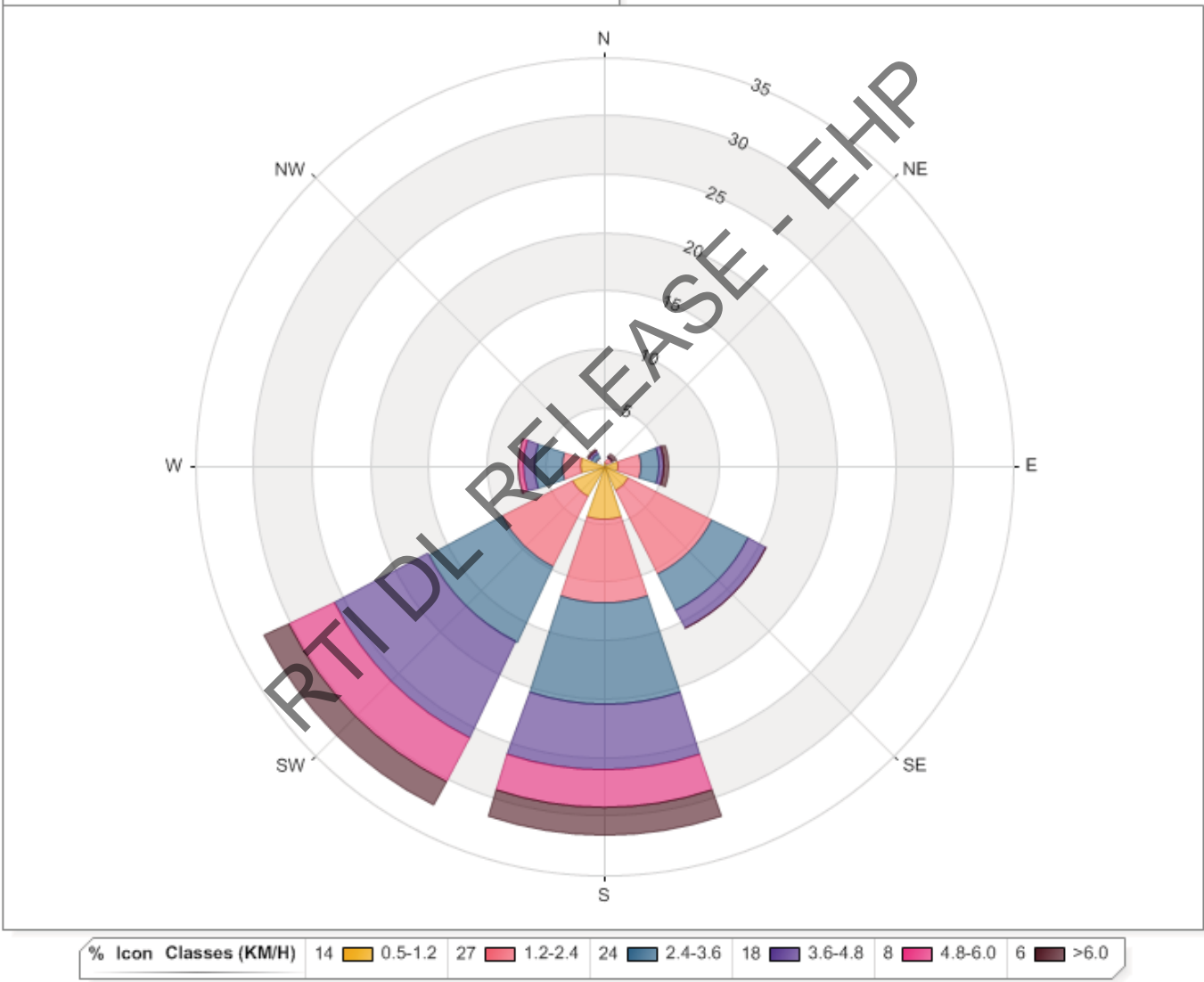
Climatic Monthly Summary Report

MONTHLY WIND ROSE (1 HOUR DATA)

(30 METRES)

Stanwell Power Station

Stanwell AWS 01/10/2011 01:00 - 01/11/2011 00:00 Calm: 4.4%



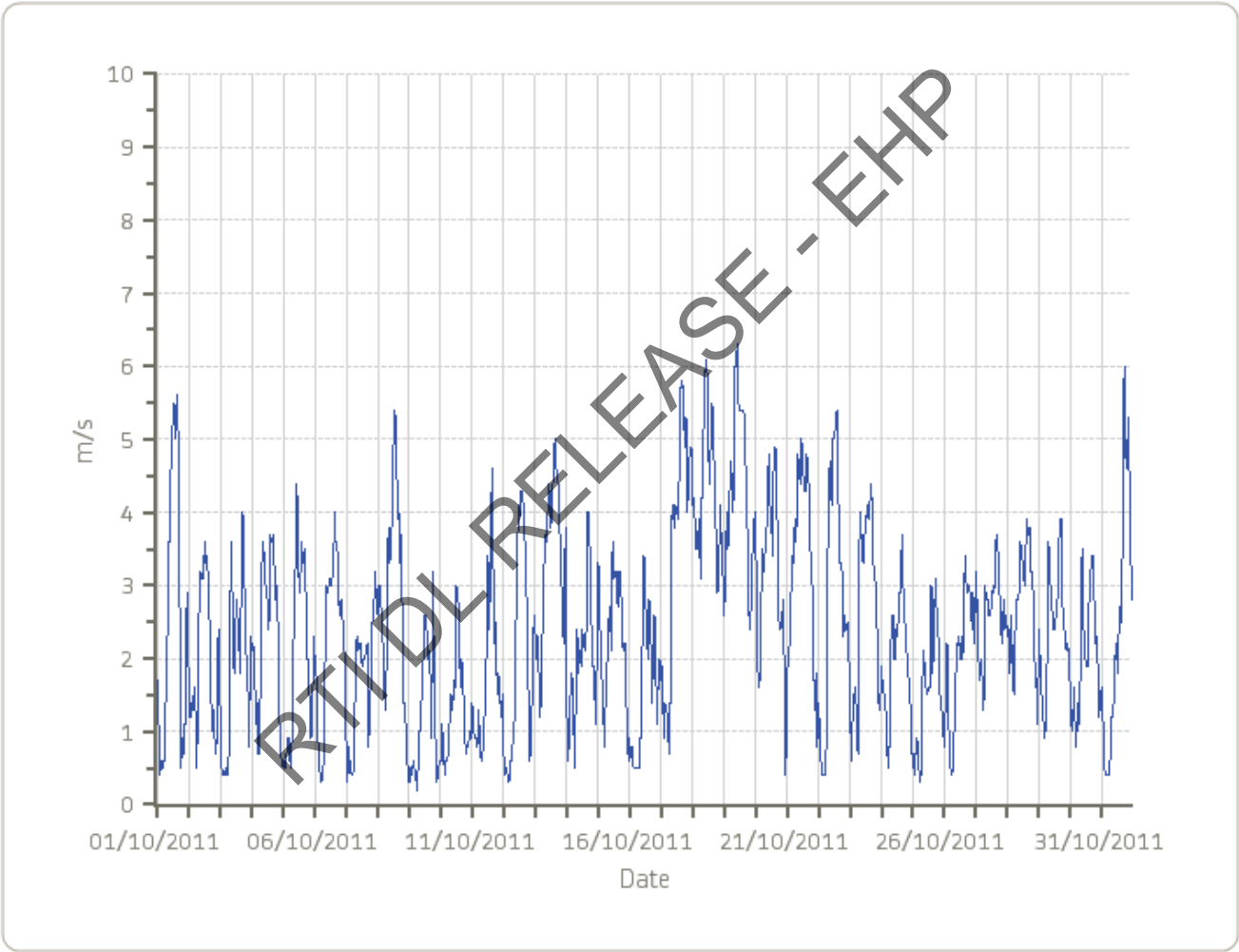
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Climatic Monthly Summary Report

WIND SPEED 10 METRES, 1 HOUR AVERAGE VS. TIME

Stanwell Power Station

WS10[m/s] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.



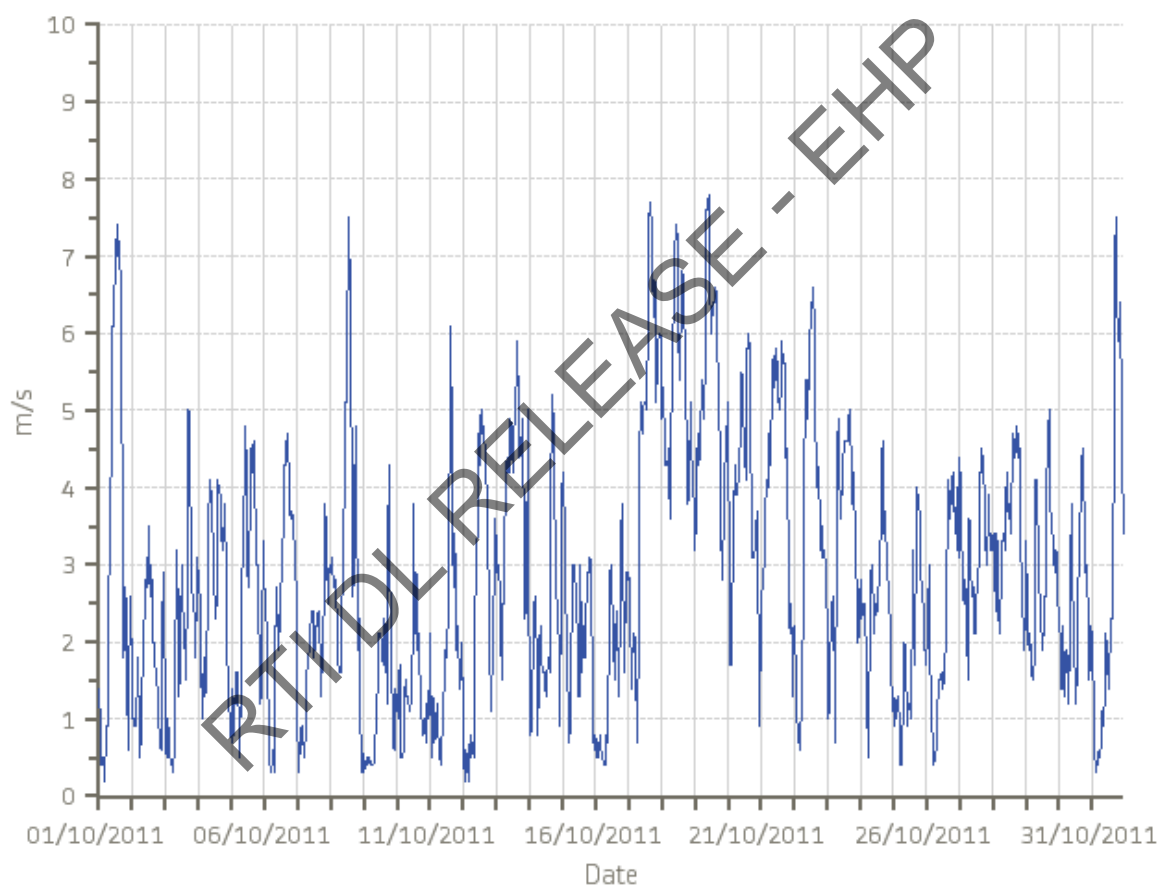
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Climatic Monthly Summary Report

WIND SPEED 30 METRES, 1 HOUR AVERAGE VS. TIME

Stanwell Power Station

WS30[m/s] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.



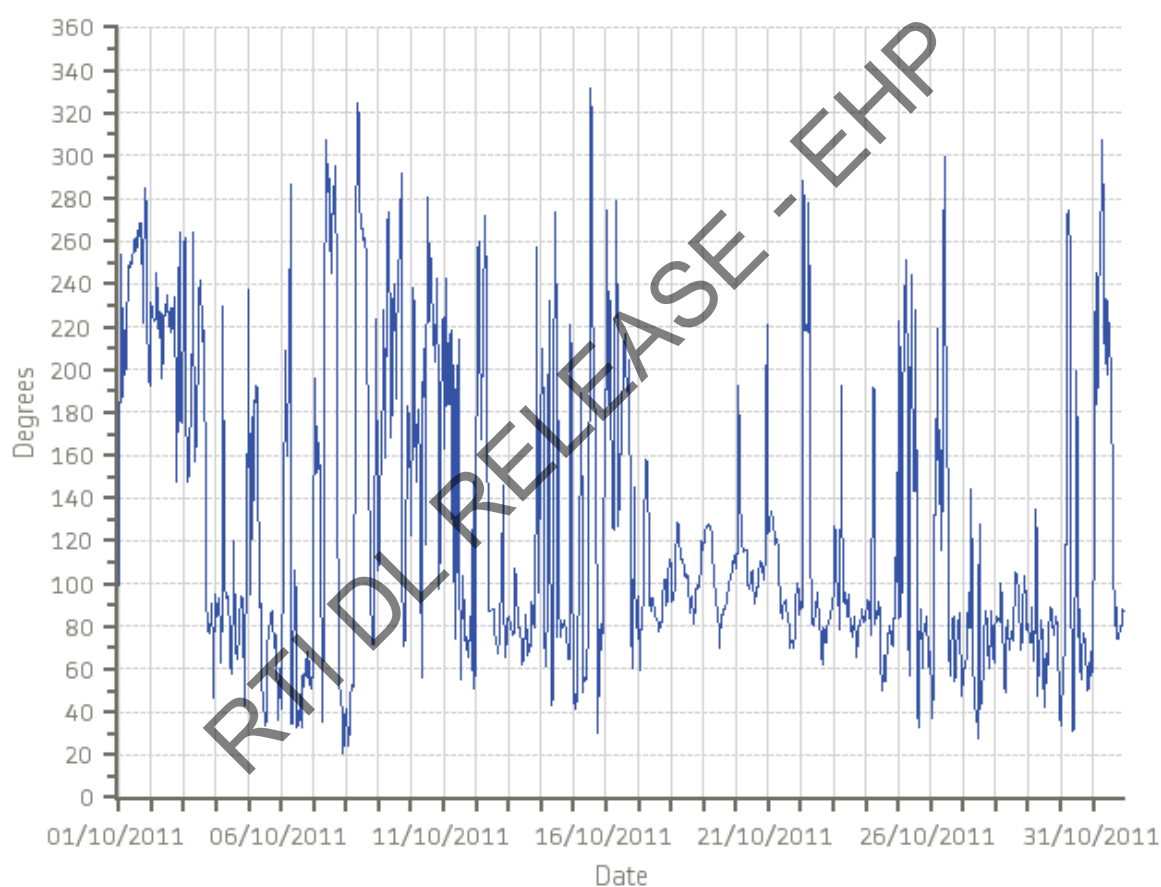
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Climatic Monthly Summary Report

WIND DIRECTION 10 METRES, 1 HOUR AVERAGE VS. TIME

Stanwell Power Station

WD10[deg] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.



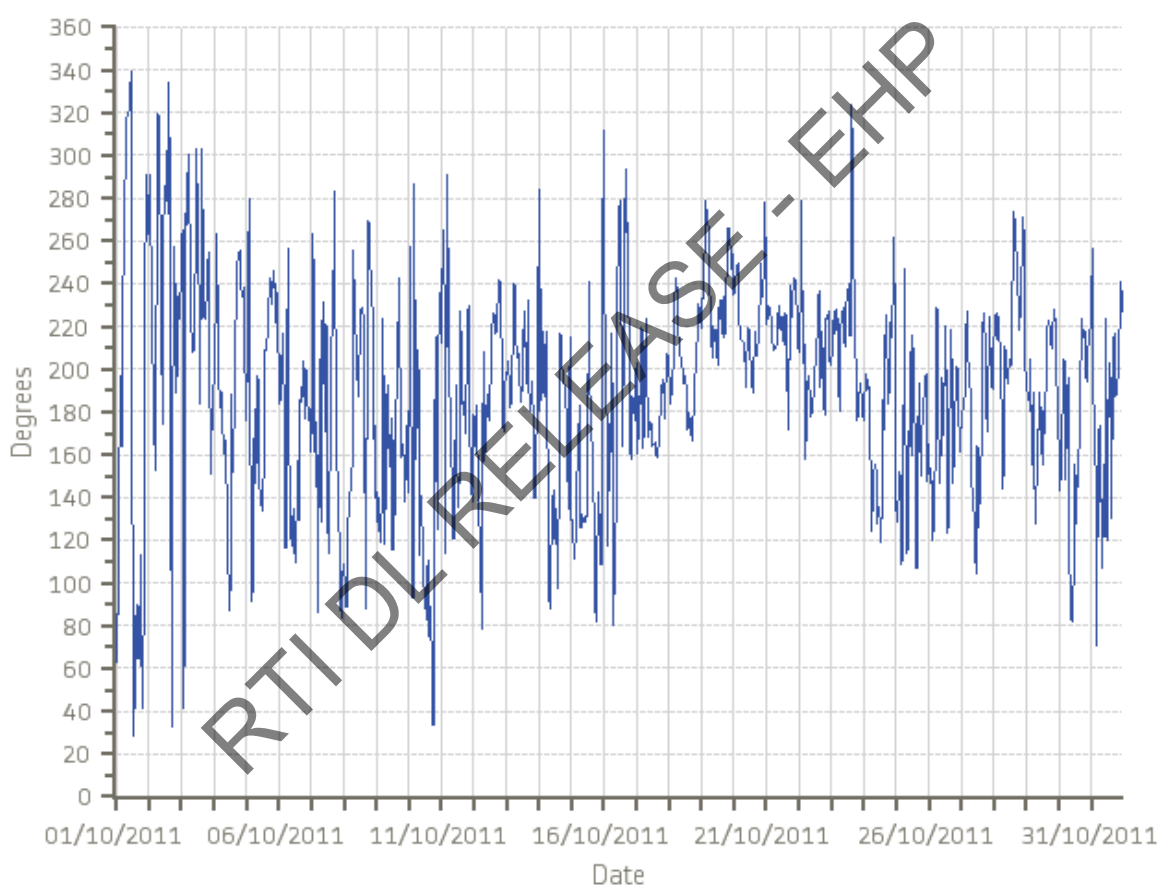
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Climatic Monthly Summary Report

WIND DIRECTION 30 METRES, 1 HOUR AVERAGE VS. TIME

Stanwell Power Station

WD30[deg] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.



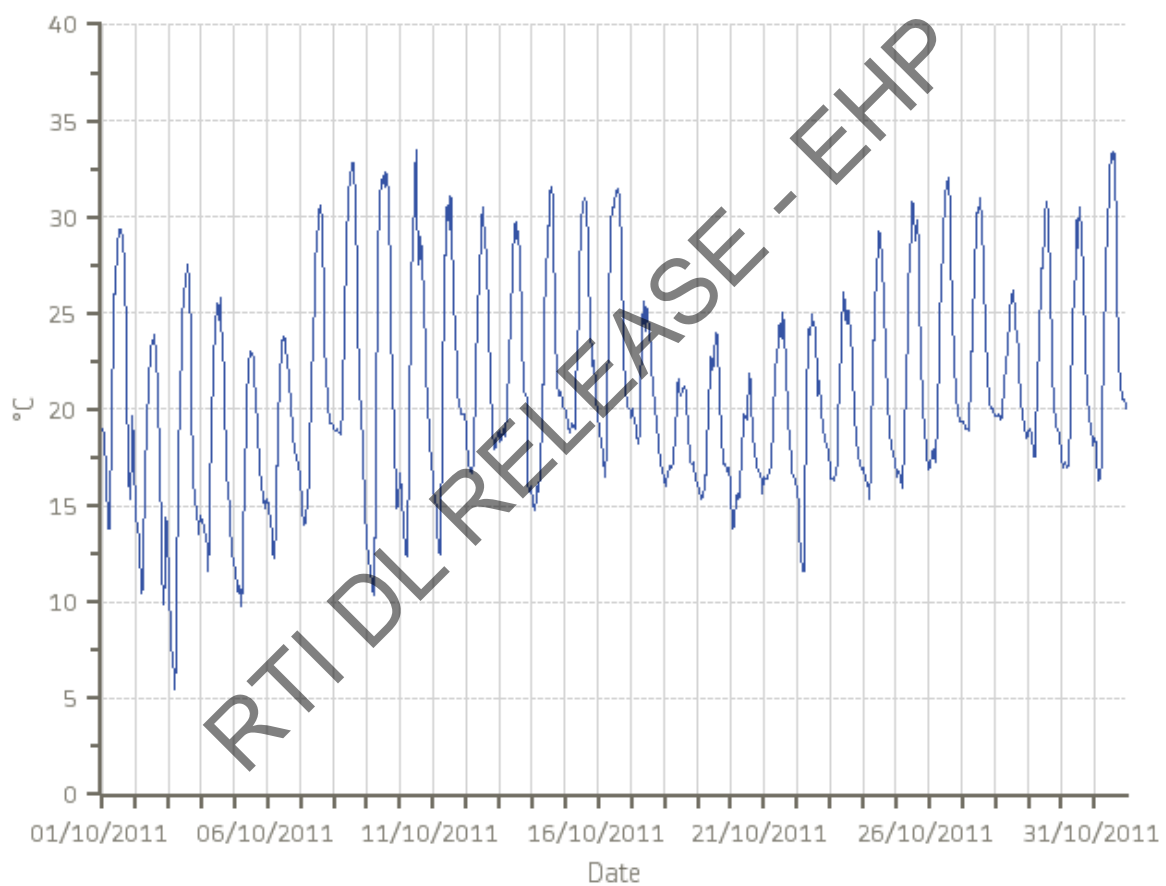
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Climatic Monthly Summary Report

TEMPERATURE 10 METRES, 1 HOUR AVERAGE VS. TIME

Stanwell Power Station

Temp 10m[°C] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.



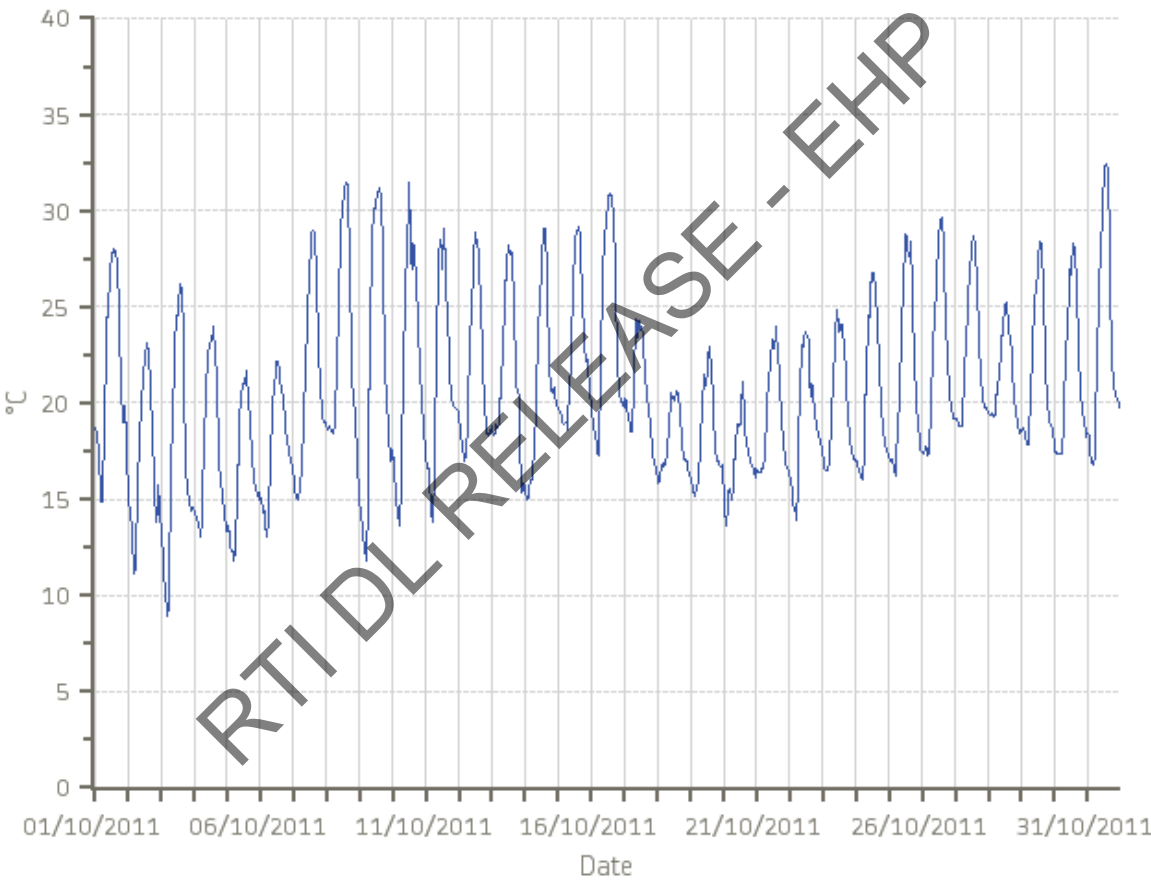
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TEMPERATURE 30 METRES, 1 HOUR AVERAGE VS. TIME

Stanwell Power Station

Temp 30m[°C] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.



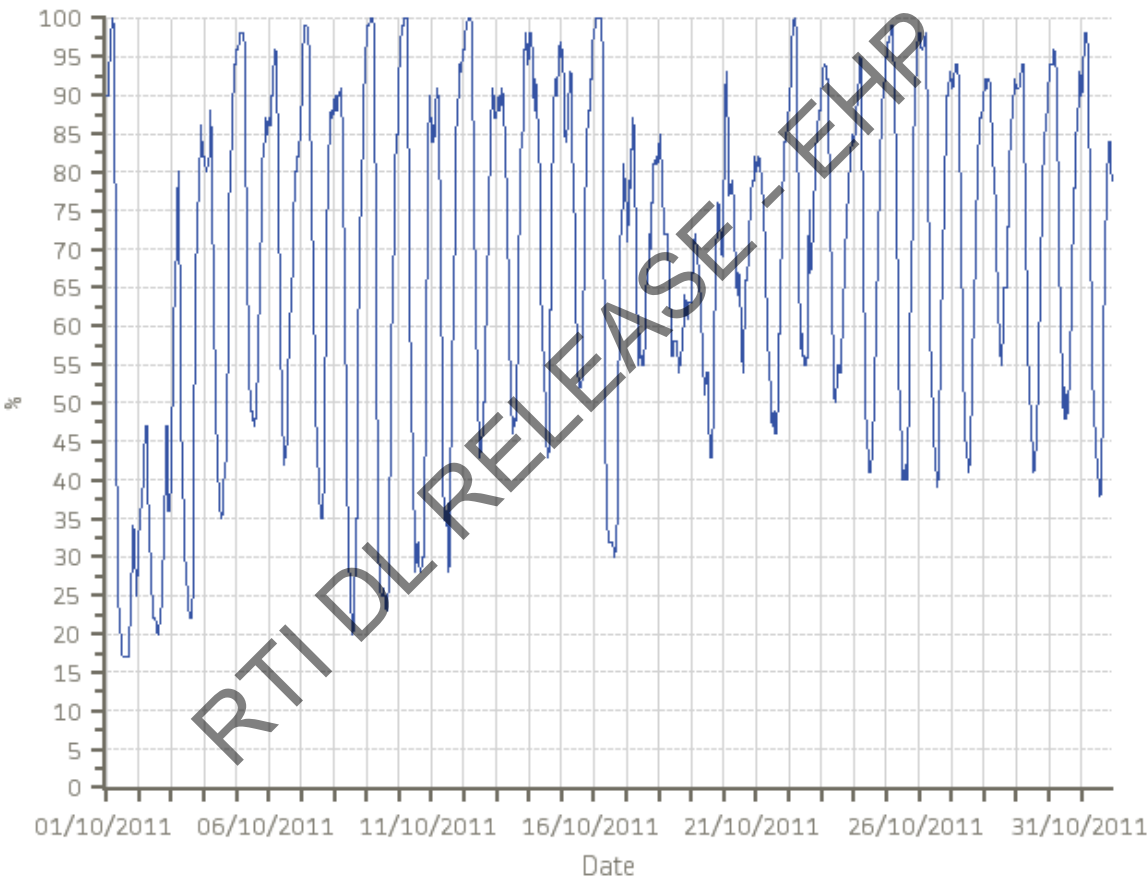
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Climatic Monthly Summary Report

RELATIVE HUMIDITY 10 METRES, 1 HOUR AVERAGE VS. TIME

Stanwell Power Station

RH 10m[%] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.



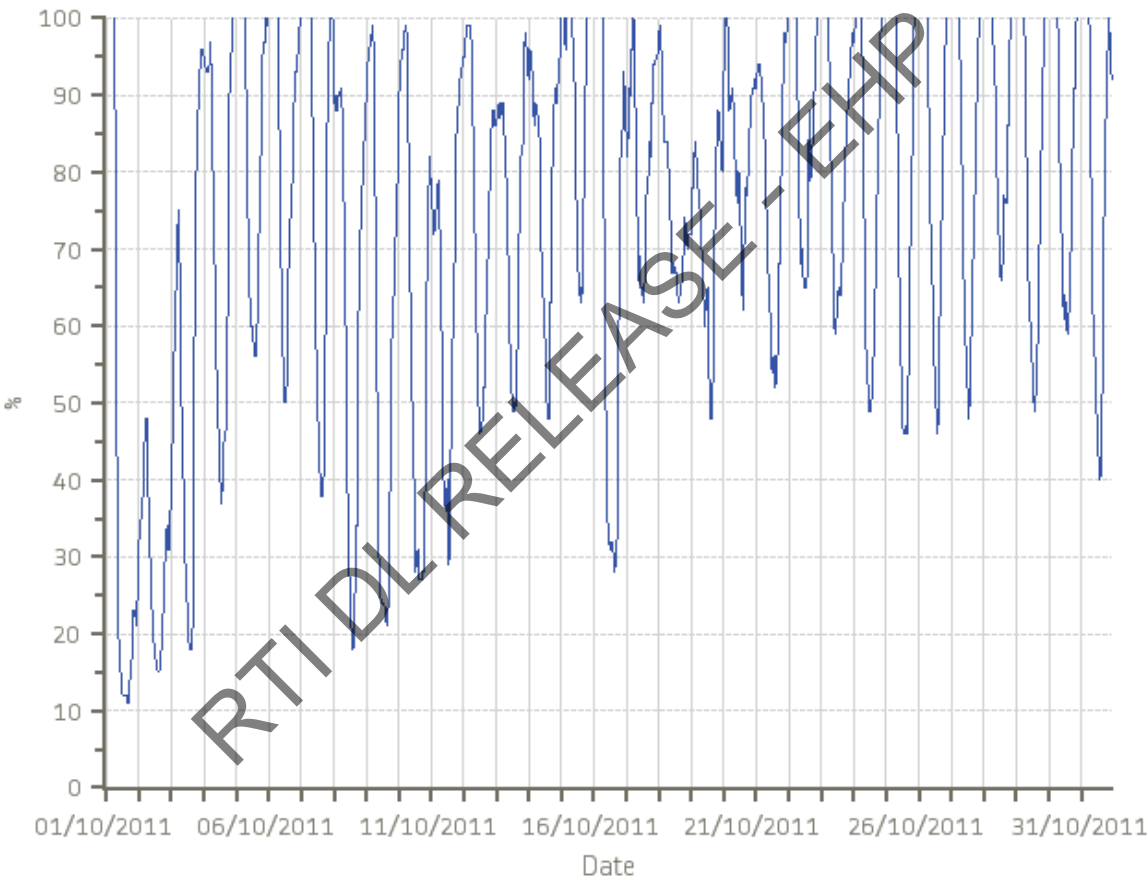
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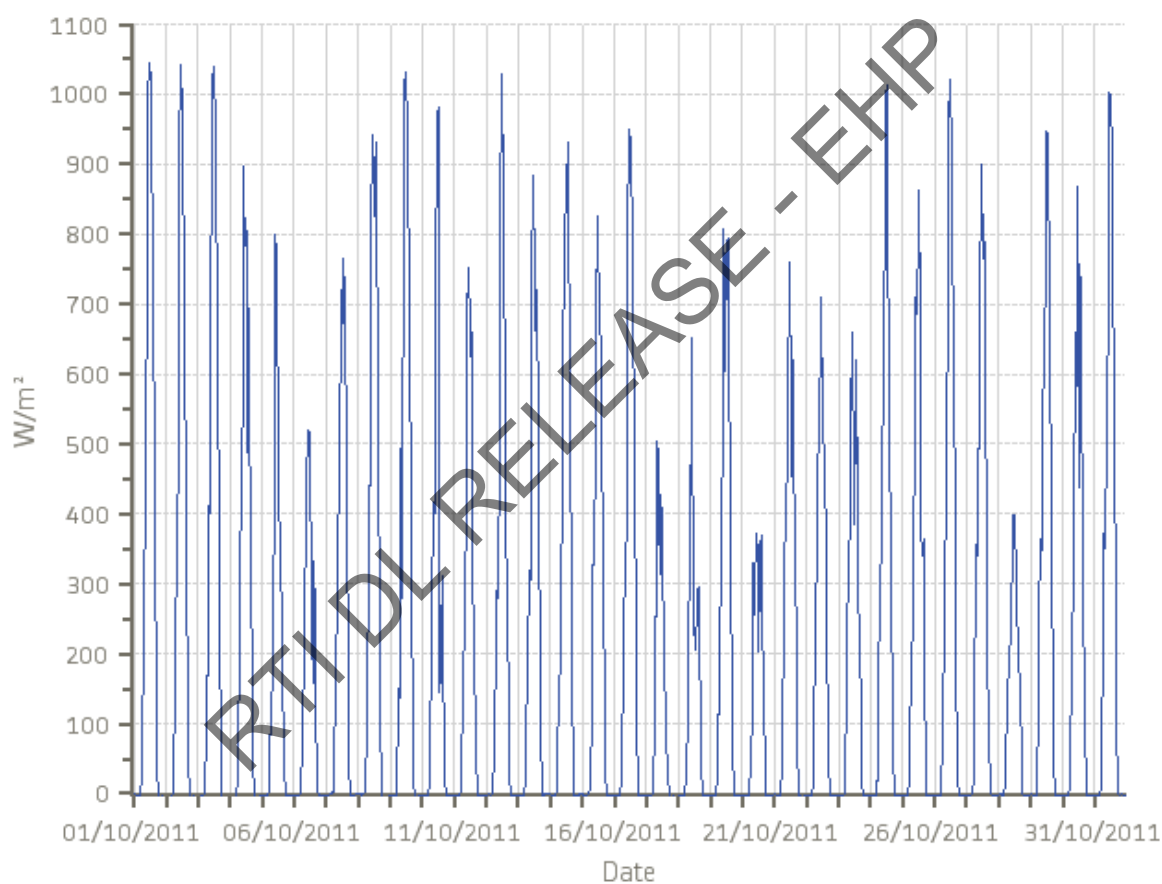
RELATIVE HUMIDITY 30 METRES, 1 HOUR AVERAGE VS. TIME

Stanwell Power Station

RH 30m[%] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.



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Climatic Monthly Summary Report**SOLAR RADIATION, 1 HOUR AVERAGE VS. TIME****Stanwell Power Station**Global Rad[W/m²] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Hr.

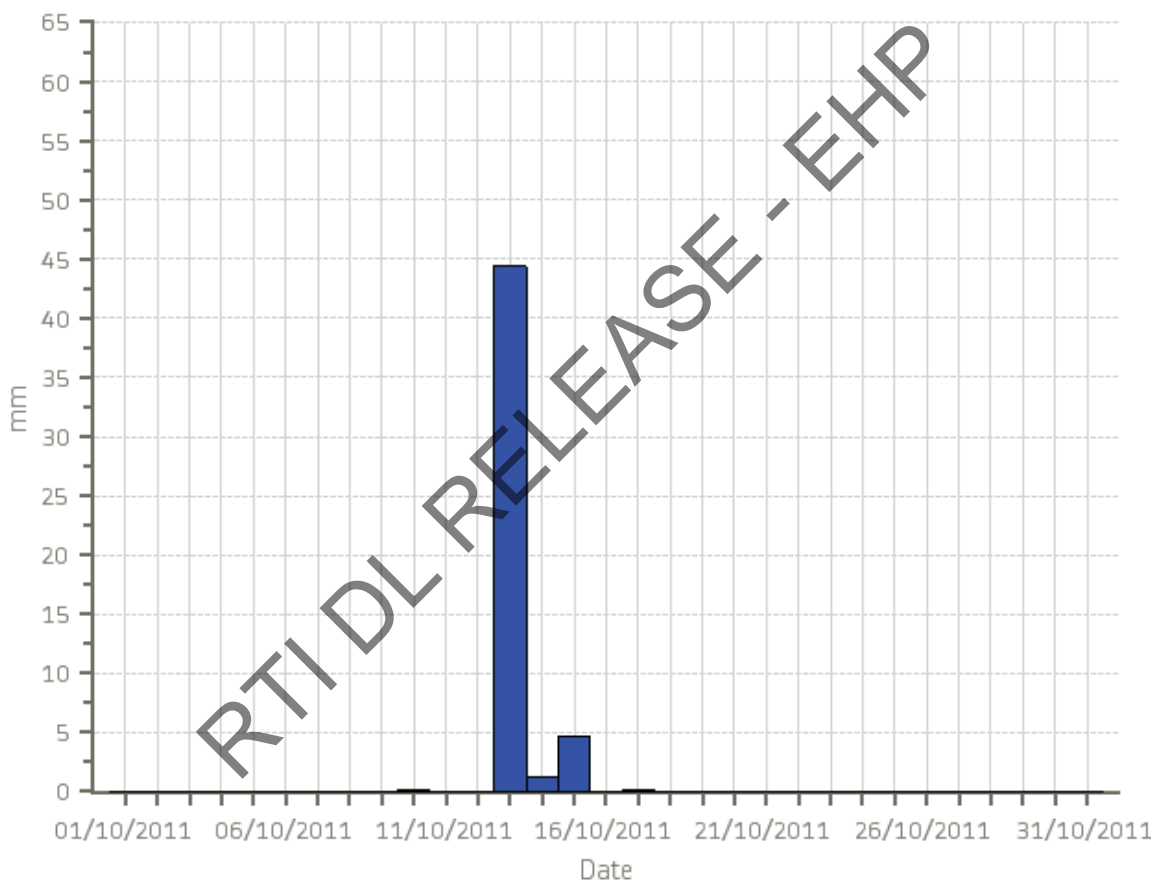
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Climatic Monthly Summary Report

RAINFALL, DAILY TOTAL

Stanwell Power Station

Rain[mm] Station: Stanwell AWS Monthly: 10/2011 Type: AVG 1 Day



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ATTACHMENT 1

SITE LOG

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No visits recorded during the reporting period

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School of Chemical & Biomedical Sciences
Faculty of Arts, Health & Science

☎ : 07 49309612
📠 : 07 4930 9209
✉ : d.druskovich@cqu.edu.au

10 May 1999

Mr Robert Evans
Environmental Officer
Stanwell Power Station
Stanwell Corporation Ltd
PO Box 5895 MC
Rockhampton 4702

Dear Robert

It is my pleasure to submit the final of a series of reports on Atmospheric Corrosion Evaluation at Stanwell Power Station.

Data for "three month", "six month", "nine month" and "twelve month" atmospheric corrosivity on mild steel coupons at eight selected sites is presented and discussed.

If you need any further information pertaining to this study, please do not hesitate to contact me.

Yours sincerely

Dr David Druskovich

Background

Corrosion is the deterioration of metals as a consequence of a reaction with its surroundings that results in a total or partial destruction of the metal and a consequent degradation of its properties.

Corrosion processes are frequently electrochemical in nature and depend on both the nature of the metal **and** the environmental conditions of their location.

The corrosion of the metal (eg a steel surface) is an anodic process characterised by a loss of electrons as depicted in the half-reaction.



On the same metal surface there is a corresponding cathodic reaction which is normally



The factors affecting atmospheric corrosivity depend on both the nature of the metal, and the environmental conditions. They are numerous but include at least the following:

- time of wetness of the surface
- atmospheric pollutants such as atmospheric chlorides, SO_x and NO_x
- rainfall
- relative humidity
- temperature
- exposure conditions (eg prevailing winds)
- metal composition
- properties of the oxide coating.

Corrosion scientists have established that in order for electrochemical corrosion to occur, a metal surface must be covered by a film of moisture. Figure 1 shows the dependence of corrosion upon thickness of this film (Costa, Morcillo and Feliu, 1989). For very thin films, corrosion is negligible, mainly due to the resistance of the film, but when the film is a few micrometres thick the corrosion reaches its highest value. Indeed a considerable part of the damage to structures and equipment by corrosion in the atmosphere is attributable to the condensation of moisture during the periodic cooling of air.

Figure 1: Effect of moisture layer thickness on corrosion rate. (adapted from Costa, Morcillo and Feliu, 1989).

The effect of sulphur dioxide on steel has been extensively studied by a number of authors. Costa, Morcillo and Feliu discuss the studies in their review (1989) and in general there is evidence that sulphur dioxide, other pollutants and moisture act synergistically in causing steel corrosion.

Aims of the Stanwell Atmospheric Corrosivity Study

The aims of the study were to:

- measure the relative corrosivity of the atmosphere in the vicinity of Stanwell Power Station
- establish if any enhanced corrosivity is attributable to station emissions, such as stack SO_x or NO_x

Method

Mild steel coupons were prepared and mounted as per ASTM G1-90 and ASTM G50-76 and evaluated as per ASTM G1-90 using the C3.1 chemical cleaning procedure (ASTM, 1998).

Sites were chosen in consultation with Stanwell and Katestone Scientific staff. Control sites needed to be located so as to reflect background corrosivity but not be so distant from the stack as to have no relativity to the background atmospheric conditions of the test area.

Coupons were cut from the same roll with dimensions of 100mm x 150mm and a thickness of 1mm. Each coupon was supported from a centrally drilled hole using an insulated stainless steel 304 bolt.

The test program was conducted using six sets of coupons (each set comprised 3 coupons) at each location with an interval of three months to 1 year's exposure . The insertion and removal of coupons was as described in Table 1.

Table 1: Interval testing program

Coupon Set	Start (Month)	Finish (Month)	Duration (Months)
1	0	3	3
2	0	6	6
3	0	9	9
4	0	12	12
5	6	12	6
6	9	12	3

The eight sites chosen for the testing are listed in column 1 of Table 2. Column 2 give an approximate “true north” compass bearing with respect to the station and column 3 is the approximate distance of the site from the station stack. A map of the site testing area is included as Appendix 1.

Table 2: Test sites and their location with respect to station stack

	Site	Compass Location	Approx Distance to Stack
1	Barnes	25 degrees to stack	2.5 kilometres
2	Brooks	90	3
3	Kalapa	75	5.5
4	Sowdens	85	8
5	Mercy	228	3.5
6	Stanwell Township	200	2
7	Ridgeland*	165	27.5
8	Brown's Lookout*	5	8

* control sites

Results

Table 3 lists the corrosion rates determined at 3, 6, 9 and 12 month testing intervals. Each value is an average of three determinations and typical errors for the readings are about $\pm 1\mu\text{m}/\text{year}$.

Table 3: Measured corrosion rates at the test sites

Location	Corrosion rate ($\mu\text{m}/\text{year}$)			
	3 months	6 months	9 months	12 months
Site 1 – Barnes	21	26	25	22
Site 2 – Brooks	45	43	39	34
Site 3 – Kalapa	38	39	35	34
Site 4 – Sowdens	39	39	36	33
Site 5 – Mercy	24	28	25	20
Site 6 – Stanwell Township	36	40	38	31
Site 7 – Ridgeland	31	29	27	25
Site 8 – Brown’s Lookout	23	23	23	21

At all sites very uniform corrosion was observed on the topside and underneath side of the coupons. No evidence for pitting corrosion was obtained.

An examination of the data shows that:

- *The trend of corrosion values with site is identical for each testing interval.* Found this sentence a bit unclear This is illustrated in Figure 2 for the 12-month corrosion rates. Possible reasons for enhanced values at certain testing sites will be examined later in this report.

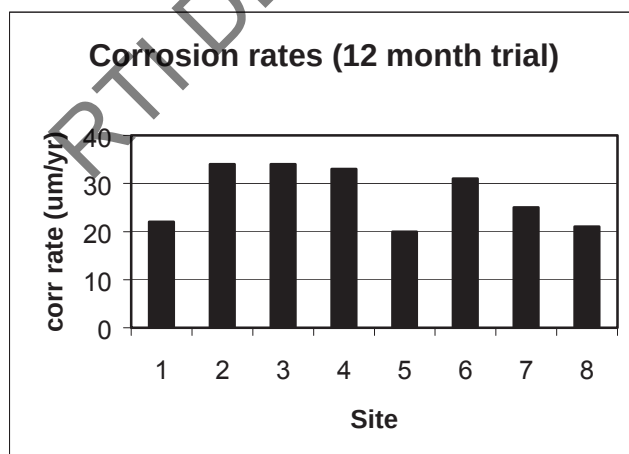


Figure 2: Plot of corrosion rate ($\mu\text{m}/\text{year}$) versus testing site. The 12-month data is used in this figure.

- In general, corrosion rates tend to decrease with time at any particular site. This is consistent with the formation of a protective oxide film on the steel surface, which decreases the corrosion rate. The “six month” data presented in Table 3 is somewhat higher than may be expected on the basis of the above statement. A possible explanation for this is that August and September 1998 were unseasonably wet months for Central Queensland and this may have resulted in enhanced corrosion at all sites. The dependence of corrosion rate with time for the Mercy site is shown in Figure 3 to illustrate the above observation.

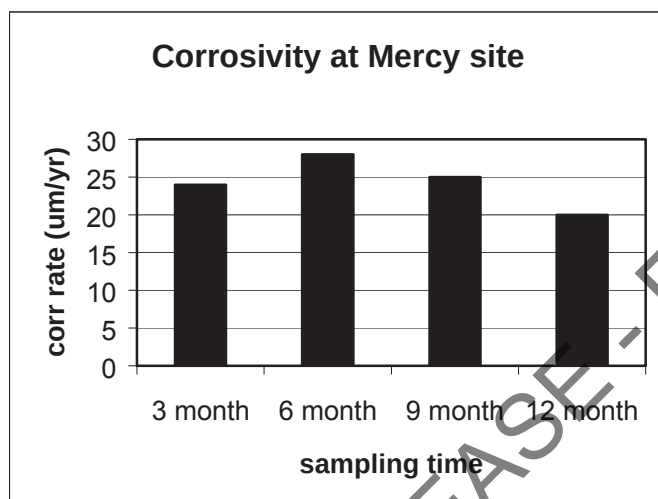


Figure 3: Dependence of Corrosion rate with time at Mercy (site 5)

- The relatively low corrosion rate values obtained at Browns Lookout (Site 8) and Ridglands (Site 7) indicate that the “control” sites were probably well chosen.
- To definitively answer the question as to whether any enhanced corrosivity is attributable to station stack emissions, we would need to compare the corrosion rates in Table 3 to values that existed prior to station commissioning. Such data is not available as no corrosivity measurements were carried out in the Stanwell region in the 1980’s. However, a proposed study to develop a predictive relationship between corrosion rates for mild steel and atmospheric parameters may allow the prediction of a pre-commissioning corrosivity (Druskovich, Best and Evans, 1999).
- The data in Table 3 illustrates that a number of test sites show enhanced atmospheric corrosivity compared to the two control sites. The enhanced corrosivity at most of these sites (site 2: Brooks, site 3: Kalapa, site 4: Sowdens) is consistent with the observation that the wind was blowing towards the site during the corrosion testing interval. The annual wind % as measured at the Seirups and Kalapa air monitoring stations was provided by Katestone Scientific and is compared to the corrosivity in Table 4.

Table 4: Correlation between corrosivity and annual wind %

Location	12 month Corrosivity ($\mu\text{m}/\text{yr}$)	Distance from stack (km)	Annual wind % (Seirups) ¹	Annual wind % (Kalapa) ²
Site 1 – Barnes	22	2.5	24	27
Site 2 – Brooks	34	3	51	52
Site 3 – Kalapa	34	5.5	44	48
Site 4 – Sowdens	33	8	44	48
Site 5 – Mercy	20	3.5	18	22
Site 6 – Stanwell Township	31	2	20	19
Site 7 – Ridgeland	25	27.5	13	7
Site 8 – Brown's Lookout	21	8	15	12

¹ Data from Seirups air-monitoring station were used for the values in this column

² Data from Kalapa air-monitoring station were used for the values in this column

Reposition table 5

Table 5: Repeat corrosivity studies

	Corrosion rate ($\mu\text{m}/\text{year}$)			
Location	3 months	3 month R	6 months	6 months R
Site 1 – Barnes	21	24	26	32
Site 2 – Brooks	45	51	43	45
Site 3 – Kalapa	38	44	39	44
Site 4 – Sowdens	39	45	39	45
Site 5 – Mercy	24	28	28	25
Site 6 – Stanwell Township	36	41	40	30
Site 7 – Ridgeland	31	35	29	33
Site 8 – Brown's Lookout	23	24	23	30

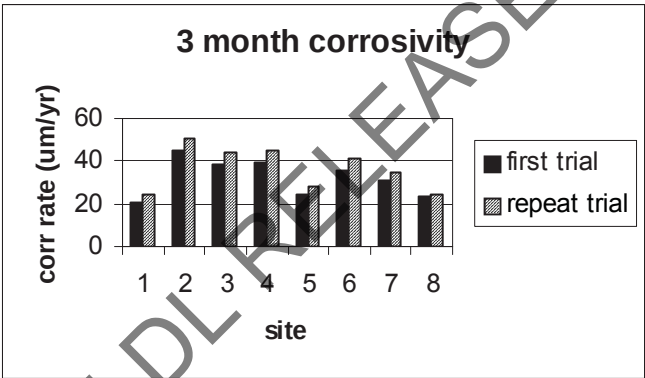
R – Repeat trial

There appears to be a correlation between the annual wind % and the 12-month corrosivity value at each site. No analysis has been attempted in this report since the 8 sites are at different distances from the stack and the correlation would involve at least these three variables. This aspect certainly needs to be further investigated.

The sites at Kalapa and Stanwell Township are close to a major highway and electric railway line used for coal transport and it is likely that some of the atmospheric corrosivity is transportation related. This also is an aspect which warrants further investigation.

Finally, 3 month and 6 month repeat trials were performed starting at 6 months and 9 months after the initial experiment commenced (19.3.98). As in the initial experiment, triplicate coupons were mounted at each site and the reproducibility of the corrosion rate is $\pm 1 \mu\text{m}/\text{year}$ Table 5 summarises the data obtained.

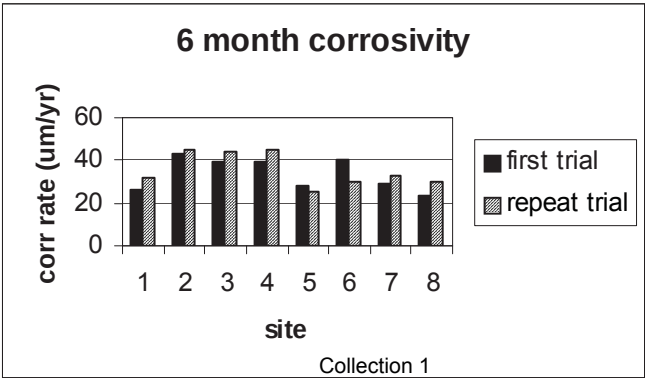
In Figure 4, the corrosivity data for the first trial is compared to the data for the repeat trial and it can be seen that the correlation between the two trials is excellent for the 3-month data, and reasonable for the 6-month data. Site 5 (Mercy) and 6 (Stanwell Township) show lower corrosivity than might be expected for the repeat trial of the 6-



month assessment.

Fig 4: Corrosivity data for 3 and 6 months, showing the correlation between the original trial and repeat trial.
Three-month data: first trial commenced 19.3.98,-second trial commenced 11.12.98
Six-month data: first trial commenced 19.3.98,-second trial commenced 6.10.98

The decrease in the six month “repeat trial” corrosivity at Stanwell Township may be due to the fact that during the trial (6.10.98 to 1.3.99) the wind % to the site was approximately 10% compared to 27% for the initial trial from 19.3.98 to 6.10.98. These values were provided by Katestone Scientific and are included as Appendix 2.



Conclusion

The corrosivity data collected in this series of tests is important in that it is a first step to quantify corrosion rates within the Stanwell airshed. However, it is difficult to attach significance to the numbers obtained because there is no pre-commissioning data available for comparison, nor has there been any attempt to develop a corrosion map for the region. The only data that can be used for comparison at this stage is the ISO classification of corrosivity (ISO 9223:1992(E)) which is reproduced below in Table 6.

Table 6: ISO classification of corrosivity

Corrosivity	Corrosion rate ($\mu\text{m}/\text{year}$)
very low	<1.3
low	1.3 to 25
medium	25 to 50
high	50 to 80
very high	80 to 200

On the basis of the above data the corrosivity in the Stanwell region can be classified as defined by the corrosion sites, is “low” to “medium”.

Finally one can put the measured corrosion rates into some perspective by asking the question of how long will a plate of steel last under certain environmental conditions. If a piece of unpainted mild steel plate of thickness 1mm is corroding uniformly at $34\mu\text{m}/\text{year}$, and the manufacturer has specified that the steel is acceptable for its intended application provided the thickness does not get below 0.5mm, a simple calculation shows that the steel lifetime is about 14 years.

There are a number of assumptions implicit in the above calculation but it does provide a useful ballpark figure when one is trying to translate “corrosion rates” into “expected lifetime of a metal”.

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RTI DL RELEASE - EHP

Response to EHP letter Re: Compilation of dust data relating to the Ash Storage Area

Prepared for

Stanwell Corporation

September 2012

Final

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Glossary

Term	Definition
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Units of measurement

$\mu\text{g}/\text{m}^3$	micrograms per cubic metre
μm	microns
km	kilometre
km/h	kilometre per hour
m	metre
m/s	metres per second
mg	milligram

Air pollutants and chemical nomenclature

PM	Particulate matter (fine dust)
PM _{2.5} and PM ₁₀	Particulate matter less than 2.5 or 10 microns, respectively
TSP	Total suspended particles

Other abbreviations

ASA	Ash Storage Area
EHP	Department of Environment and Heritage Protection
EPP(Air)	Environmental Protection (Air) Policy
OHS	Occupational Health and Safety
SPS	Stanwell Power Station
Stanwell	Stanwell Corporation

Executive Summary

Katestone Environmental has been commissioned by Stanwell Corporation (Stanwell) to assist Stanwell Power Station in compiling a report which contains data directly related to dust from the ash storage area detailed in the letter from the Department of Environment & Heritage Protection (EHP) dated 8 August 2012.

The scope of work included:

- Interpret meteorological conditions during recent dust sampling near the ash storage area and potential impact from the ash storage on the sample (Hi-Vol sampling and Dust Deposition Gauges).
- Review Stanwell's current commitments with respect to dust monitoring and provide recommendations for sampling to best support the determination of potential offsite impacts from the ash storage area.
- Undertake a site visit to Stanwell Power Station to view ash storage and identify suitable monitoring locations.

Activities on the ash storage area that have the potential to generate dust include:

- building of a new cell
- extension of a cell wall
- profiling of the ash storage area once desired height has been achieved
- wind blow dust from exposed areas

Current dust control measures include use of a water truck and scheduling of activities to occur during times when the winds are not strong or blowing towards sensitive receptors.

Air quality monitoring has been conducted by SPS in the vicinity of the ash storage area over the past ten months. This includes a period of Hi-Volume sampling and deployment of four dust deposition monitors.

No exceedences of the EPP(Air) TSP objective were recorded during the Hi-Volume sampling campaign in October 2011. It can be inferred that the PM_{10} objective was also met for these samples as PM_{10} is only a fraction of TSP.

During the period of Hi-Volume sampling the winds were not in the direction from the ash storage area to the monitoring sites for a significant period of the sampling time.

The dust deposition sampling has been conducted for a period of six months at four locations. However, from the sampling undertaken to date it is not possible to determine the percentage contribution of emissions from the ash storage area on these samples.

A dust monitoring plan has been outlined considering the potential effect of operations at the ash storage area on levels of dust at neighbouring sensitive receptors.

1. Introduction

Katestone Environmental has been commissioned by Stanwell Corporation (Stanwell) to assist Stanwell Power Station in compiling a report which contains data directly related to dust from the ash storage area detailed in the letter from the Department of Environment & Heritage Protection (EHP) dated 8 August 2012.

1.1 Issues raised by EHP

An extract of the EHP letter with issues relevant to this work follows:

4. Wind direction data from SPS's meteorological station coincident with the air sampling period

"....EHP requests SPS consider more closely those wind direction and wind speed data on each day over which Hi-Vol sampling was undertaken, and also provide EHP hourly wind direction and wind speed data from the SPS weather station coincident with all sampling dates. A format similar to Table 2 in your letter dated 4 January 2012 would be appropriate for providing such. Further, EHP would appreciate daily wind roses are provided for each of the days on which Hi-Vol sampling was undertaken."

6. Any other air or water sampling SPS has undertaken outside of the immediate plant boundary

"...EHP is also interested to learn if SPS determined the percentage composition of fly ash in the dust deposition bottles in relation to the remainder of particulates collected."

SPS compliance with development approval IPDE00732207

"....EHP strongly recommends SPS engage in a more in depth investigation into monitoring the potential impact on sensitive receptors in the receiving environment. To that end, it is suggested SPS engage the use of appropriate air monitoring equipment to examine the impact on the receiving environment particularly in relation to PM₁₀ concentration and also to provide a detailed analysis of the chemical composition of material sampled. EHP encourages SPS to also specifically analyse samples for fly ash concentration reaching the receiving environment."

1.2 Scope of work

The scope of work includes:

- Interpretation of meteorological conditions during recent dust sampling near the ash storage area and potential impact from the ash storage on the sample (Hi-Vol sampling and Dust Deposition Gauges).
- Review of Stanwell's current commitments with respect to dust monitoring and provision of recommendations for sampling to best support the determination of potential offsite impacts from the ash storage area.
- Completion of a site visit to Stanwell Power Station to view ash storage and identify suitable monitoring locations.

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2. Air quality criteria

The ambient air quality objectives for particulate matter that are relevant in Queensland are presented in Table 1.

Dust nuisance can occur due to the deposition of larger dust particles in residential areas. Elevated dust deposition rates can cause reduced public amenity through, for example, soiling of clothes, building surfaces and other surfaces including roof catchments. A dust deposition guideline is not defined in the EPP Air..

Table 1 Ambient air quality indicators, objectives and guidelines for particulate matter used in Queensland

Indicator	Averaging period	Objective	Source
Particulates (as PM _{2.5}) ^a	24-hour	25 µg/m ³	EPP (Air)
	Annual	8 µg/m ³	EPP (Air)
Particulates (as PM ₁₀) ^b	24-hour	50 µg/m ³	EPP (Air)
Particulates (as TSP)	Annual	90 µg/m ³	EPP (Air)
Note: ^a PM _{2.5} are particles that have aerodynamic diameters that are less than 2.5 µm ^b PM ₁₀ are particles that have aerodynamic diameters that are less than 10 µm ^c Five exceedances allowed per year			

3. Monitoring data

Stanwell commissioned High-volume (Hi-Vol) sampling of Total Suspended Particles (TSP) during the month of October 2011. The results of the sampling were presented in Alstom's report *High Volume Sampling and Analysis for mercury and metals - Stanwell Power Station*, October 2011.

Stanwell also set up four dust deposition gauges (installed in December 2011) as part of a short-term monitoring program aimed at determining concentrations of total, soluble, insoluble, ash and combustible particulate matter. These dust gauges are currently still deployed in the field.

In addition, Stanwell conducts meteorological monitoring at their meteorological station located adjacent to the ash storage area on the Grape Farm property (previously called Seirups). Winds are recorded at both 10m and 30m above ground level.

Katestone recommends that the winds recorded at a height of 30m above ground be taken as representative of wind conditions on the ash storage area. This is because the height of the capped ash storage area is approximately 20m above local ground level and although the meteorological tower is sited in accordance with the Australian Standard there are a large number of treed areas with heights in the order of 15 m above ground level in the surrounding area that may influence the winds recorded at 10m. Therefore the winds recorded at the station at a height of 10m may not be representative of winds at this height in the surrounding area and less representative of winds experienced on top of the ash storage area. The winds recorded at the height of 30m will provide a better indication of the winds experienced on top of the ash storage area. Winds recorded at 30m are generally higher speeds than those recorded at 10m, therefore as we have assumed that there is a higher potential for dust generation during stronger winds, this assumption results in a conservative assessment of the conditions.

The following sections summarise the results of the monitoring and review the meteorological conditions during the sampling periods to determine the potential contribution from the ash storage area on each sample. Figures showing the arc of winds that have the potential to transport dust from the ash storage area to each of the monitoring sites are presented in Figure 2 for the Hi-Volume sampler sites and Figure 3 for the dust deposition gauge sites.

3.1 Hi-Volume

Hi-Volume sampling was undertaken at three locations. Details of the monitoring locations are provided in Table 2 and Figure 1. It should be noted that the intention of this sampling program was to investigate the potential amount of mercury present in the local environment. As a result, the locations of the Hi-Volume sampling sites are not ideal to determine the potential for impacts due to the ash storage area on the nearby sensitive receptors. Notwithstanding this, the data collected is useful and some conclusions can be drawn. The sampling program also demonstrated that the level of mercury in the environment is very low and well below air quality objectives.

Table 2 Hi-Volume monitoring stations

Station	Monitoring period for analysis	Location ¹	Approximate Distance from the site	Direction from ash storage area
Grape Farm	12, 13, 14, 17, 18 October 2011	224,381 mE 7,396,494 mW	0.5 km	SW
Woodlands	19, 20, 21 October 2011	223,162 mE 7,398,197 mW	1.7 km	NW
State Farm	25, 26, 27, 28 October 2011	223,831 mE 7,398,902 mW	1.8 km	NNW

¹ Datum MGA94 1997 Zone 56

Hi-Volume sampling was undertaken in accordance with:

- AS 3580.1.1 2007: Ambient Air sampling and analysis, Guide for siting air monitoring equipment
- AS 3580.9.3 2003: Ambient Air particulate matter, determination of total suspended particulate matter (TSP) – High volume sampler gravimetric method

Results of the Hi-Volume monitoring are summarised in Table 3 and plotted in Figure 6

Table 3 TSP results (Source: Alstom 2011)

Location	Filter No.	Start Date ²	Run Time (Hours)	TSP($\mu\text{g}/\text{Nm}^3$) ¹
Grape Farm	000808	12/10/11 11:00am	22.43	28.1
Grape Farm	000812	13/10/11 11:00am	10.43	35.8
Grape Farm	000815	14/10/11 11:00am	68.87	20.6
Grape Farm	000814	17/10/11 11:00am	22.98	31.4
Grape Farm	000813	18/10/11 11:00am	22.98	30.3
Woodlands	000811	19/10/11 11:00am	22.82	19.1
Woodlands	000810	20/10/11 11:00am	22.98	25.8
Woodlands	000816	21/10/11 11:00am	91.93	23.1
State Farm	000821	25/10/11 11:00am	22.98	18.7
State Farm	000817	26/10/11 11:00am	24.53	20.5
State Farm	000818	27/10/11 11:00am	21.37	18.2
State Farm	000819	28/10/11 11:00am	25.55	16.6
Notes: ¹ Sample volumes were corrected to STP (1 atm and 0°C) ² The exact start time for each sample has not recorded, however on consultation with SPS personnel who collected the samples an approximate time of 11am was selected.				

Presentation of wind roses, scatter plots and time series of wind speed and direction at both 10m and 30m recorded at the Stanwell meteorological station for each sampling period can be found in the figures presented at the end of this report (see Figure 7 to Figure 42). A summary of the data is presented in the following table along with an analysis of the percentage of sampling period winds were recorded in an arc that has the potential to take any dust emissions from the ash storage area across the monitoring site. A graphical presentation of the wind arc of importance for each monitoring site is presented in Figure 2.

Table 4 Analysis of likely contribution from ASA on Hi-Volume sampling days

Location	Date	TSP ($\mu\text{g}/\text{m}^3$)	Percentage of winds from direction of ASA to monitoring site during sampling period		Summary of meteorological conditions	Likely contribution from ASA
			At 10m	At 30m		
Grape Farm	12/10/11	28.1	<1%	0	Winds were predominately light to moderate easterly and east-northeasterly at 10m and moderate southwesterly and south-southwesterly at 30m. Little or no winds in the direction from the ASA to the monitoring site for this period.	Low
Grape Farm	13/10/11	35.8	<1%	0	Winds were predominately moderate to strong easterly and east-northeasterly at 10m and strong southerly to southwesterly at 30m. Little or no winds in the direction from the ASA to the monitoring site for this period.	Low
Grape Farm	14/10/11	20.6	13%	4%	Winds were predominately light to moderate northeasterly at 10m and light easterly to southerly to westerly at 30m. There is a small percentage of time (between 3 to 9 hours over the three day sampling period) when winds were in the direction from the ASA to the monitoring site. Dust lift off is possible for a small period due to moderate winds recorded at 10m.	Low- Medium
Grape Farm	17/10/11	31.4	0	0	Winds were predominately moderate to strong easterly to east-southerly at 10m and moderate to strong southerly and southwesterly at 30m. Dust lift off possible due to strong winds, however direction not consistent with sampling site. No winds in the direction from the ASA to the monitoring site for this period.	Low

Location	Date	TSP ($\mu\text{g}/\text{m}^3$)	Percentage of winds from direction of ASA to monitoring site during sampling period		Summary of meteorological conditions	Likely contribution from ASA
			At 10m	At 30m		
Grape Farm	18/10/11	30.3	0	0	Winds were predominately moderate to strong east to east-southeasterly at 10m and strong to very strong southerly and southwesterly at 30m. Dust lift off possible due to strong winds, there were no winds in the direction from the ASA to the monitoring site for this period.	Low
Woodlands	19/10/11	19.1	26%	0	Winds were predominately light to moderate easterly and east-southeasterly at 10m and moderate southerly to southwesterly at 30m. Winds are strong enough to result in potential dust lift off from the ash storage area. There is a small percentage of time (6 hours over the one day sampling period) when winds were in the direction from the ASA to the monitoring site as recorded at 10m. Winds recorded at 30m are more representative of winds on top of the ASA and no winds were in the direction from the ASA to the monitoring site at 30m.	Low-Medium
Woodlands	20/10/11	25.8	38%	0	Winds were predominately light to moderate east-southeasterly at 10m and south-southwesterly to southwesterly at 30m. There is a percentage of time (9 hours over the one day sampling period) when winds were in the direction from the ASA to the monitoring site as recorded at 10m. Winds recorded at 30m are more representative of winds on top of the ASA and no winds were in the direction from the ASA to the monitoring site at 30m.	Low-Medium

Location	Date	TSP ($\mu\text{g}/\text{m}^3$)	Percentage of winds from direction of ASA to monitoring site during sampling period		Summary of meteorological conditions	Likely contribution from ASA
			At 10m	At 30m		
Woodlands	21/10/11	23.1	3%	3%	Winds were predominately moderate to strong easterly and east-northeasterly at 10m and moderate to strong from the south at 30m. There was a small percentage of time (3 over the four day sampling period) when winds were in the direction from the ASA to the monitoring site. Dust lift off is possible for a small period due to moderate to strong winds	Low
State Farm	25/10/11	18.7	<1%	18%	Winds were light to moderate from the northerly to easterly direction at 10m and southeasterly to southerly to southwesterly direction at 30m. Winds recorded at 30m were towards the monitoring site for 4 hours during the 24 hour sampling. The winds were strong enough to potentially result in dust lift off for some of that time.	Medium
State Farm	26/10/11	20.5	0	14%	Winds were predominately light to moderate east-northeasterly and northeasterly at 10m and light to moderate southerly to southwesterly at 30m. Winds recorded at 30m were towards the monitoring site for 3 hours during the 24 hour sampling. The winds were strong enough to potentially result in dust lift off for some of that time.	Medium
State Farm	27/10/11	18.2	0	9%	Winds were predominately light to moderate easterly and east-northeasterly at 10m and light to moderate southwesterly and south-southwesterly at 30m. Winds recorded at 30m were towards the monitoring site for 2 hours during the 24 hour	Medium

Location	Date	TSP ($\mu\text{g}/\text{m}^3$)	Percentage of winds from direction of ASA to monitoring site during sampling period		Summary of meteorological conditions	Likely contribution from ASA
			At 10m	At 30m		
					sampling. The winds were strong enough to potentially result in dust lift off for some of that time.	
State Farm	28/10/11	16.6	0	8%	Winds were predominately light to moderate easterly and east-northeasterly at 10m and light to moderate southwesterly at 30m. Winds recorded at 30m were towards the monitoring site for 2 hours during the 24 hour sampling. The winds were strong enough to potentially result in dust lift off for a small percentage of that time.	Low

The analysis and summary of conditions during each of the Hi-Volume sampling days presented in the table above shows the following:

- The highest levels of dust were recorded at the Grape Farm monitoring site.
- Over the six days of sampling conducted at the Grape Farm only ten hours were winds recorded in the direction likely to carry emissions from the ash storage area to the monitoring site.
- Over the six days of sampling conducted at the Woodlands monitoring site only three hours were winds recorded in the direction likely to carry emissions from the ash storage area to the monitoring site.
- Over the four days of sampling conducted at the State Farm monitoring site only eleven hours were winds recorded in the direction likely to carry emissions from the ash storage area to the monitoring site.

3.2 Dust deposition gauges

Dust deposition gauges have been installed at four locations. Details of the monitoring locations are provided in Table 5 and Figure 1.

Table 5 Dust deposition gauge monitoring sites

Station	Monitoring period for analysis	Location ¹	Approximate distance from monitor to the ASA	Direction from ASA
DG1	Dec 2011 – Jul 2012 ²	224134 mE 7397410 mN	0.4 km	NW
DG2	Dec 2011 – Jul 2012 ²	224217 mE 7397168 mN	0.2 km	W
DG3	Dec 2011 – Jul 2012 ²	224397 mE 7396875 mN	0.2 km	SW
DG4	Dec 2011 – Jul 2012 ²	223759 mE 7397486 mN	0.8 km	WNW
Notes ¹ Datum MGA94 Zone 56 ² Dust deposition data was not captured between 8 February and 1 April 2012				

The results of the dust deposition sampling were supplied to Katestone. Sampling was undertaken in accordance with:

- AS 3580.1.1 2007: Ambient Air sampling and analysis, Guide for siting air monitoring equipment
- AS 3580.10.1 2003: Determination of particulate matter – deposited matter gravimetric method.

The results of the sampling were corrected to a monthly deposition rate. The sampling results for both total insoluble matter and ash are presented in this report. It should be noted that the ash referred to in the context of dust deposition monitoring is not directly related to ash from the ash storage area. The Australian Standard defines ash as the mass of the proportion of the insoluble matter remaining after combustion.

The meteorological data from the Stanwell Meteorological station at the time of the monitoring was reviewed with the dust deposition results and several types of plots are presented in Figure 41 to Figure 58. The plots presented are:

- Bar charts of ash content and total insoluble matter at the four monitoring locations for each month
- Wind roses at 10m and 30m for period of sampling
- Scatter plots of wind speed vs. wind direction at 10m and 30m for period of sampling.

A summary of the data is presented in the Table 6 along with an analysis of the percentage of sampling period winds were recorded in an arc that has the potential to take any dust emissions from the ash storage area across the monitoring site. A graphical presentation of the wind arc of importance for each monitoring site is presented in Figure 3.

It should be noted that a dirt carpark was opened in April 2012 next to DG1, potentially affecting the amount of dust deposition recorded from April onwards (at this stage the

carpark will be operational until September 2012). Depending on the wind direction during the time when the cars were arriving and departing it is also possible that this dust also impacts on DG2 and DG4.

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Table 6 Analysis of likely contribution from ash storage area during dust deposition sampling periods

Sampling Period	Site	Monthly average ³			Percentage of winds from direction of ASA to monitoring site during sampling period		Summary of meteorological conditions	Likely contribution from ASA
		Ash Content (mg/m ² /day)	Total Insoluble Matter (mg/m ² /day)	Ash Content %	10m	30m		
21 Dec 2011 to 20 Jan 2012	DG1	97	140	69	31%	22%	Winds were predominately light to moderate easterly to east-northeasterly at 10m and moderate to strong southeasterly to southerly to southwesterly at 30m. Winds recorded at 10m and 30m were towards DG1 and DG2 and are strong enough to potentially result in dust lift off for some of that time. While winds are also toward DG4 it is unlikely that any dust lift off would travel far enough to DG4. Winds from the ash storage area towards DG3 are unlikely to be strong enough to result in significant dust lift off.	Medium to High
	DG2	130	167	78	51%	22%		Medium to High
	DG3	47	83	57	20%	11%		Low
	DG4	23	47	49	21%	12%		Low
20 Jan 2012 to 27 Jan 2012 ¹	DG1	40	63	63	34%	15%	Winds were predominately light to moderate easterly to east-northeasterly at 10m and light to moderate southwesterly at 30m. The majority of winds from ash storage area to DG1, DG2 DG3 and DG4 were light and not likely to generate significant dust lift off.	Low
	DG2	47	80	59	60%	14%		Low
	DG3	53	83	64	26%	8%		Low
	DG4	27	57	47	25%	9%		Low

Sampling Period	Site	Monthly average ³			Percentage of winds from direction of ASA to monitoring site during sampling period		Summary of meteorological conditions	Likely contribution from ASA
		Ash Content (mg/m ² /day)	Total Insoluble Matter (mg/m ² /day)	Ash Content %	10m	30m		
27 Jan 2012 to 8 Feb 2012 ²	DG1	33	63	52	42%	11%	Winds are predominately light to moderate easterly to east-southeasterly at 10m. Winds at 30m were predominately moderate to strong with the majority from the southwest and west. Whilst winds at 30m were strong enough for dust lift off, a very small percentage of winds were in the direction of the ash storage area to the monitoring locations.	Low
	DG2	60	100	60	69%	11%		Low
	DG3	57	93	61	16%	10%		Low
	DG4	13	43	30	29%	6%		Low
1 Apr 2012 to 30 Apr 2012	DG1	33	47	70	28%	17%	Winds were light to moderate easterly through to southerly at 10m. Winds at 30m were from all directions with the strongest winds from the south, southwest and west. The majority of winds from ash storage area to sampling sites were light and not likely to generate dust lift off. The stronger winds required for dust lift at 30m were away from the sampling sites.	Low
	DG2	13	27	48	34%	18%		Low
	DG3	17	40	43	13%	13%		Low
	DG4	13	33	39	19%	11%		Low

Sampling Period	Site	Monthly average ³			Percentage of winds from direction of ASA to monitoring site during sampling period		Summary of meteorological conditions	Likely contribution from ASA
		Ash Content (mg/m ² /day)	Total Insoluble Matter (mg/m ² /day)	Ash Content %	10m	30m		
1 May 2012 to 31 May 2012	DG1	90	110	82	27%	16%	Light winds were predominately from the south (southwesterly to southerly to southeasterly), while moderate winds were predominately from the east at 10m. At 30m moderate to strong winds were from the south and southeast, whilst light winds were predominately from the north. Winds recorded at 30m were towards the sampling sites and are strong enough to potentially result in dust lift off for some of that time.	Medium
	DG2	73	93	78	33%	13%		Medium
	DG3	50	97	52	14%	26%		Medium
	DG4	77	133	58	18%	8%		Medium
1 Jun 2012 to 30 Jun 2012	DG1	57	73	78	13%	12%	Winds were predominately light westerly to southwesterly to southerly at 10m. Winds at 30m were light and from all directions, but the majority of winds were from the northwest. Majority of winds from ash storage area to sampling sites were light and not likely to generate dust lift off.	Low to medium
	DG2	27	43	63	13%	15%		Low
	DG3	43	70	61	23%	30%		Low
	DG4	20	43	47	7%	8%		Low
Note ¹ Dust bottles were collected after seven days, therefore results are not in accordance with the Australian Standard ² Dust bottles were collected after twelve days, therefore results are not in accordance with the Australian Standard ³ Monthly average reported in sampling reports converted to units of mg/m ² /day assuming a 30 day sampling period								

From inspection of Table 6 the following conclusions can be drawn:

- Over the 130 days of sampling conducted at DG1, the equivalent number of days the winds were recorded in the direction likely to carry emissions from the ash storage area to the monitoring site was between 21 to 36.
- Over the 130 days of sampling conducted at DG2, the equivalent number of days the winds were recorded in the direction likely to carry emissions from the ash storage area to the monitoring site was between 21 to 50.
- Over the 130 days of sampling conducted at DG3, the equivalent number of days the winds were recorded in the direction likely to carry emissions from the ash storage area to the monitoring site was 23.
- Over the 130 days of sampling conducted at DG4 the equivalent number of days the winds were recorded in the direction likely to carry emissions from the ash storage area to the monitoring site was between 12 to 24.
- A review of the winds conditions during the period of dust deposition sampling indicates that the winds were in the direction from the ash storage area to the monitoring sites for some time during the sampling period. However, from the sampling undertaken to date, it is not possible to determine the percentage of the contribution of emissions from the ash storage area on these samples.

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4. Dust monitoring plan

A dust monitoring plan to best capture the potential effect of operations at the ash storage area on levels of dust at neighbouring residences is presented in this section and has considered the following:

- activities and location of dust sources;
- dust parameters to measure and the averaging period;
- the types of monitors available;
- power and requirements of the site;
- considerations for siting of dust monitors; and
- data collection, storage and reporting.

Expectations of EHP presented in its letter dated 8 August 2012 include:

- concentrations of PM₁₀ in the receiving environment
- detailed analysis of the chemical composition of the material sampled (specifically fly ash).

4.1 Site inspection

On Friday 24 August Ms Christine Killip of Katestone visited the Stanwell Power Station with the following aims:

- inspect the activities on the ash storage
- inspect the current dust monitoring sites
- determine a suitable location for future dust monitoring.

A map of the potential dust sources in the area is provided in Figure 59. These sources were considered in the selection of an appropriate site for the dust monitor.

4.2 Ash storage area activities

This section presents a description of the activities on the ash storage area and a summary of the potential sources of dust.

Ash is pumped as a slurry from the power station to the top of the ash storage area in pipes. The pipes release the wet ash slurry down the active face of the storage cell. A cross-sectional schematic of the ash storage area is presented in Figure 60.

The width of the active face spans the width of the ash storage area of approximately 500m (see Figure 61). The entire ash storage area is surrounded by a bund wall approximately 14m above local ground level. The active face may consist of two or more cells. The slurry being pumped down the active cell face is wet and therefore has minimum dust potential. Once the slurry reaches the height of the cell wall, the next cell along the active face is then used and the full cell is left to dry out before a front end loader can drive across the surface and dig out the slurry to make the cell wall higher (see Figure 62). This activity occurs infrequently. The cell surface and walls are very hard once dry, as a crust is formed (like concrete). During activities such as extending the cell walls the crust is broken and therefore there is potential for dust to be generated.

Once the cells have reached the desired final height (approximately 20m above local ground level) a dozer profiles the top and then adds topsoil (see Figure 63). Once the topsoil is added, grass starts to grow almost immediately and is typically vegetated in 2-3 months.

Dust is controlled on the site by a water truck, which is used when needed, for example, when topsoil is cleaned to start a new line of cells or on top of the active face during strong winds. Due to the steep nature of the active face it is not possible to use a water truck on this surface.

4.2.1 Review of dust monitoring equipment

There are a wide range of monitors that can measure dust concentrations in the atmosphere. This section presents the available monitors that would meet the requirements for monitoring dust at Stanwell. A detailed matrix of dust monitoring equipment has been compiled and is provided in Appendix A.

The decision of which dust monitor to use for the Stanwell monitoring program should take into consideration all of the information provided. The priorities for this monitoring site would be:

- Compliance with the Australian Standards for monitoring and sampling of 24-hour average PM₁₀
- Reliability of the measurements
- Frequency of maintenance or sample collection requirement
- Ability to collect a sample for chemical analysis.

A summary of the dust monitoring matrix detailing a range of properties for the preferred dust monitors and samplers is shown in Table 7.

Table 7 Preferred dust monitors

Property	Monitor/Sampler	
	BAM 1020	Low volume sampler
Technique employed	beta attenuation	manual gravimetric
Pollutants measured	PM ₁₀	TSP, PM ₁₀ ,
Minimum valid averaging period	1 hour	24 hr
Direct size selection measurement	Yes	Yes
Australian standards (AS), if compliant	AS3580.9.11 (PM ₁₀)	AS3580.9.9 (PM ₁₀)
Maintenance/calibration requirements (1=high, 5=low)	4	2
Power requirement	240VAC (solar possible)	Generally run off battery / solar power, mains option standard)
Comments	Simple design and reliable. USEPA approved for PM ₁₀ , can use solar power	Simple design and reliable. Low cost compliance sampler for PM ₁₀ . collects a sample

The BAM 1020 is recommended for the following reasons:

- Compliant with Australian Standards for monitoring PM₁₀
- Capable of good data resolution and reliable measurements
- Requires only low to moderate amount of maintenance
- Capable of measuring different dust size fractions (if required in the future)
- Can run on solar power
- Provides hourly average data as well as 24 hour average.

The Low volume sampler is recommended for the following reasons:

- Compliant with Australian Standards for monitoring PM₁₀
- Reliable measurements
- Ability to collect a sample for analysis
- Capable of measuring different dust size fractions (if required in the future)
- Can run on solar power
- Portable and low cost
- Potential for external activation of sample.

4.3 Siting requirements

Dust monitors should be sited and operated in accordance with EHP's Air Quality Sampling Manual (EPA, 1997). The manual refers to the Australian Standard when siting a monitoring station.

The Australian Standard for the siting of air quality monitoring equipment (AS3580.1.1) includes the following considerations:

- A sampling unit should be situated so that it can yield data which is representative of the location
- Avoid sites that have restricted airflows in the vicinity of the sampling inlet, such as sites adjacent to buildings, walls, trees, etc.
- Avoid sites that are adjacent to objects that may alter pollutant concentrations by absorption or adsorption
- Avoid sites where chemical interference with the measured pollutant may occur
- Avoid sites where physical interference may produce atypical results
- Ground level sampling sites (sample inlet less than 5 metres above ground level) are generally preferable in sparsely built up areas
- Sampling sites should not be affected by extraneous local emissions
- Local activities around a sampling site may change its suitability as a site, either temporarily or permanently.

Specific requirements in the Australian Standard for siting dust monitoring equipment are summarised below:

- Clear sky angle of 120° above sampling inlet
- Unrestricted airflow of 360° around sample inlet
- 10 metres from dripline of trees
- No extraneous sources nearby
- Greater than 5 metres from source.

In addition to the Australian Standard requirements we recommend the following when selecting suitable sites for monitoring:

- Seek sites that are secure and have a low potential for vandalism
- Seek sites that have adequate access for transporting equipment, e.g. instruments, cylinders of calibration gas
- Seek sites that are not prone to natural disasters, e.g. flooding
- Seek sites that have adequate and reliable communication services e.g. phone, ADSL lines, radio or wireless data transfer with line-of-sight requirements

- Seek sites where noise levels generated by pumps or air conditioners or maintenance and calibration activities do not impose on the local residents/ population. The station location should be selected in order to minimise the impact on the general activities of the local population and should not be restrictive on the intended usage of the location; e.g. when situated in a public park or sports ground ensure the monitoring equipment location does not restrict normal activities
- Seek sites where access times accord with the intended data capture rates; e.g. if data capture rates are stipulated as 90 percent for the project it is obvious that access after normal working hours and during weekends will be required to remedy equipment failures or perform unscheduled maintenance activities
- Seek sites where personnel will be able to perform their activities in a safe environment and workplace in accordance with OHS regulatory requirements. Look out for unsafe exposure to traffic, radiation, weather, security, and the like.

A suitable location for the dust monitoring station was evaluated during the site visit by Katestone personnel (see Figure 64 for photos and Figure 59 for location). The site selected has the following attributes:

- Meets the Australian Standard for siting of dust monitors
- Is well removed from dust sources other than the ash storage area (i.e. dirt roads and car parks)
- Is near to the existing Stanwell meteorological station
- Good access
- Located on land owned by Stanwell
- The predominant wind direction (see Figure 65) in the area is from the east-northeast to east and therefore the site is downwind of the ash storage area for the majority of the time.

It should be noted that there are some trees in the near vicinity of the site that will need to be monitored to ensure the site remains compliant with the Australian Standards if the trees grow.

5. Summary of potential ash storage area impacts

Activities on the ash storage area that have the potential to generate dust include:

- building of a new cell
- extension of a cell wall
- profiling of the ash storage area once desired height is achieved
- wind blow dust from exposed areas.

Current dust control measures include use of a water truck and scheduling of activities to occur during times when the winds are not strong or towards sensitive receptors.

Air quality monitoring has been conducted by SPS in the vicinity of the ash storage area over the past ten months. This includes a period of Hi-Volume sampling and deployment of four dust deposition monitors.

No exceedences of the EPP(Air) TSP objective were recorded during the Hi-Volume sampling campaign in October 2012. It can be inferred that the PM₁₀ objective was also met for these samples as PM₁₀ is always a fraction of TSP.

From the Hi-Volume sample analysis presented in Table 6 it can be seen that:

- The highest levels of dust were recorded at the Grape Farm monitoring site.
- Over the six days of sampling conducted at the Grape Farm only ten hours were winds recorded in the direction likely to carry emissions from the ash storage area to the monitoring site.
- Over the six days of sampling conducted at the Woodlands monitoring site only three hours were winds recorded in the direction likely to carry emissions from the ash storage area to the monitoring site.
- Over the four days of sampling conducted at the State Farm monitoring site only eleven hours were winds recorded in the direction likely to carry emissions from the ash storage area to the monitoring site.

The Hi-Volume sampling did not conclusively show that there is no potential for offsite impacts due to dust emissions from the ash storage area as the winds were not in the direction of the monitoring sites for a significant period of the sampling time.

The dust deposition sampling has been conducted for a period of six months at four locations. However, from the sampling undertaken to date it is not possible to determine the percent contribution of emissions from the ash storage area to these samples.

The dust monitoring plan outlined in this report considered the following:

- activities and location of dust sources (both from the ash storage area and other sources in the area, such as dirt roads)
- dust parameters to measure and the averaging period
- the types of monitors available
- power and requirements of the site
- considerations for siting of dust monitors
- data collection, storage and reporting.
- ability to record concentrations of PM₁₀ in the receiving environment
- ability to collect a sample for subsequent analysis of the chemical composition of the material sampled (specifically fly ash).

6. References

Australian Standard 2007, Methods for sampling and analysis of ambient air, Part 1.1: Guide to siting air monitoring equipment. AS3580.1.1:2007.

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Queensland Environmental Protection Agency 1997, Air Quality Sampling Manual, Queensland Government 1997

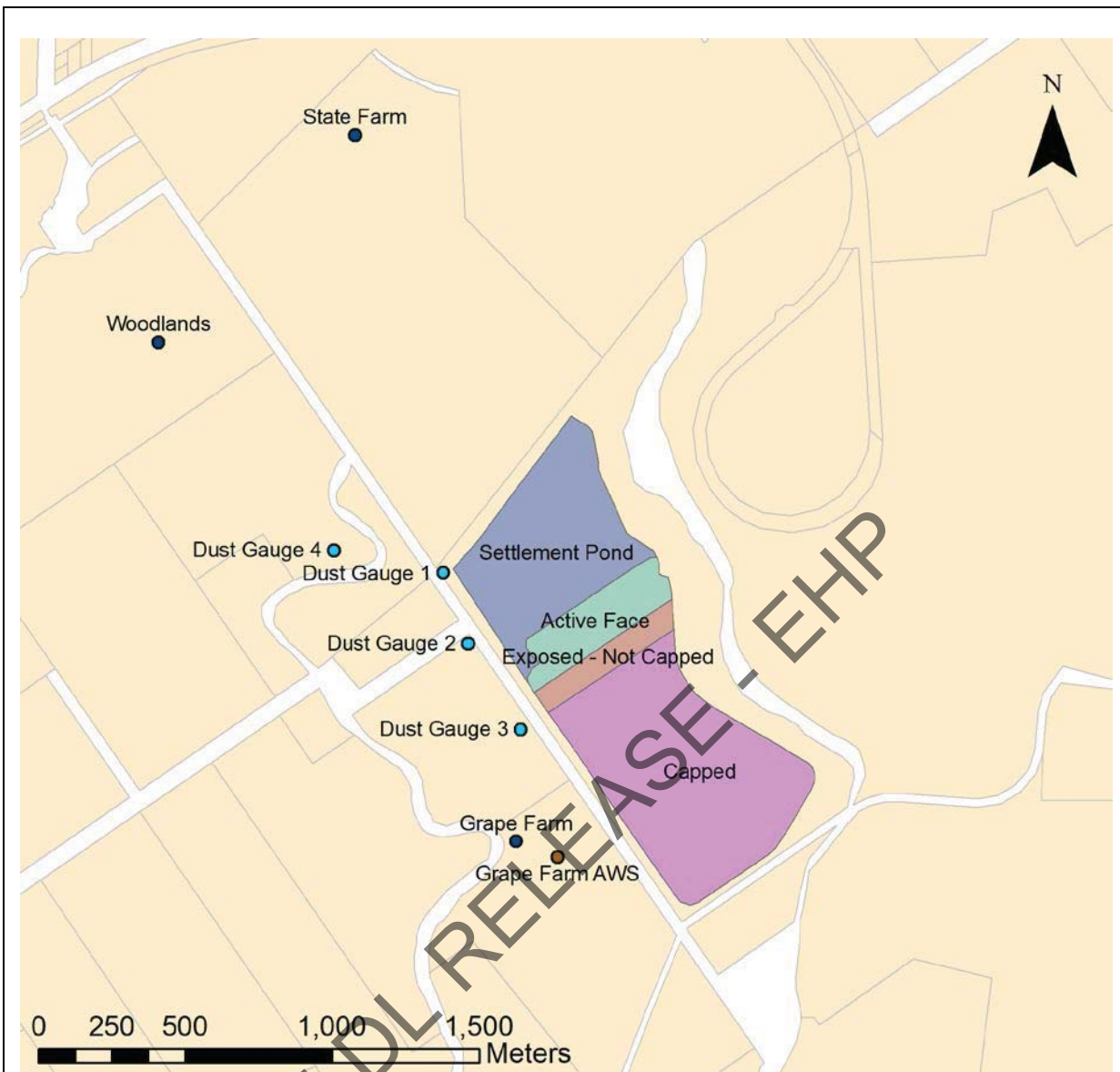


Figure 1 Location of Hi-Vols and dust deposition gauges

Location: Stanwell	Data source: Stanwell Corporation	Units: Projection MGA94 Zone
Type: Aerial map	Prepared by: Michael Burchill	Date: August 2012

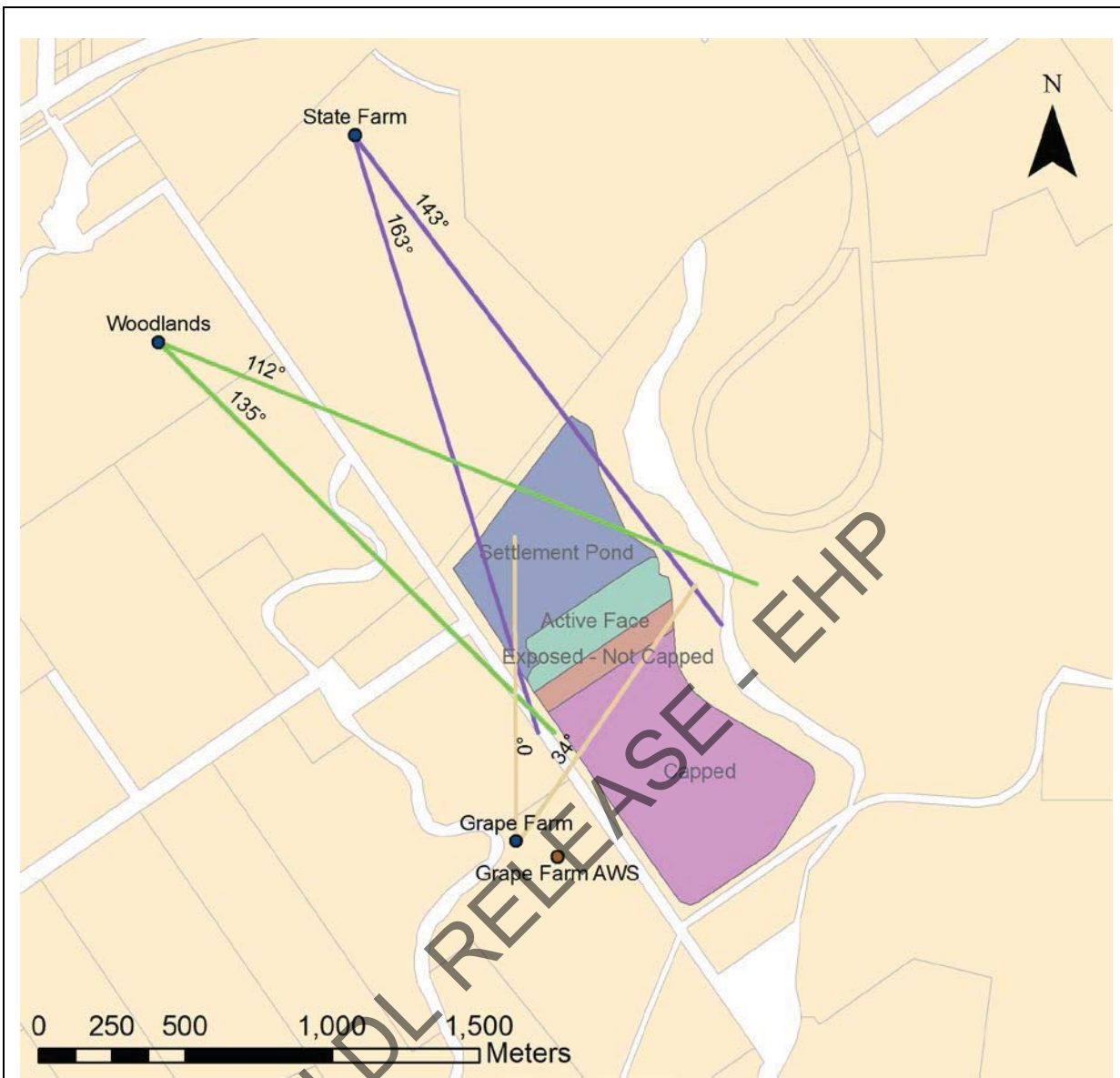


Figure 2 Angles of influence for dust from ash storage area to each Hi-Volume Sampler site

Location: Stanwell	Data source: Stanwell Corporation	Units: Projection MGA94 Zone
Type: Aerial map	Prepared by: Michael Burchill	Date: August 2012

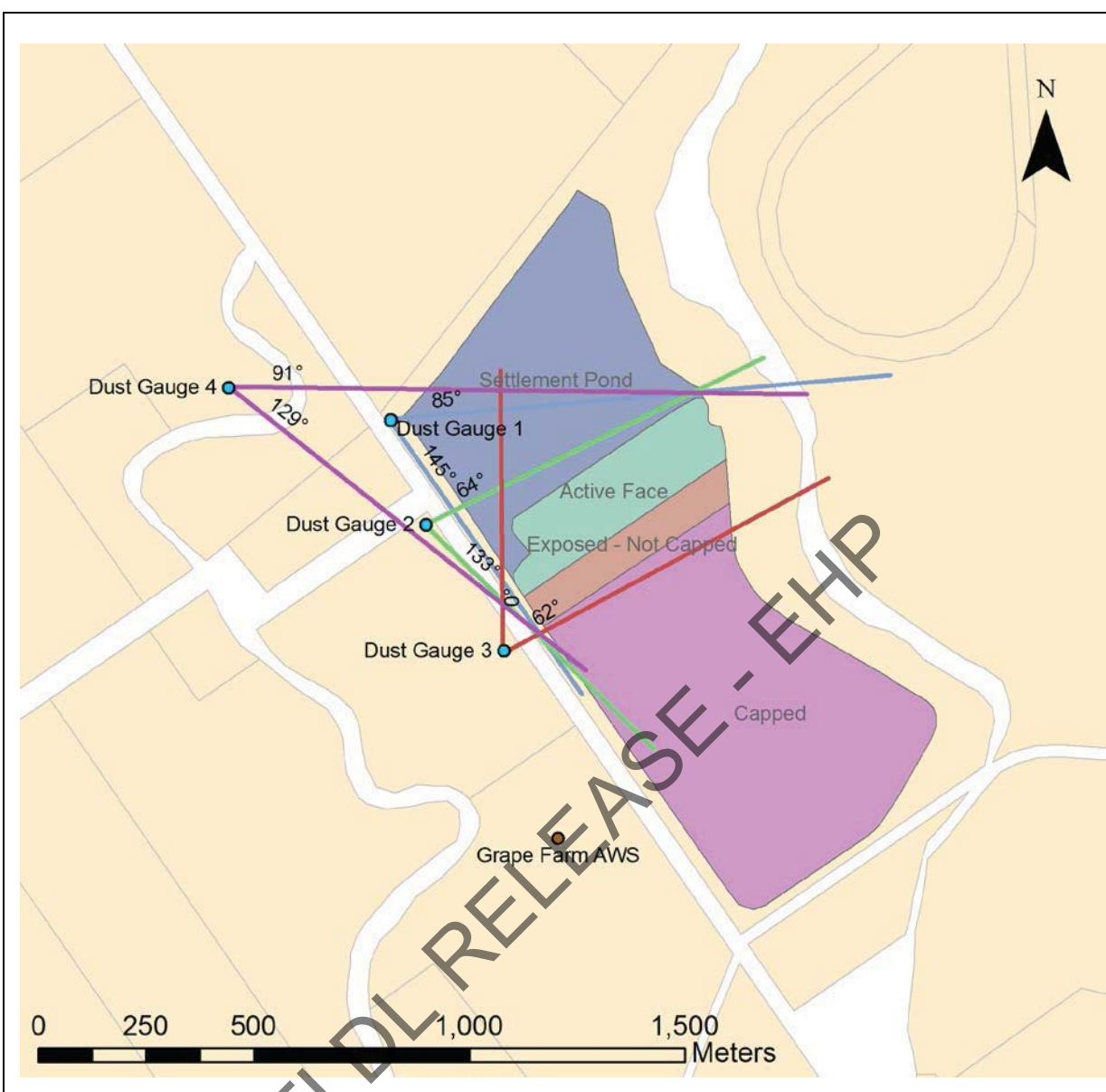


Figure 3 Angles of influence for dust from ash storage area to each dust deposition gauge

Location: Stanwell	Data source: Stanwell Corporation	Units: Projection MGA94 Zone
Type: Aerial map	Prepared by: Michael Burchill	Date: August 2012

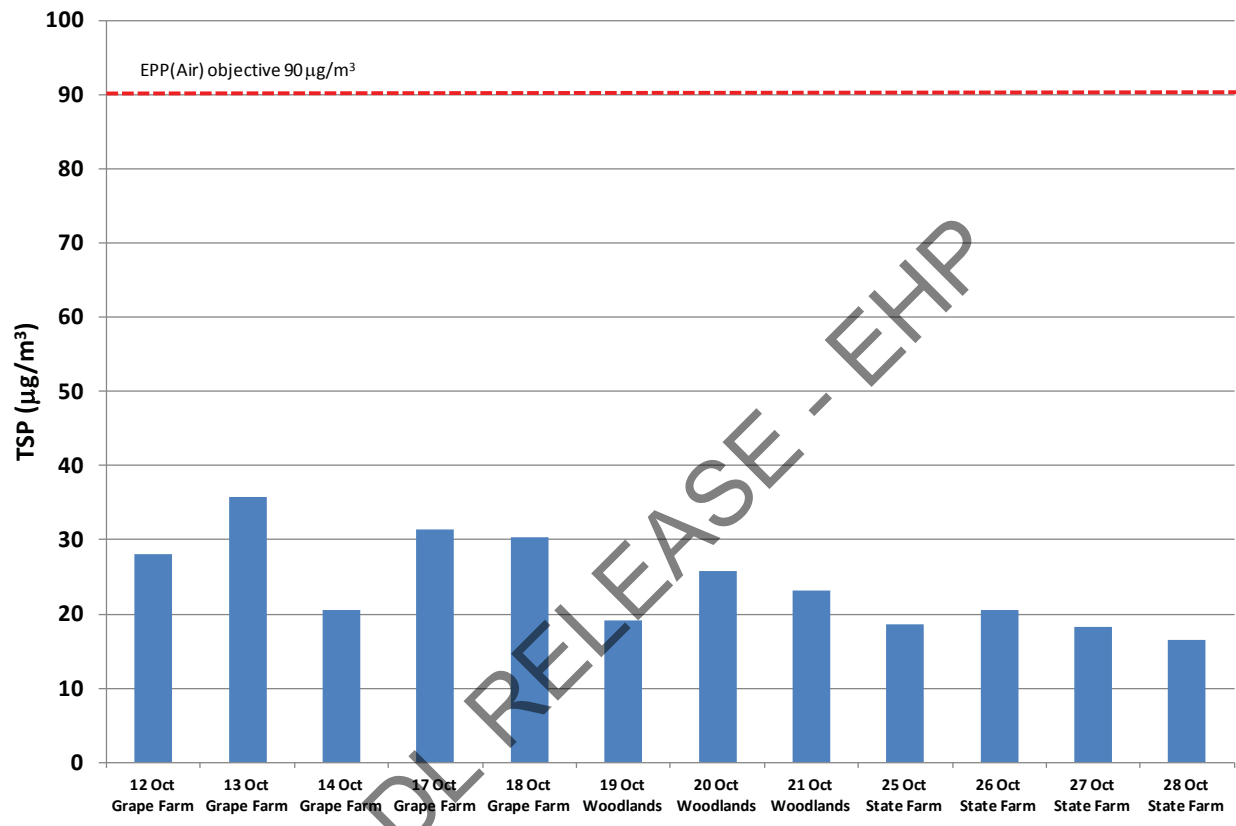


Figure 4 Concentration of TSP (Hi-Vol) monitoring

Location: Stanwell	Period: October 2011	Data source: Alstom	Units: µg/m³
Type: Bar Chart		Prepared by: N. Shaw	Date: August 2012

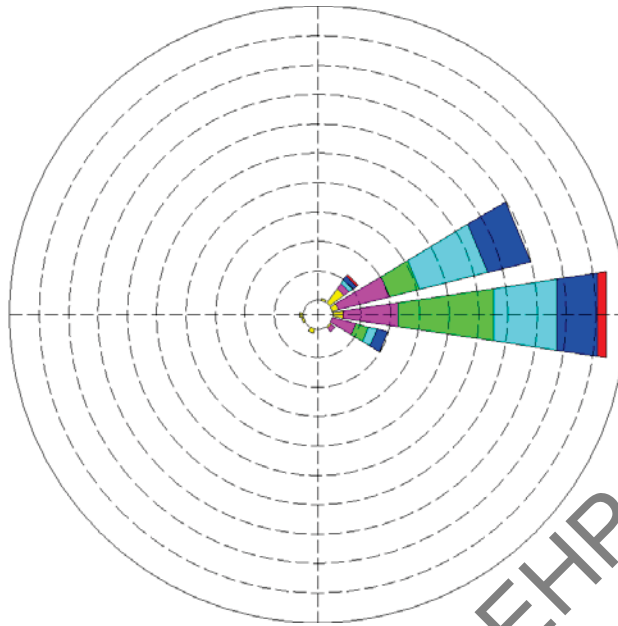
(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	Red
9.0 to < 10.0	Orange
8.0 to < 9.0	Yellow
7.0 to < 8.0	Light Green
6.0 to < 7.0	Green
5.0 to < 6.0	Dark Green
4.0 to < 5.0	Blue
3.0 to < 4.0	Light Blue
2.0 to < 3.0	Very Light Blue
1.0 to < 2.0	White
0.0 to < 1.0	Yellow

Calms = 0
Missing = 0
Total valid = 270



(b) 30m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	Red
9.0 to < 10.0	Orange
8.0 to < 9.0	Yellow
7.0 to < 8.0	Light Green
6.0 to < 7.0	Green
5.0 to < 6.0	Dark Green
4.0 to < 5.0	Blue
3.0 to < 4.0	Light Blue
2.0 to < 3.0	Very Light Blue
1.0 to < 2.0	White
0.0 to < 1.0	Yellow

Calms = 0
Missing = 0
Total valid = 270

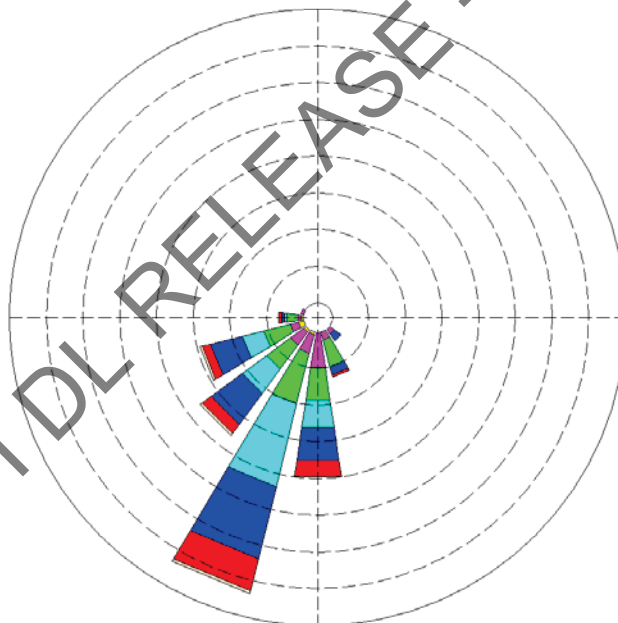
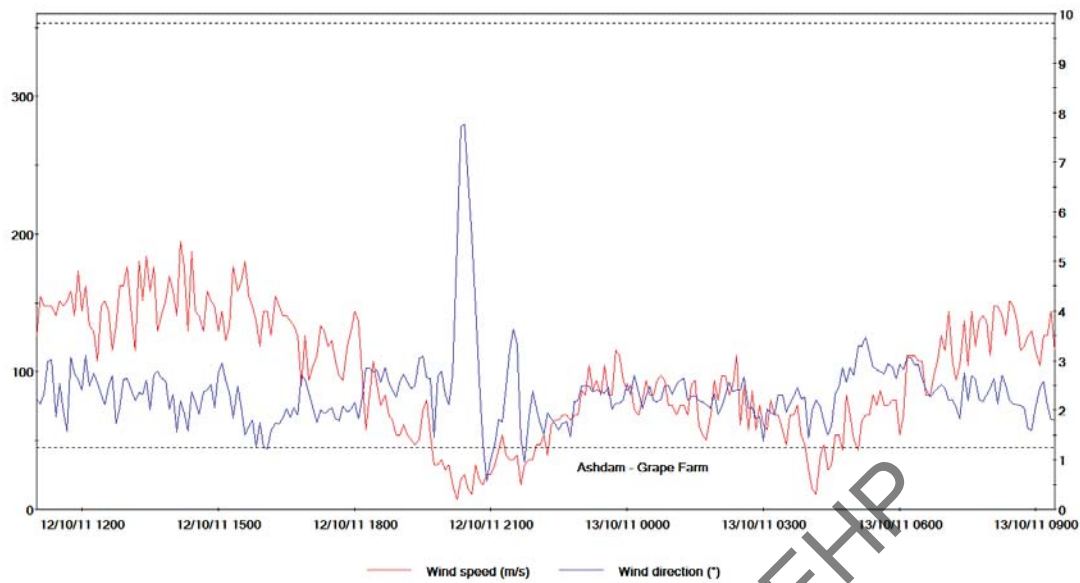


Figure 5 12 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape farm	Period: 12/10/11 11:00 – 13/10/11 09:25	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min records: 270	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

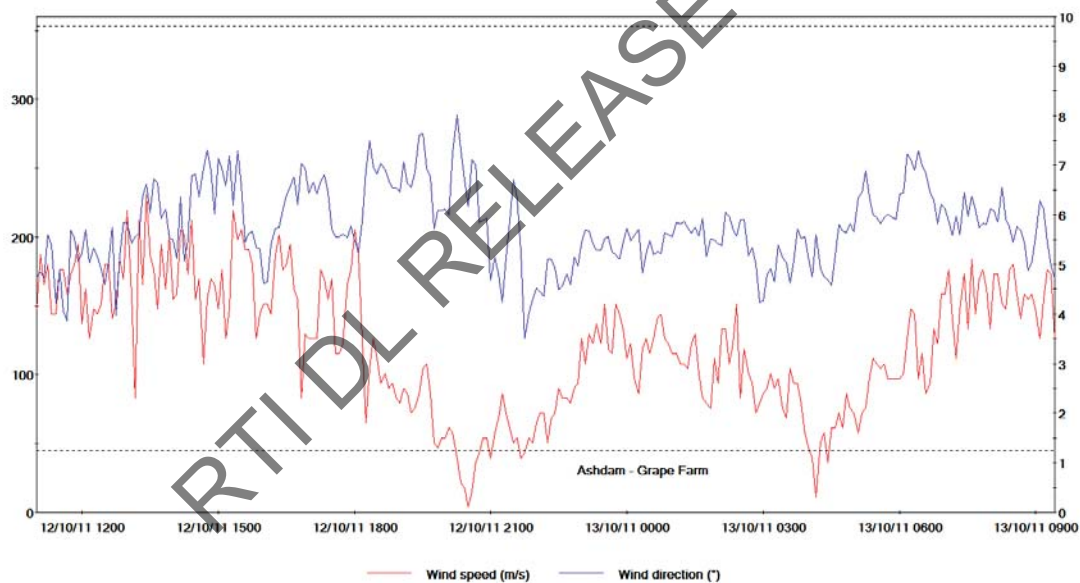
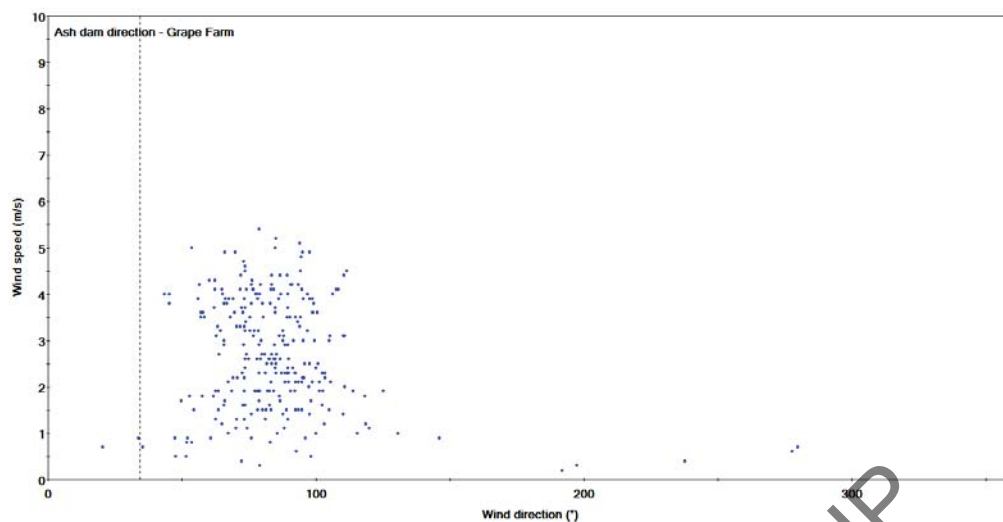


Figure 6 12 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 12/10/11 11:00 – 13/10/11 09:25	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min records: 270	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

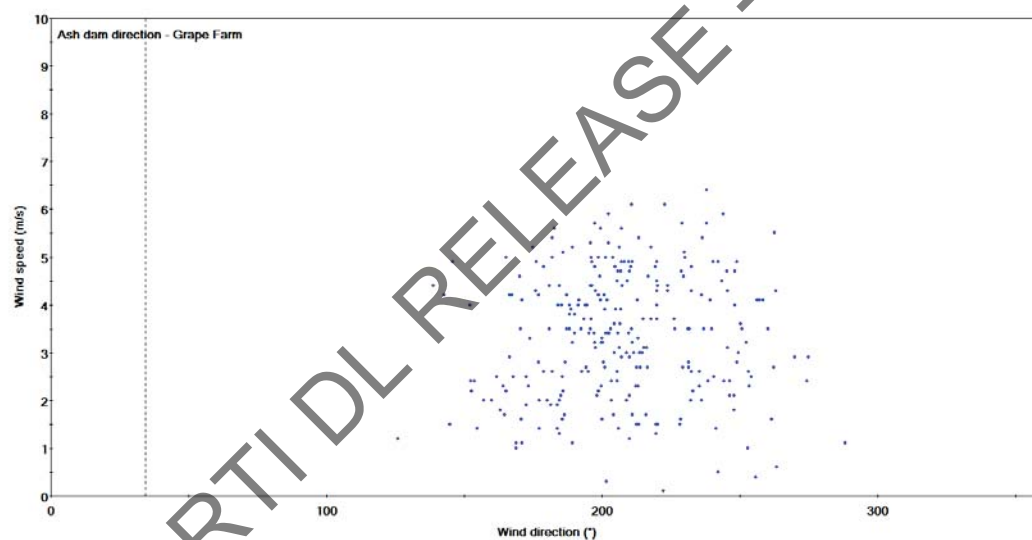


Figure 7 12 October 2011 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 12/10/11 11:00 – 13/10/11 09:25	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 270	Prepared by: K. Wright	Date: August 2012

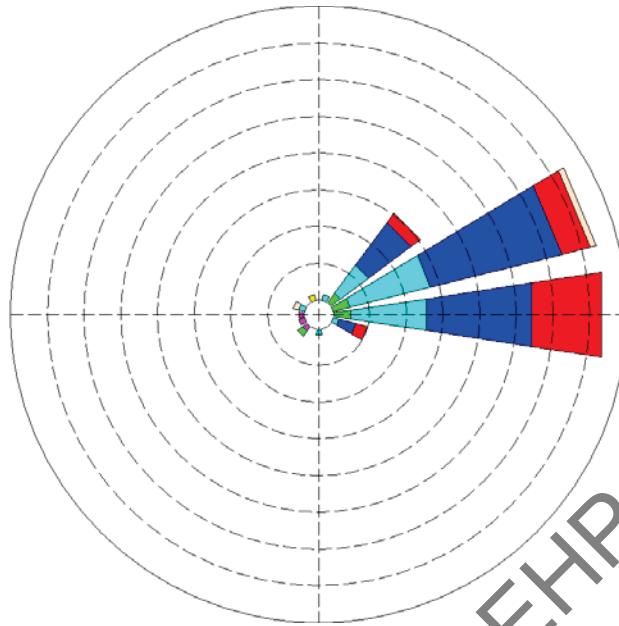
(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	Red
9.0 to < 10.0	Orange
8.0 to < 9.0	Yellow
7.0 to < 8.0	Light Green
6.0 to < 7.0	Green
5.0 to < 6.0	Dark Green
4.0 to < 5.0	Blue
3.0 to < 4.0	Light Blue
2.0 to < 3.0	Very Light Blue
1.0 to < 2.0	White
0.0 to < 1.0	Yellow

Calms = 0
Missing = 0
Total valid = 126



(b) 30m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	Red
9.0 to < 10.0	Orange
8.0 to < 9.0	Yellow
7.0 to < 8.0	Light Green
6.0 to < 7.0	Green
5.0 to < 6.0	Dark Green
4.0 to < 5.0	Blue
3.0 to < 4.0	Light Blue
2.0 to < 3.0	Very Light Blue
1.0 to < 2.0	White
0.0 to < 1.0	Yellow

Calms = 0
Missing = 0
Total valid = 126

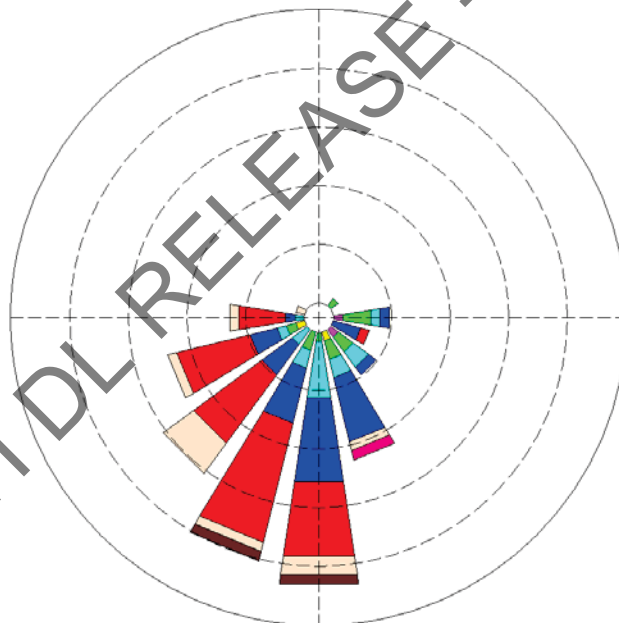
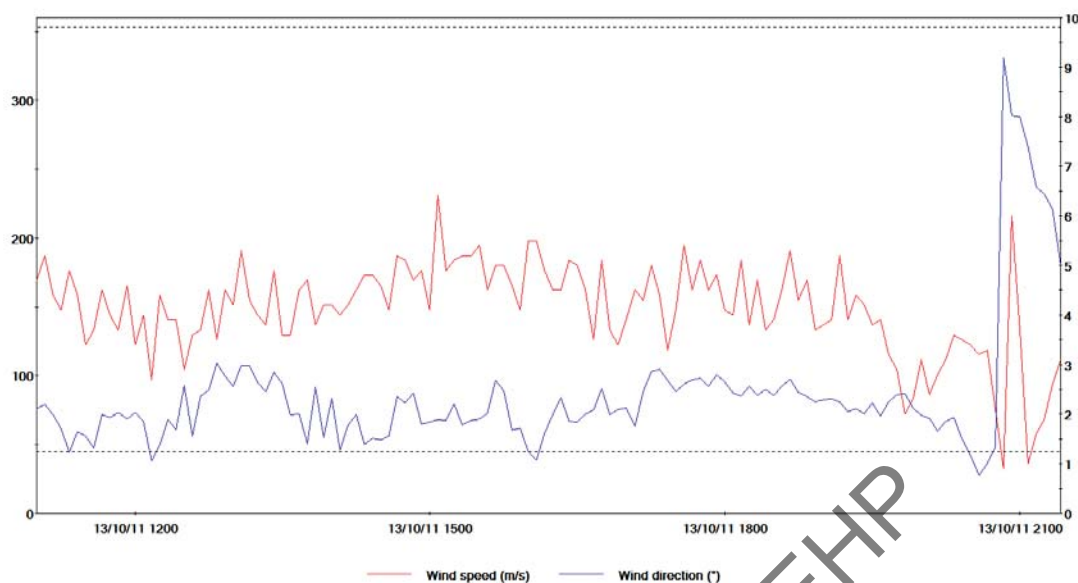


Figure 8 13 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 13/10/11 11:00 – 13/10/11 21:25	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 165	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

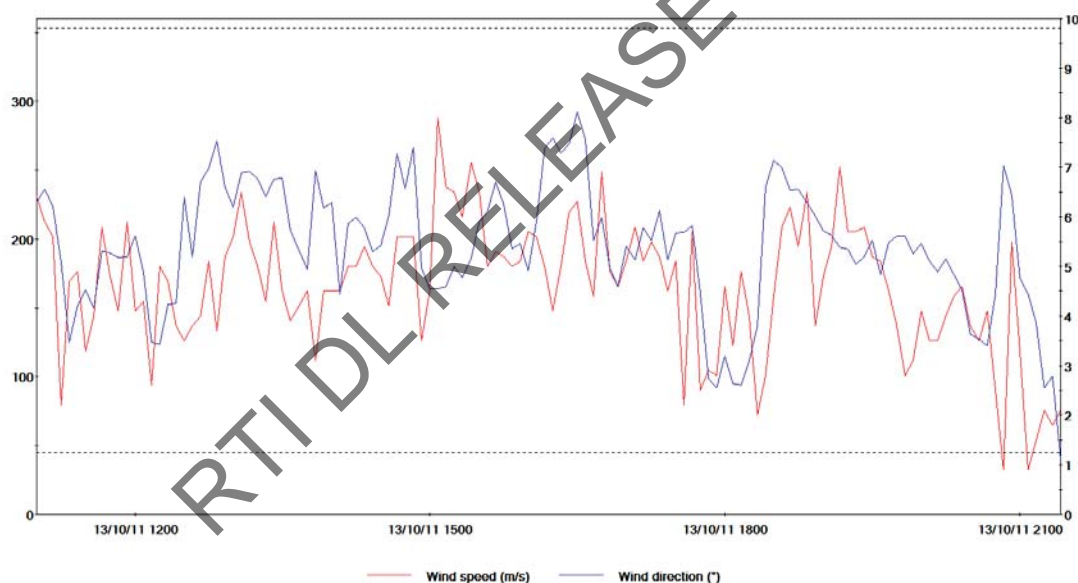
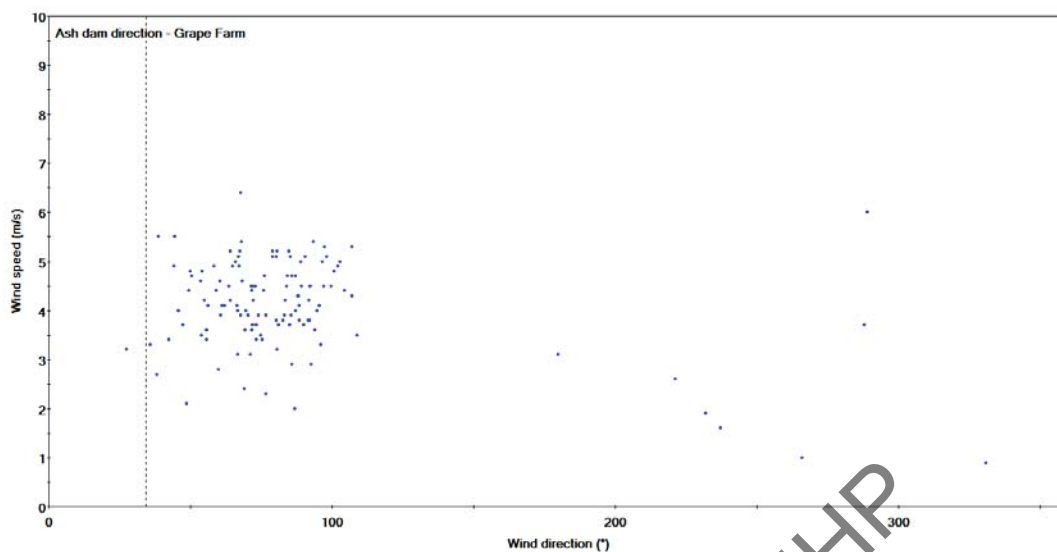


Figure 9 13 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 13/10/11 11:00 – 13/10/11 21:25	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 165	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

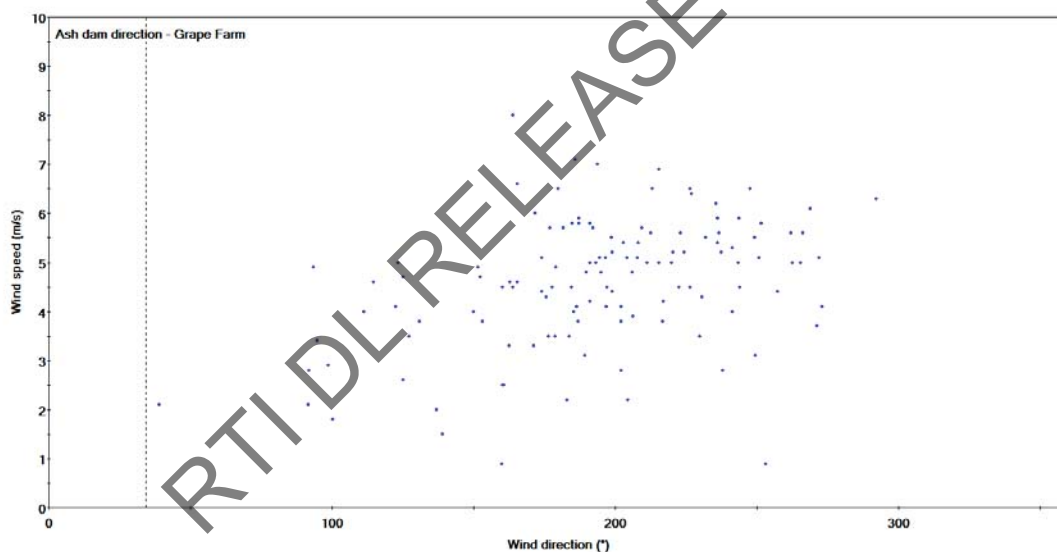


Figure 10 13 October 2011 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 13/10/11 11:00 – 13/10/11 21:25	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 165	Prepared by: K. Wright	Date: August 2012

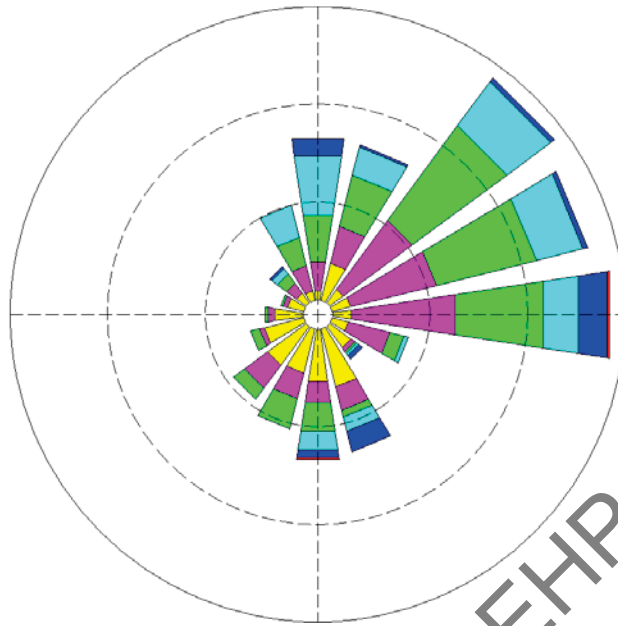
(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 827



(b) 30m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 827

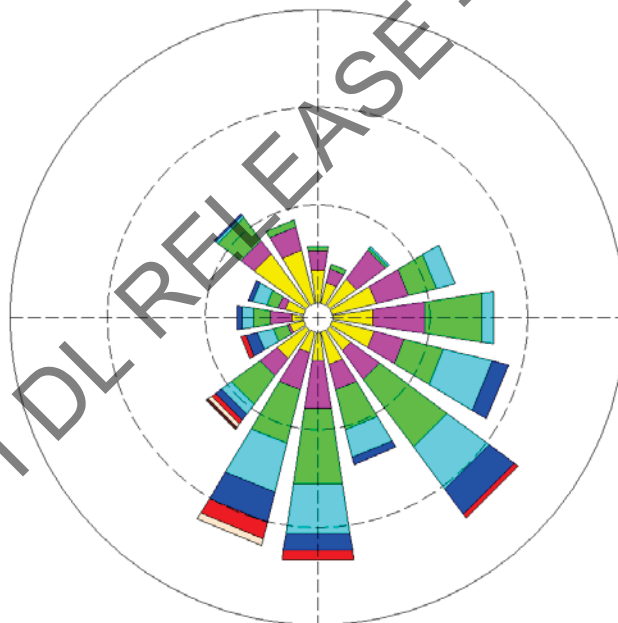
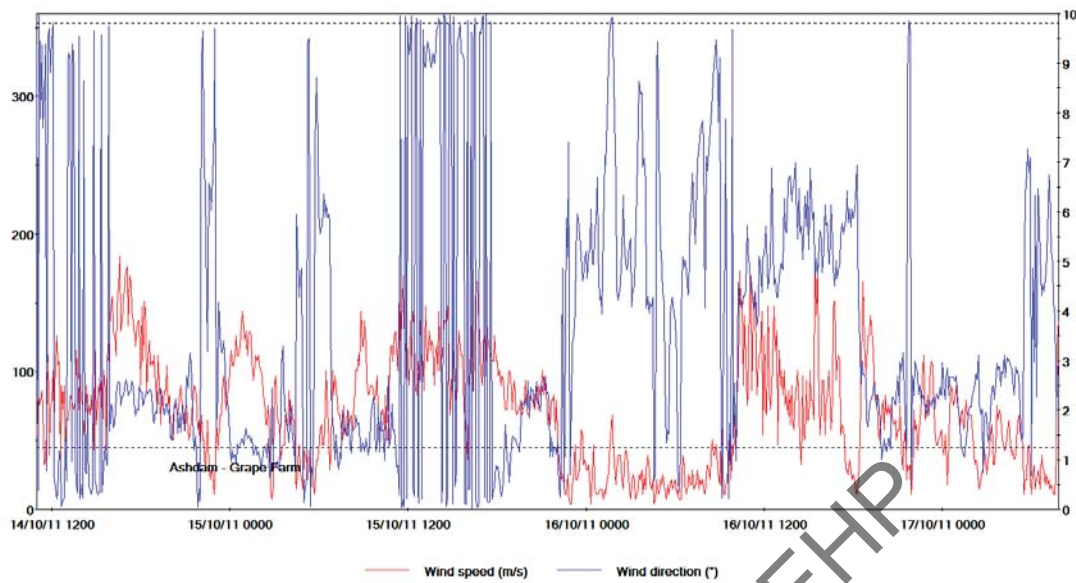


Figure 11 14 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 14/10/11 11:00 – 17/10/11 07:50	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 827	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

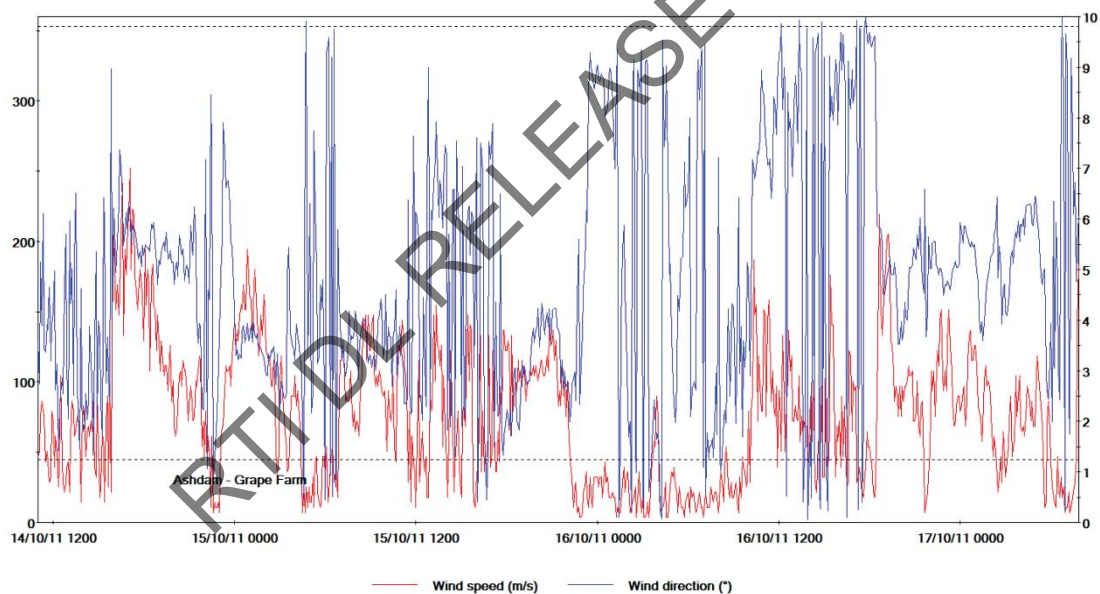
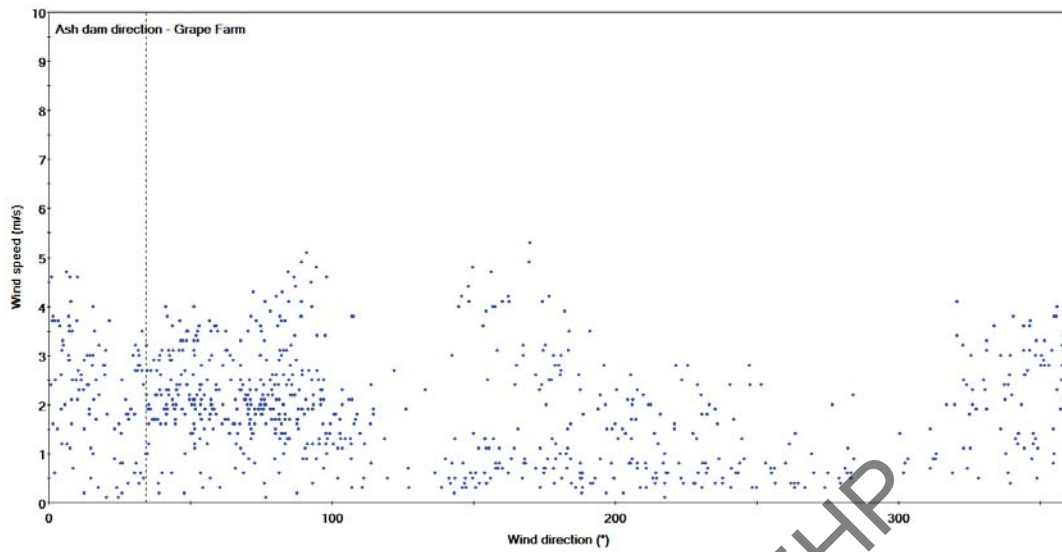


Figure 12 14 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 14/10/11 11:00 – 17/10/11 07:50	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 827	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

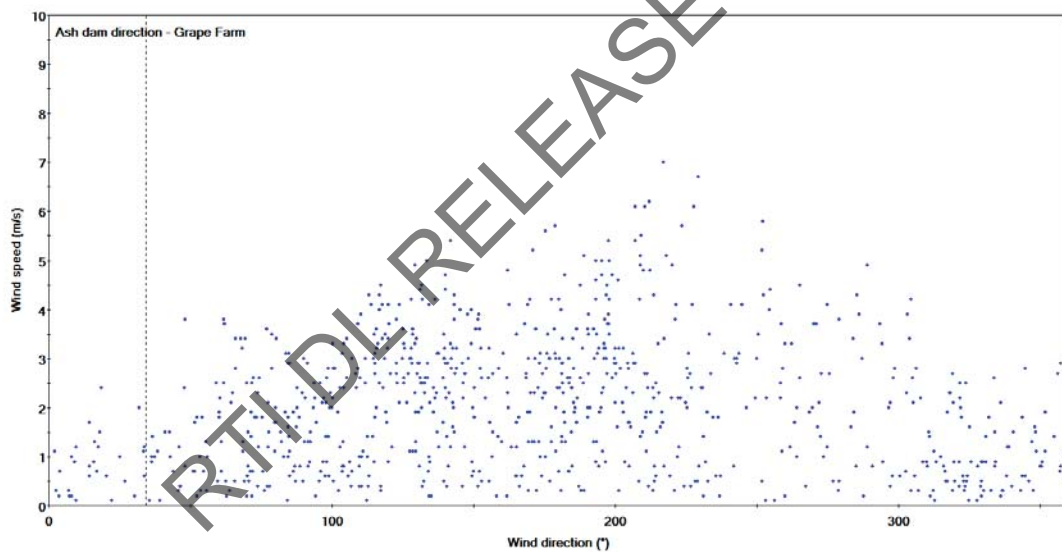
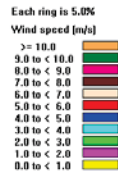


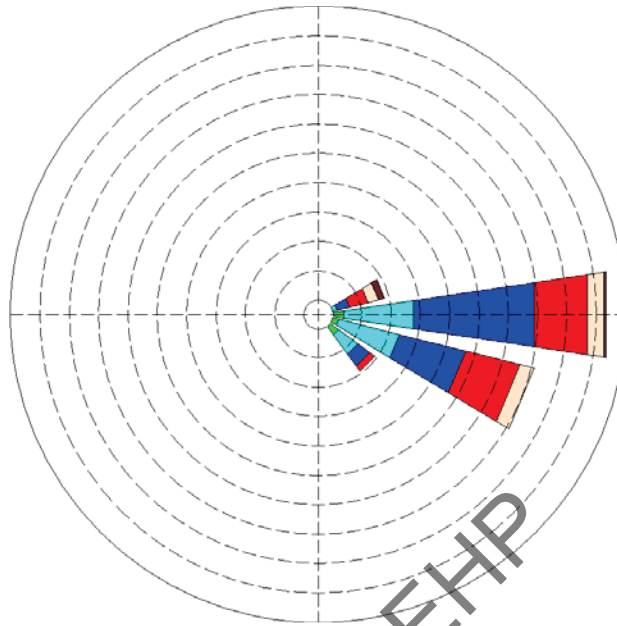
Figure 13 14 October 2011 – Wind direction vs.. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 14/10/11 11:00 – 17/10/11 07:50	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 827	Prepared by: K. Wright	Date: August 2012

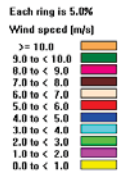
(a) 10m



Calms = 0
Missing = 0
Total valid = 277



(b) 30m



Calms = 0
Missing = 0
Total valid = 277

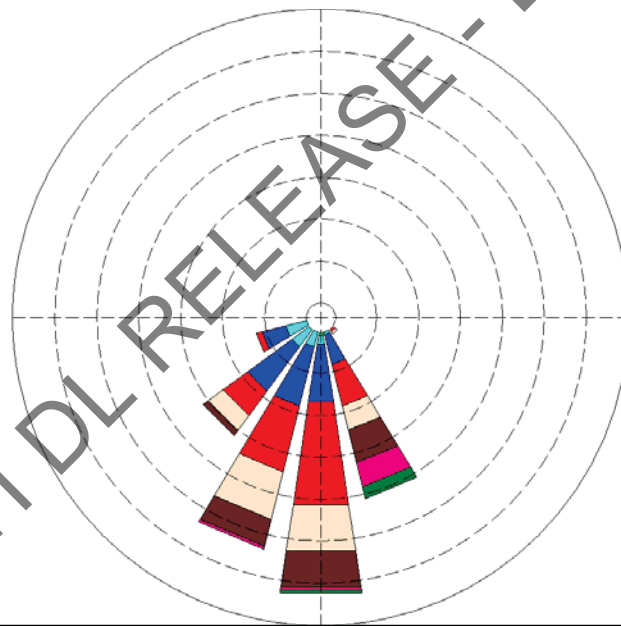
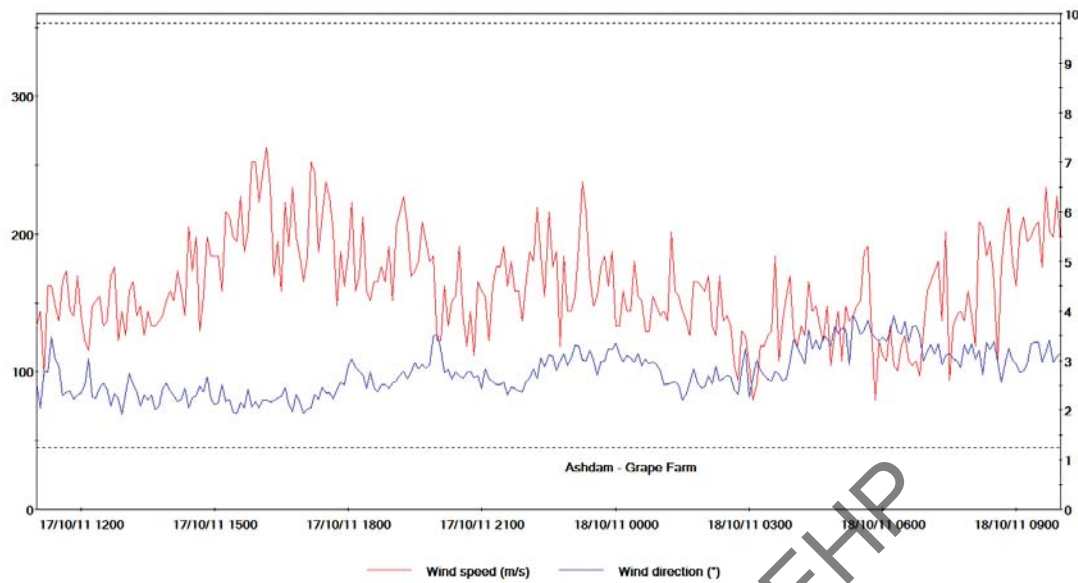


Figure 14 17 October 2011 – Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 17/10/11 11:00 – 18/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

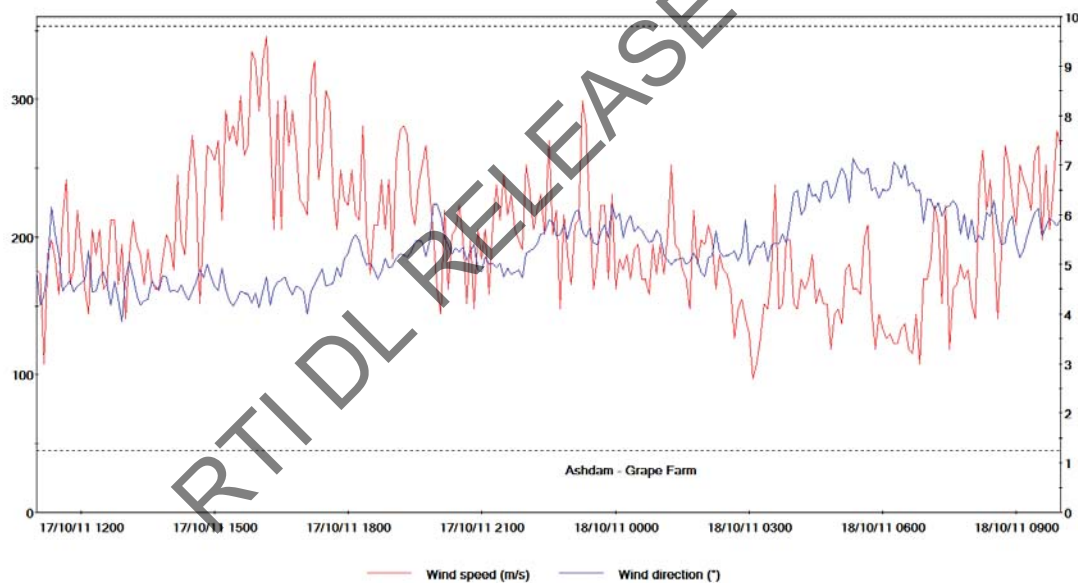
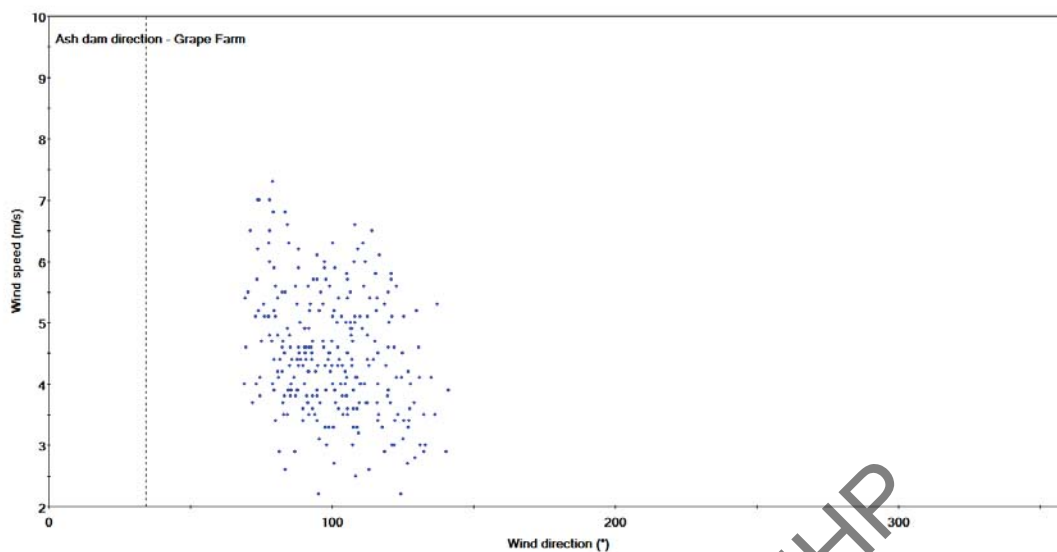


Figure 15 17 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 17/10/11 11:00 – 18/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

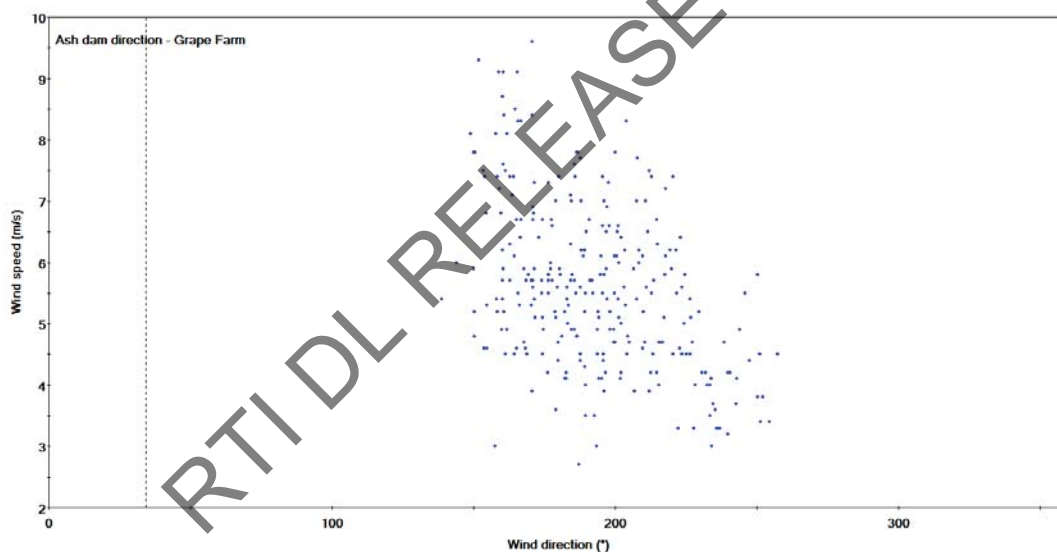


Figure 16 17 October 2011 – Wind direction vs.. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 17/10/11 11:00 – 18/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

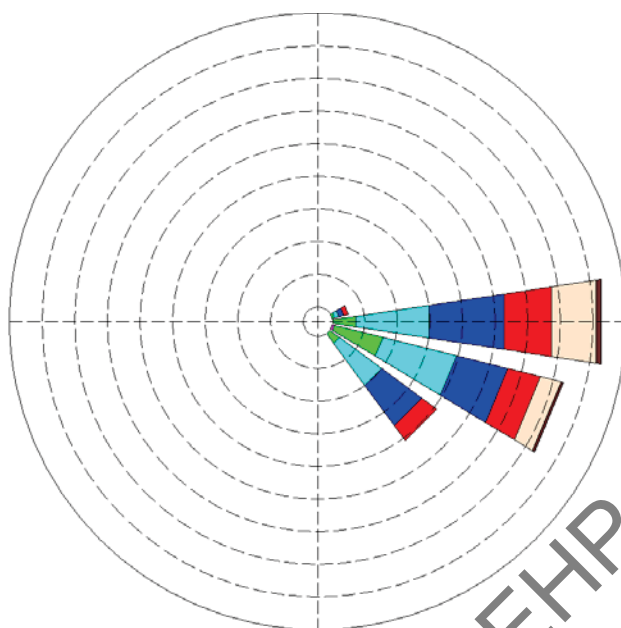
(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 277



(b) 30m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 277

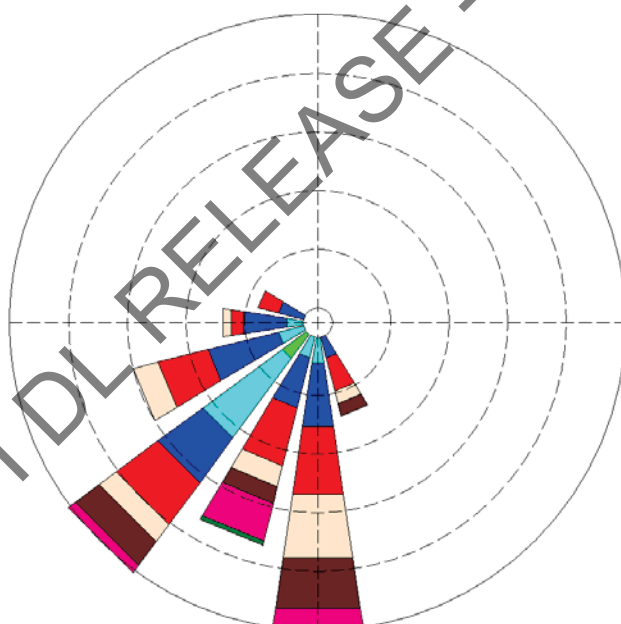
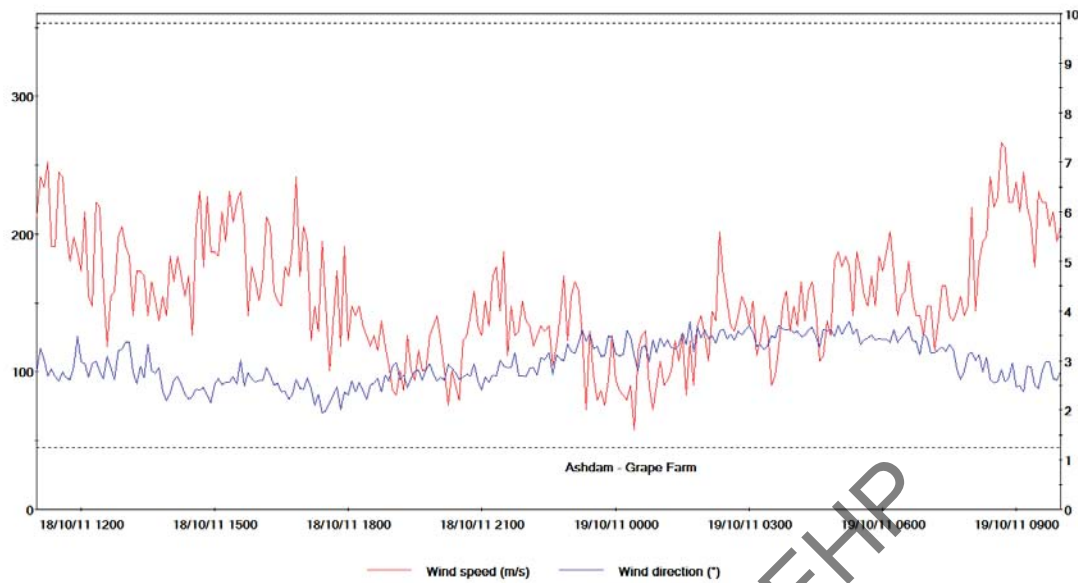


Figure 17 18 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 18/10/11 11:00 – 19/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

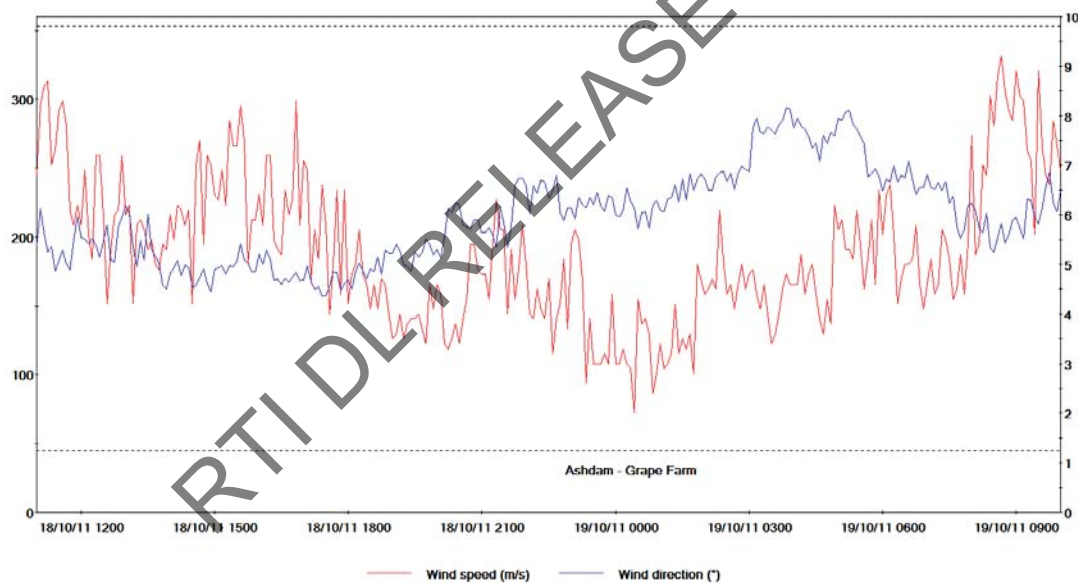
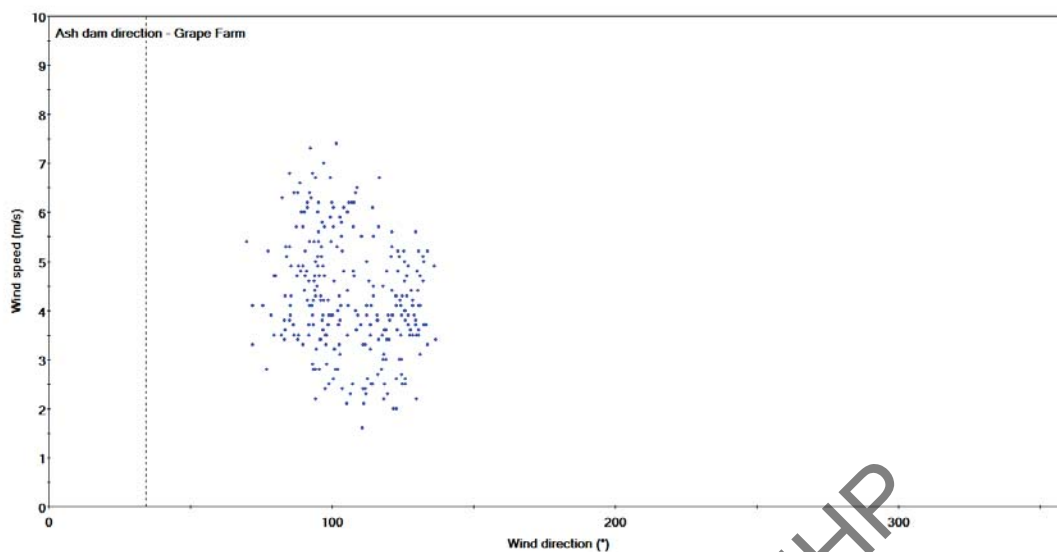


Figure 18 18 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 18/10/11 11:00 – 19/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

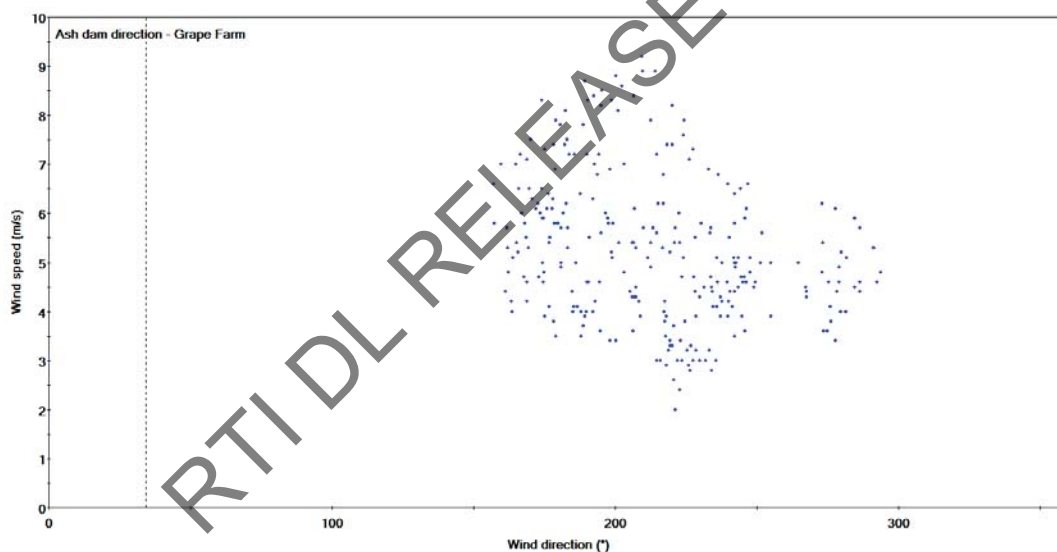


Figure 19 18 October 2011 – Wind direction vs.. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 18/10/11 11:00 – 19/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

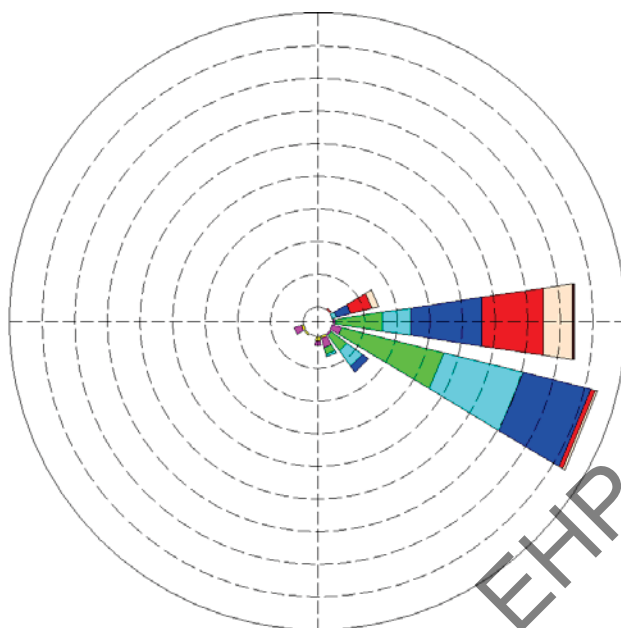
(a) 10m

Each ring is 5.0%

Wind speed (m/s)

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 275



(b) 30m

Each ring is 5.0%

Wind speed (m/s)

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 275

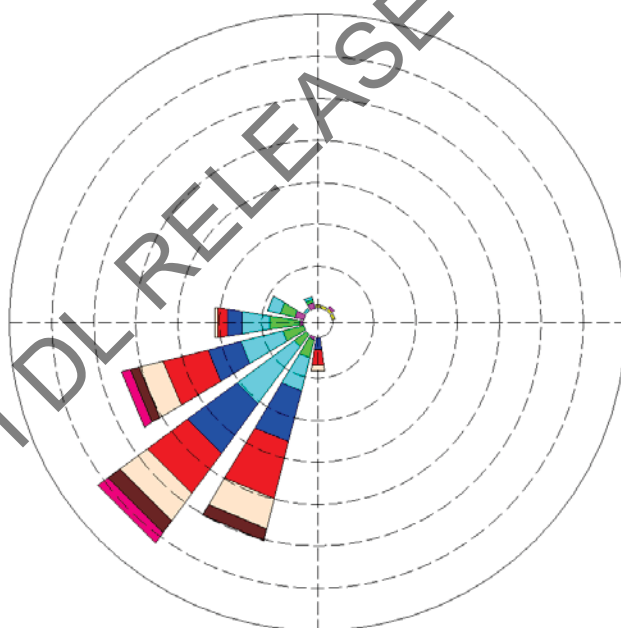
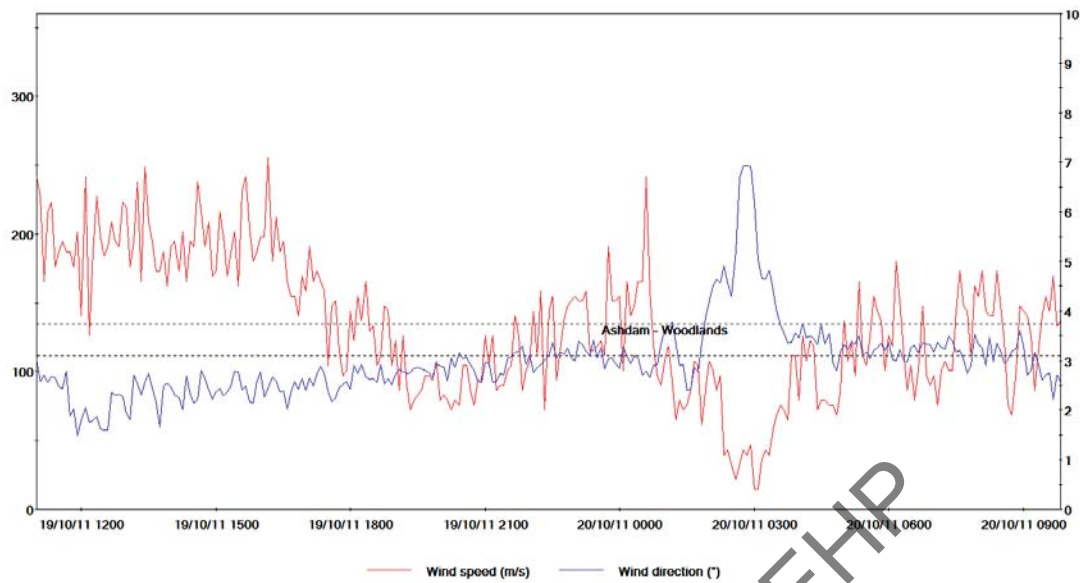


Figure 20 19 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 19/10/11 11:00 – 20/10/11 9:50	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 275	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

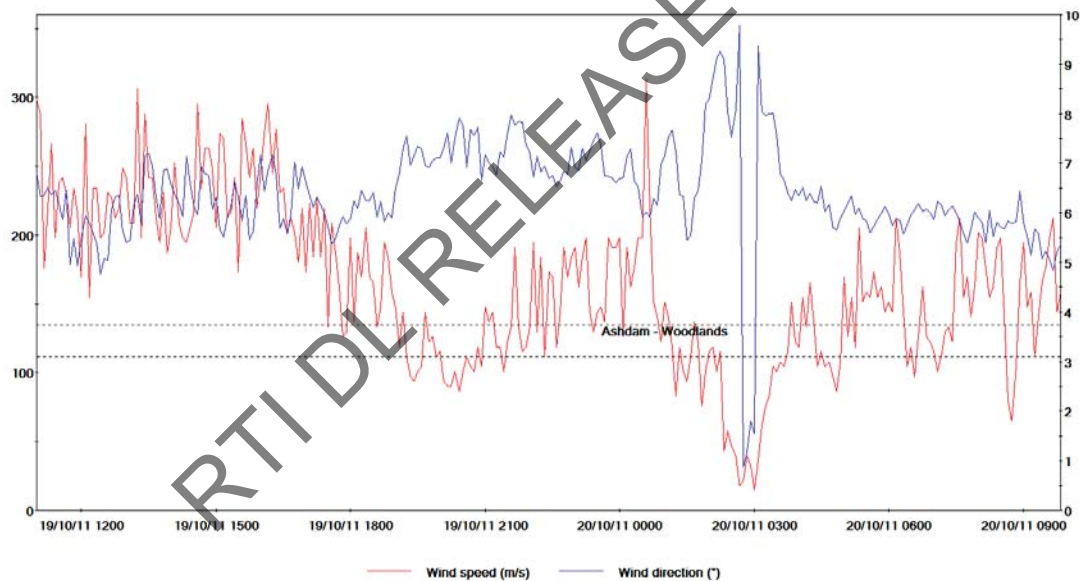
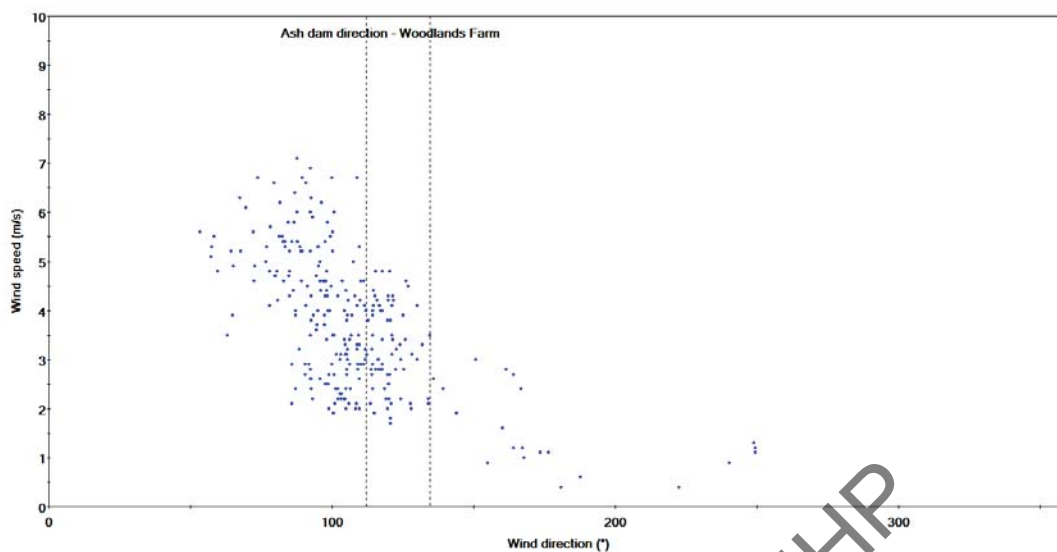


Figure 21 19 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 19/10/11 11:00 – 20/10/11 9:50	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 275	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

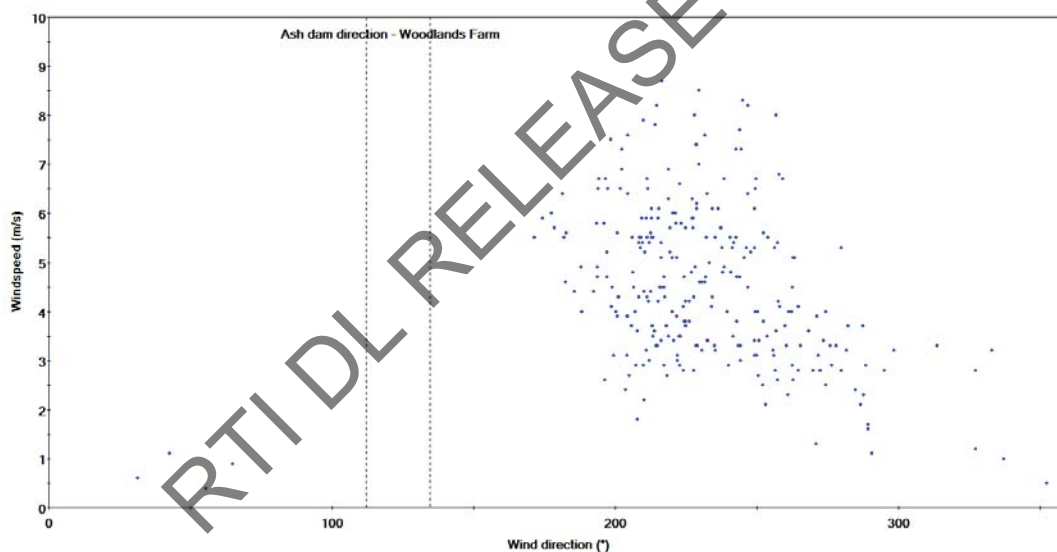


Figure 22 19 October 2011 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 19/10/11 11:00 – 20/10/11 9:50	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 275	Prepared by: K. Wright	Date: August 2012

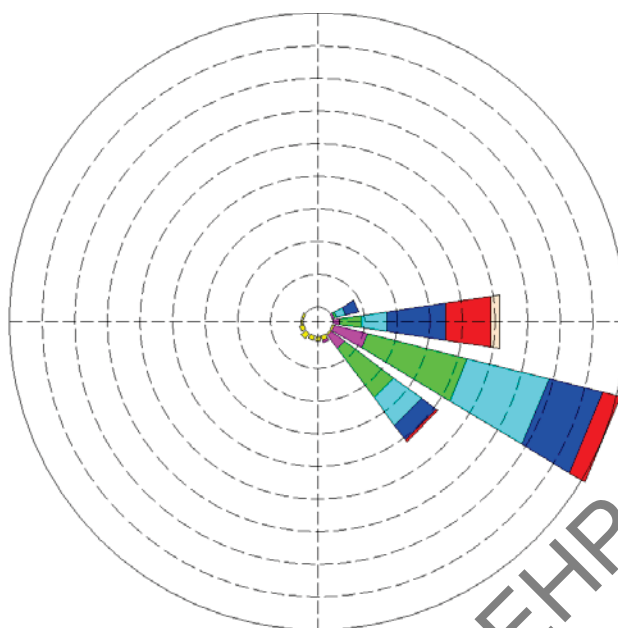
(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 289



(b) 30m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 289

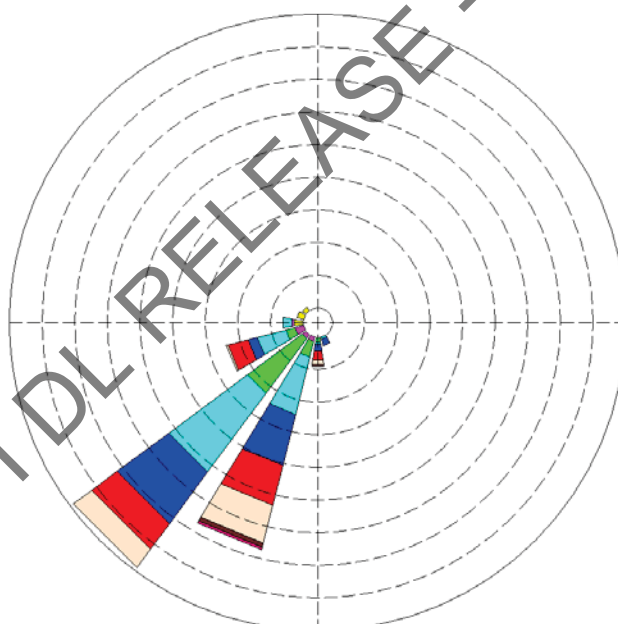
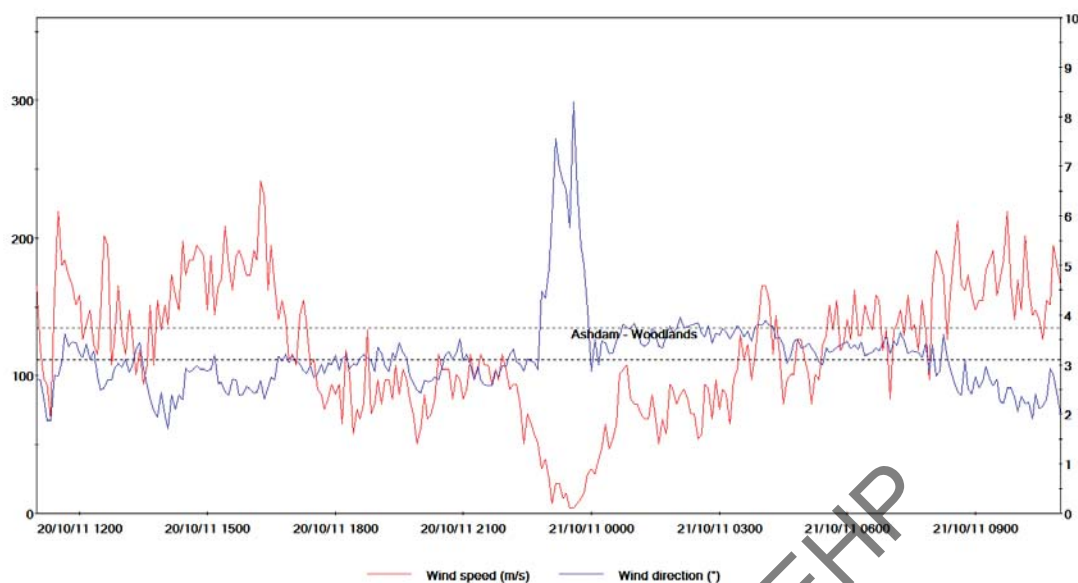


Figure 23 20 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 20/10/11 11:00 – 21/10/11 11:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 289	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

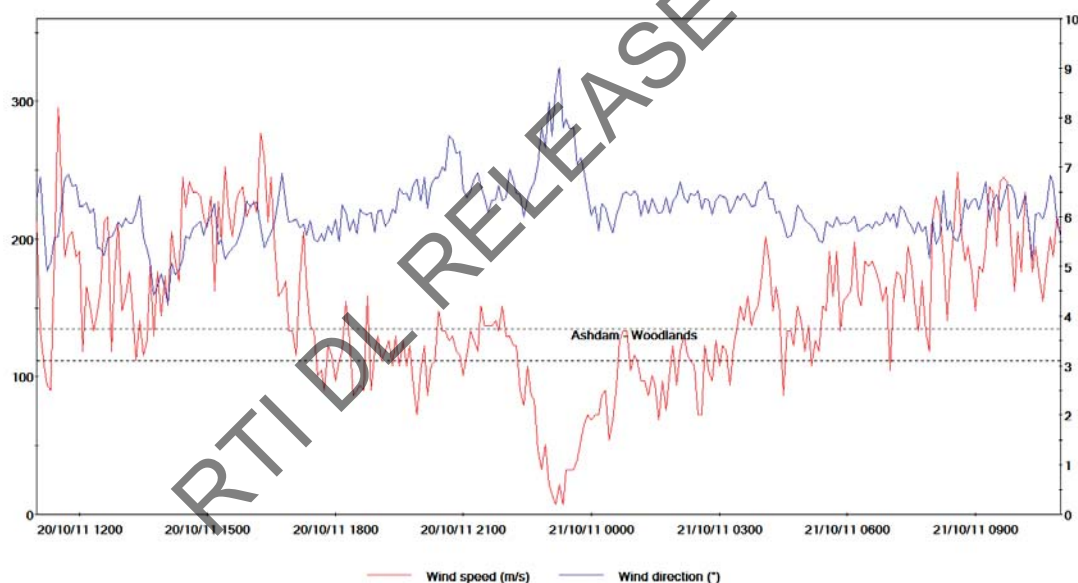
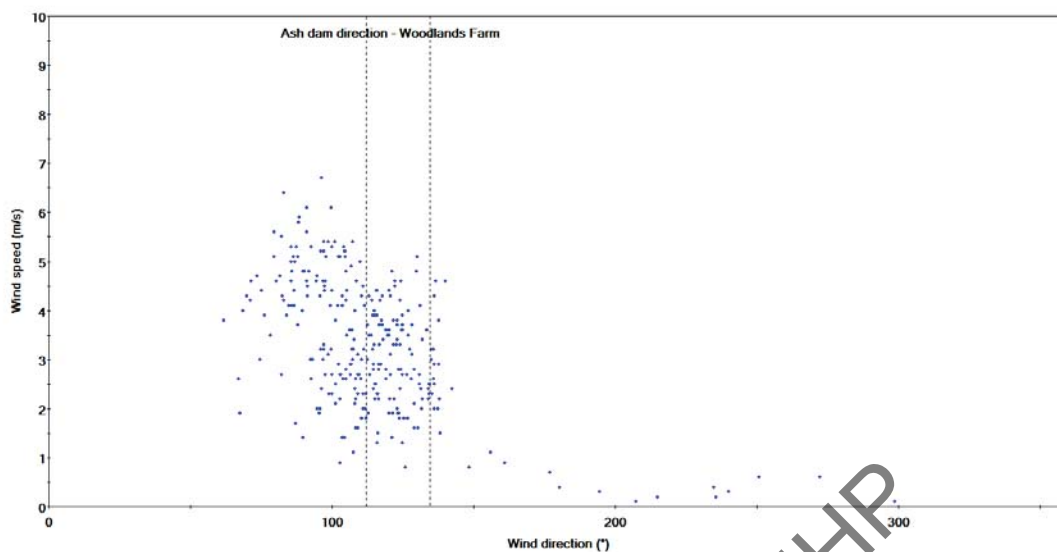


Figure 24 20 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 20/10/11 11:00 – 21/10/11 11:00	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 289	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

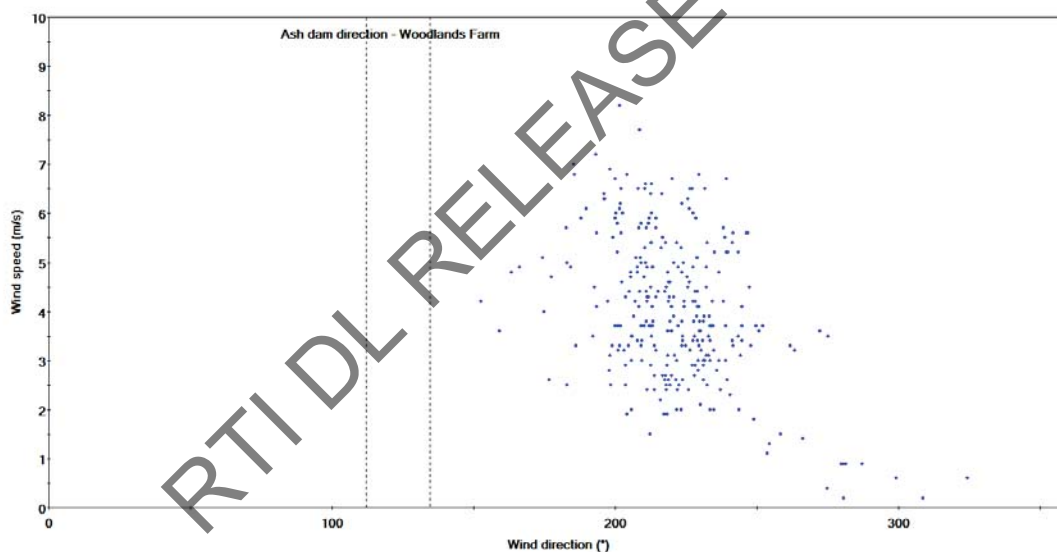


Figure 25 20 October 2011 – Wind direction vs.. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 20/10/11 11:00 – 21/10/11 11:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 289	Prepared by: K. Wright	Date: August 2012

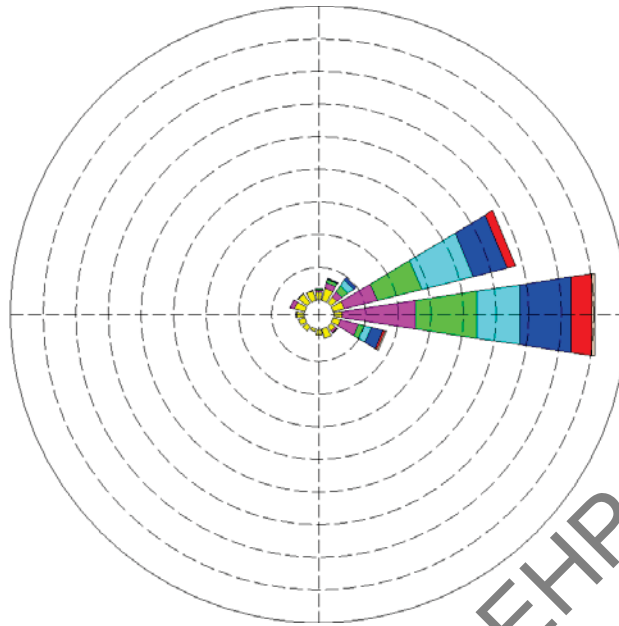
(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 0
Missing = 0
Total valid = 1105



(b) 30m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calms = 1
Missing = 0
Total valid = 1105

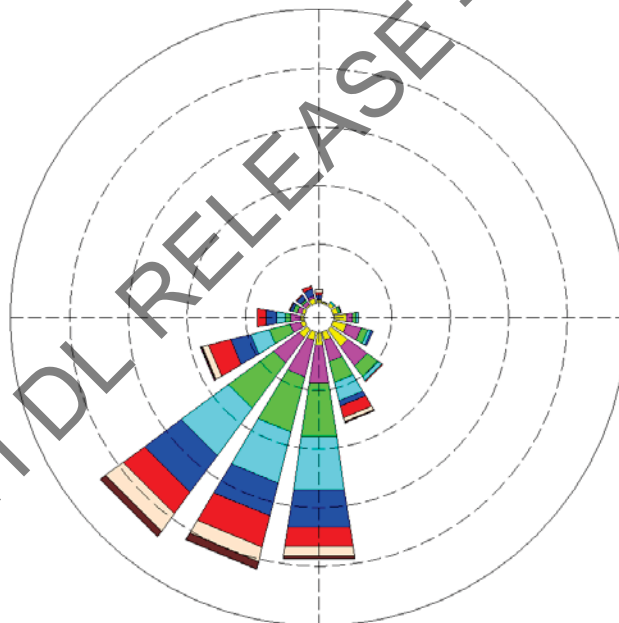
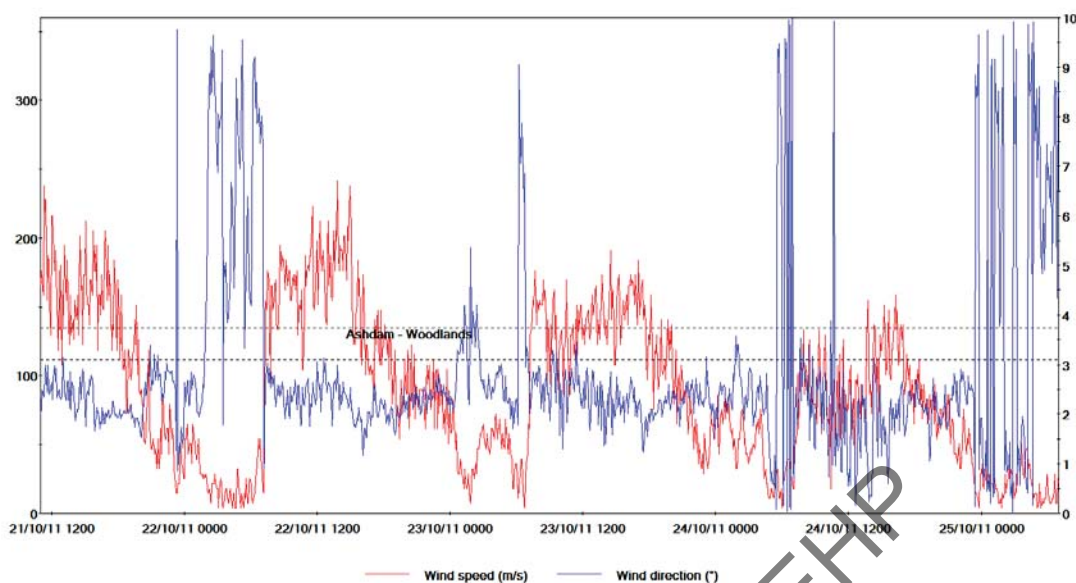


Figure 26 21 October 2011 – Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 21/10/11 11:00 – 25/10/11 07:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 1105	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

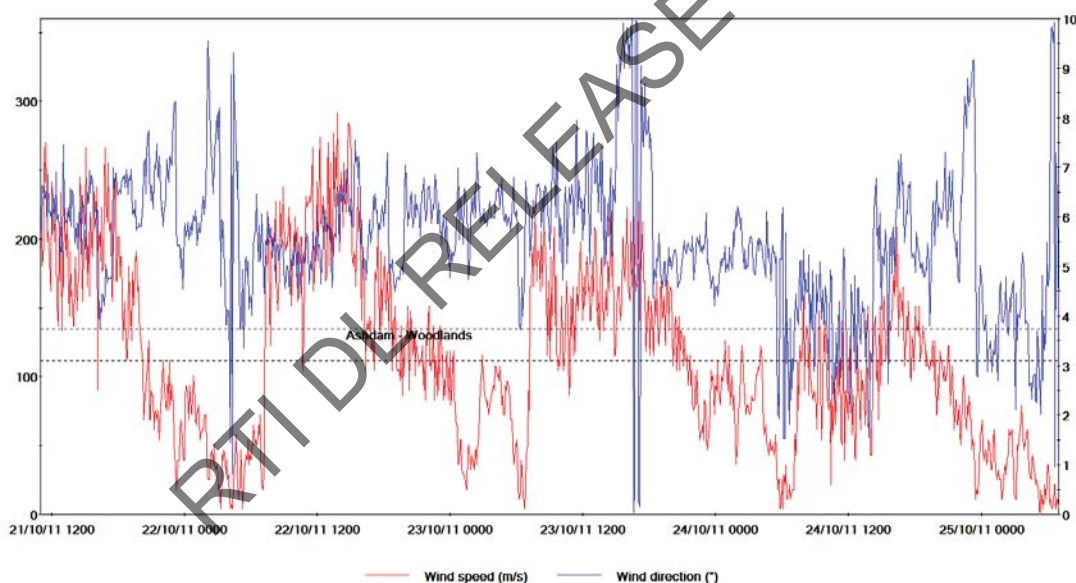
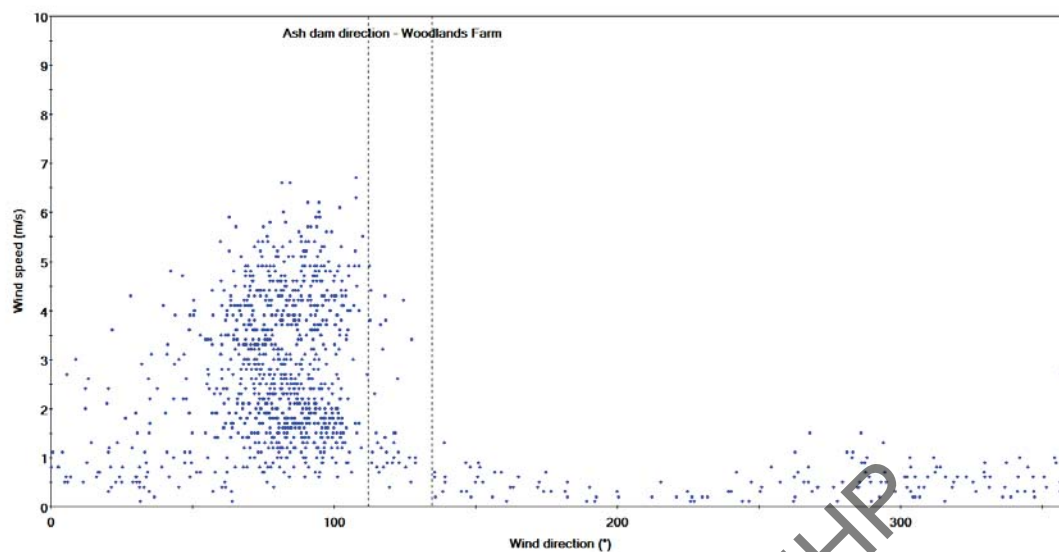


Figure 27 21 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 21/10/11 11:00 – 25/10/11 07:00	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 1105	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

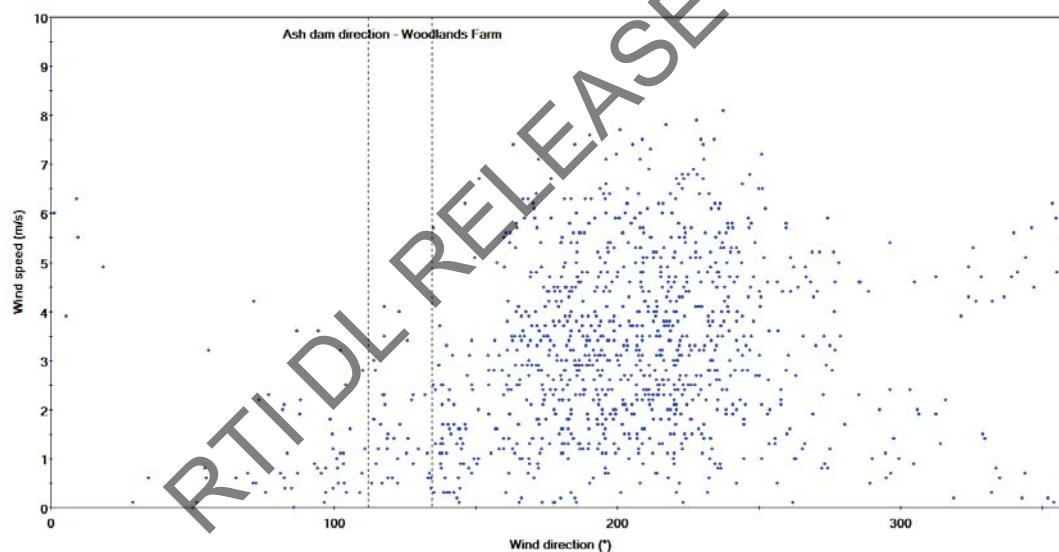


Figure 28 21 October 2011 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 21/10/11 11:00 – 25/10/11 07:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 1105	Prepared by: K. Wright	Date: August 2012

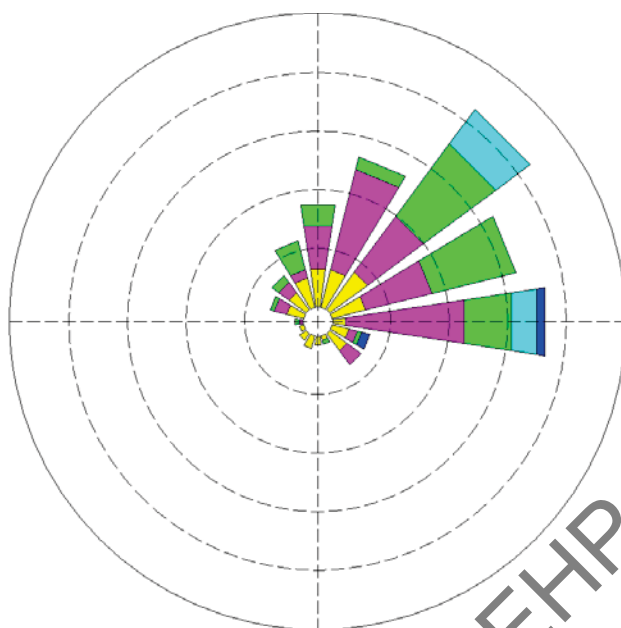
(a) 10m

Each ring is 5.0%

Wind speed (m/s)

>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Yellow
7.0 to < 8.0	Light Green
6.0 to < 7.0	Green
5.0 to < 6.0	Dark Green
4.0 to < 5.0	Blue
3.0 to < 4.0	Light Blue
2.0 to < 3.0	Very Light Blue
1.0 to < 2.0	White
0.0 to < 1.0	Yellow

Calm = 1
Missing = 0
Total valid = 277



(b) 30m

Each ring is 5.0%

Wind speed (m/s)

>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Yellow
7.0 to < 8.0	Light Green
6.0 to < 7.0	Green
5.0 to < 6.0	Dark Green
4.0 to < 5.0	Blue
3.0 to < 4.0	Light Blue
2.0 to < 3.0	Very Light Blue
1.0 to < 2.0	White
0.0 to < 1.0	Yellow

Calm = 1
Missing = 0
Total valid = 277

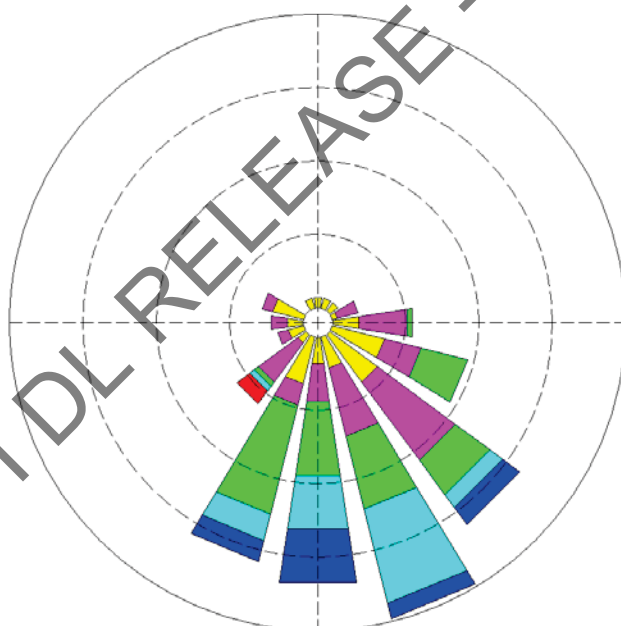
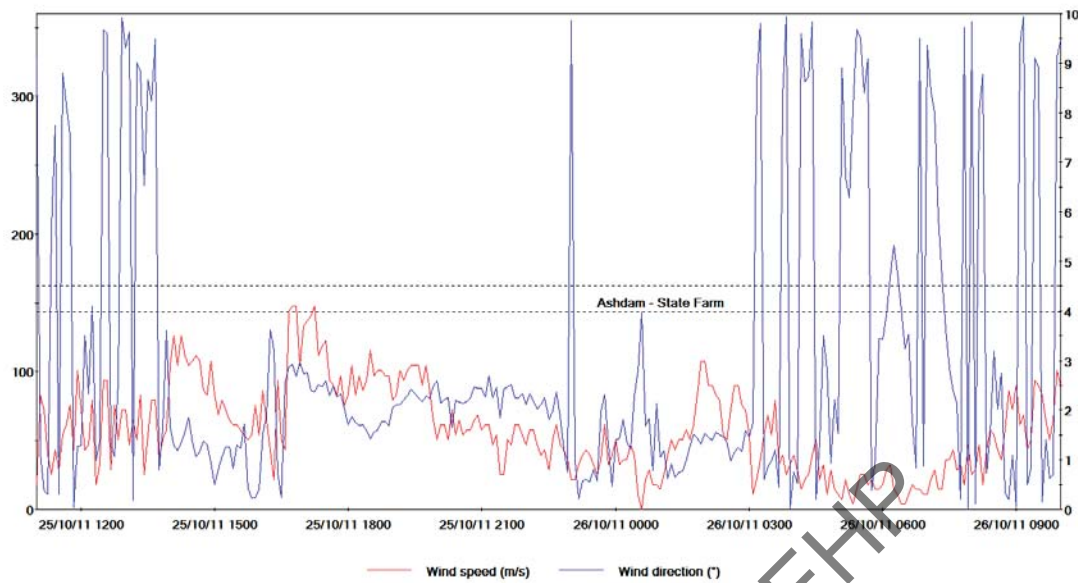


Figure 29 25 October 2011 – Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 25/10/11 11:00 – 26/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

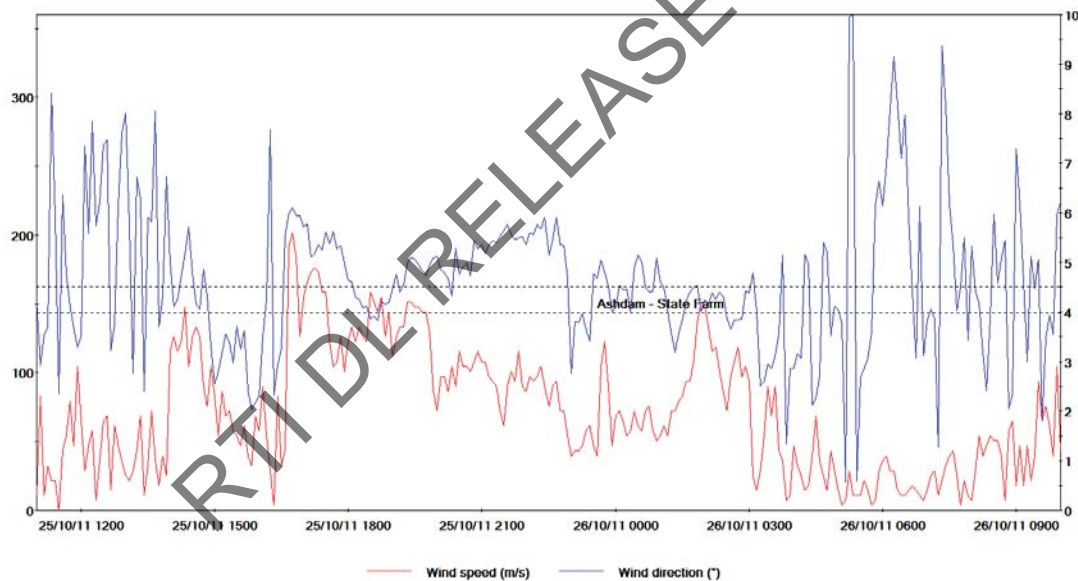
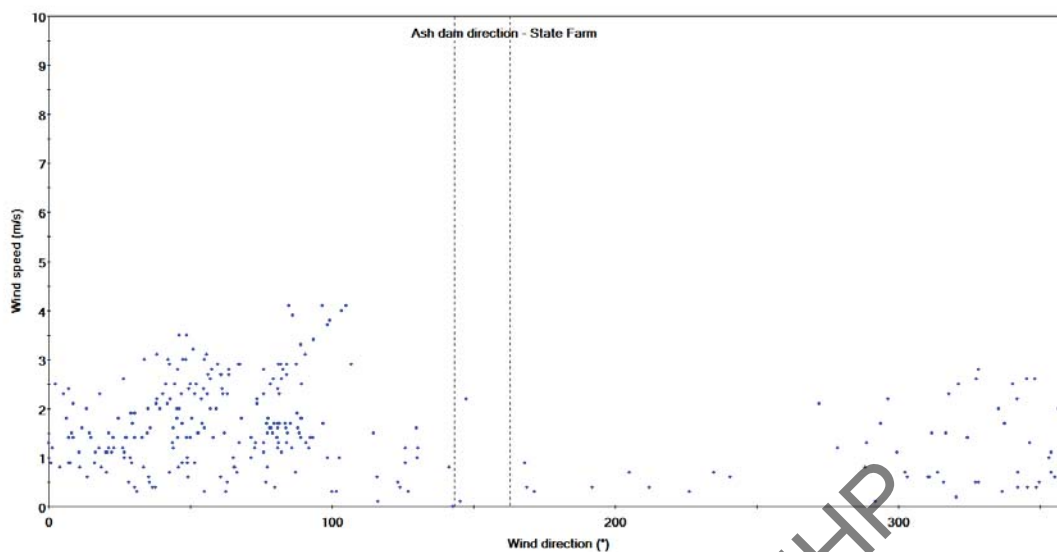


Figure 30 25 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 25/10/11 11:00 – 26/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

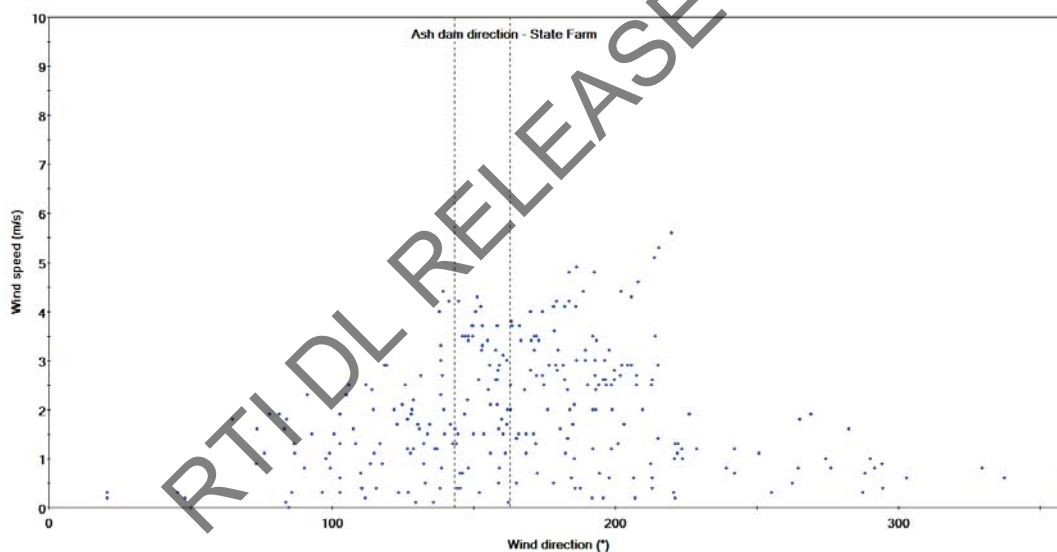


Figure 31 25 October 2011 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 25/10/11 11:00 – 26/10/11 10:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 277	Prepared by: K. Wright	Date: August 2012

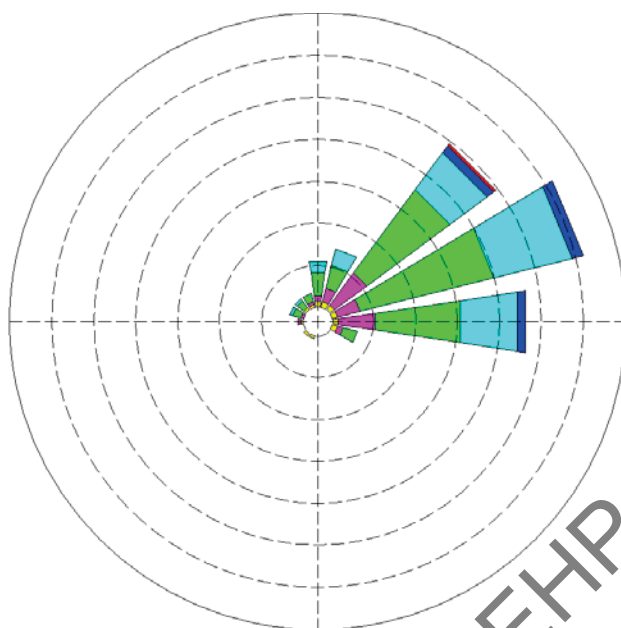
(a) 10m

Each ring is 5.0%

Wind speed (m/s)

>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Yellow
7.0 to < 8.0	Light Green
6.0 to < 7.0	Green
5.0 to < 6.0	Dark Green
4.0 to < 5.0	Blue
3.0 to < 4.0	Light Blue
2.0 to < 3.0	Very Light Blue
1.0 to < 2.0	White
0.0 to < 1.0	Yellow

Calms = 0
Missing = 0
Total valid = 295



(b) 30m

Each ring is 5.0%

Wind speed (m/s)

>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Yellow
7.0 to < 8.0	Light Green
6.0 to < 7.0	Green
5.0 to < 6.0	Dark Green
4.0 to < 5.0	Blue
3.0 to < 4.0	Light Blue
2.0 to < 3.0	Very Light Blue
1.0 to < 2.0	White
0.0 to < 1.0	Yellow

Calms = 0
Missing = 0
Total valid = 295

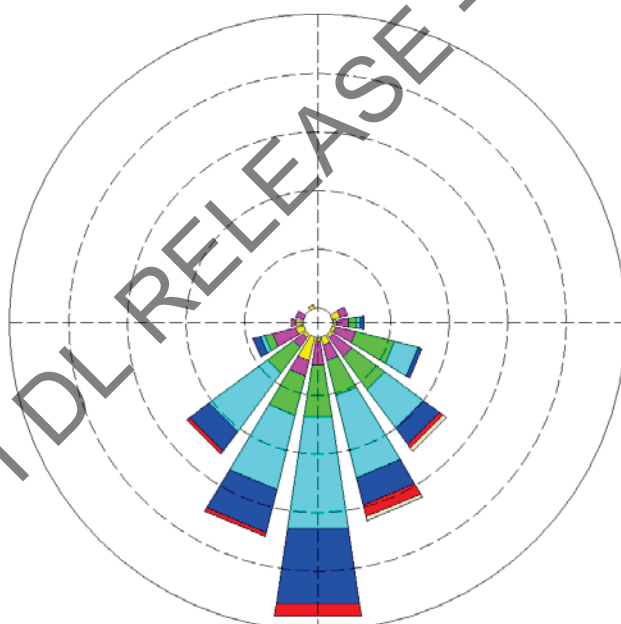
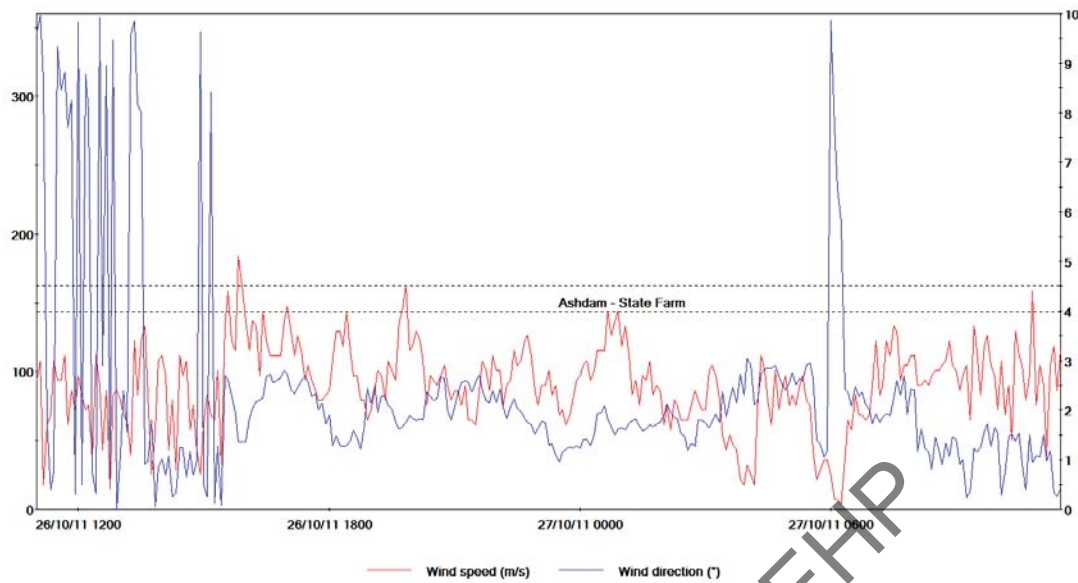


Figure 32 26 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 26/10/11 11:00 – 27/10/11 11:30	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min records: 295	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

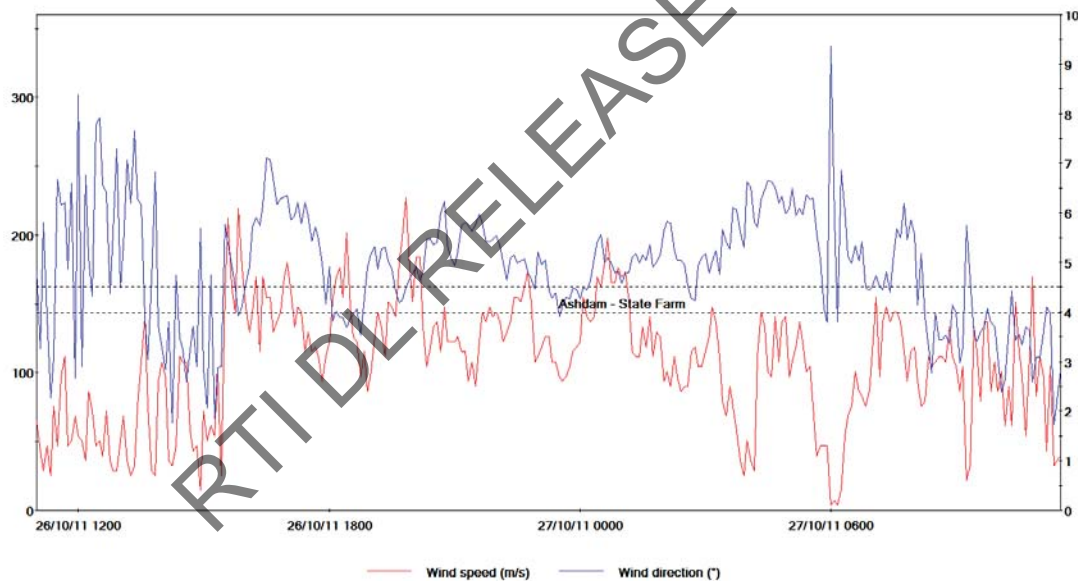
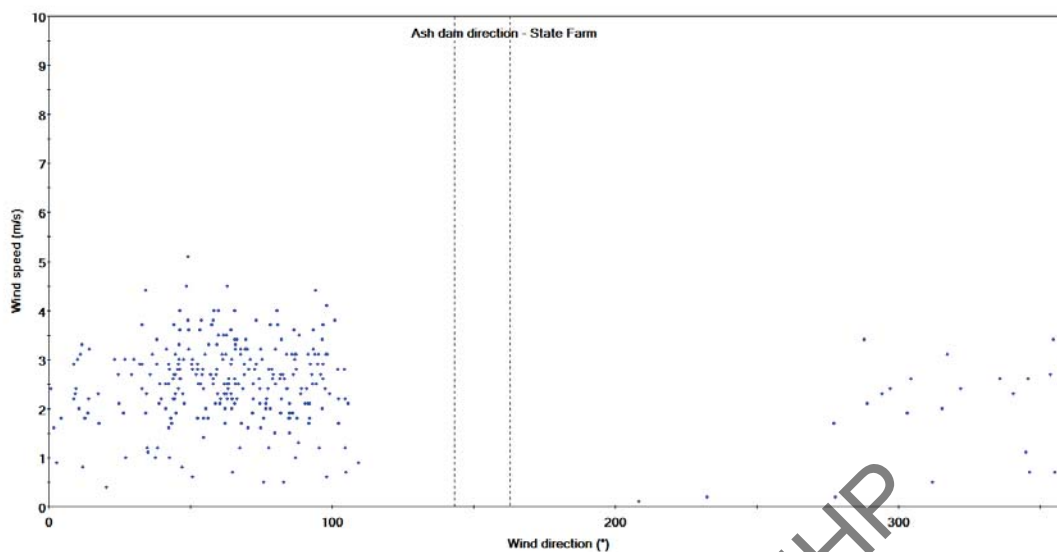


Figure 33 26 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 26/10/11 11:00 – 27/10/11 11:30	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 295	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

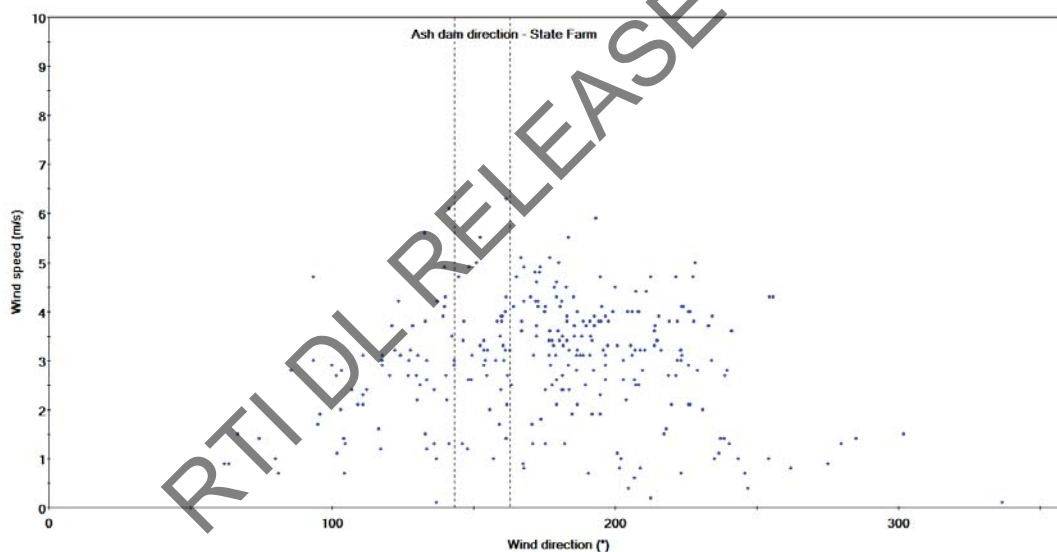


Figure 34 26 October 2011 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 26/10/11 11:00 – 27/10/11 11:30	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 295	Prepared by: K. Wright	Date: August 2012

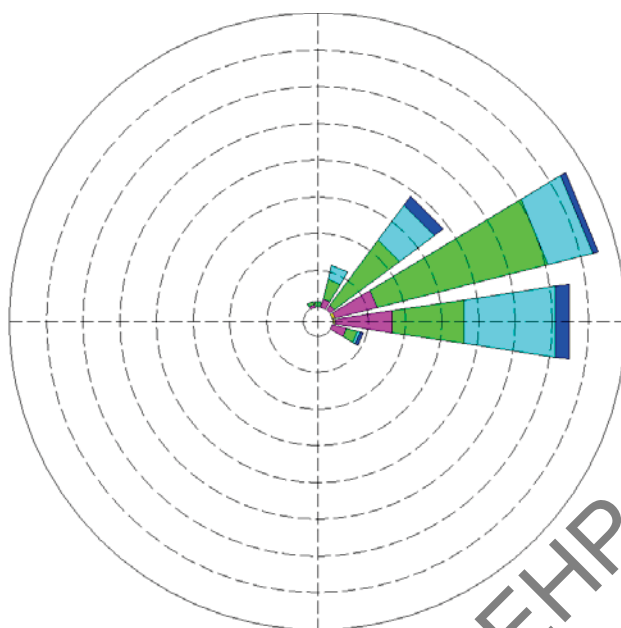
(a) 10m

Each ring is 5.0%

Wind speed [m/s]



Calms = 0
Missing = 0
Total valid = 257



(b) 30m

Each ring is 5.0%

Wind speed [m/s]



Calms = 0
Missing = 0
Total valid = 257

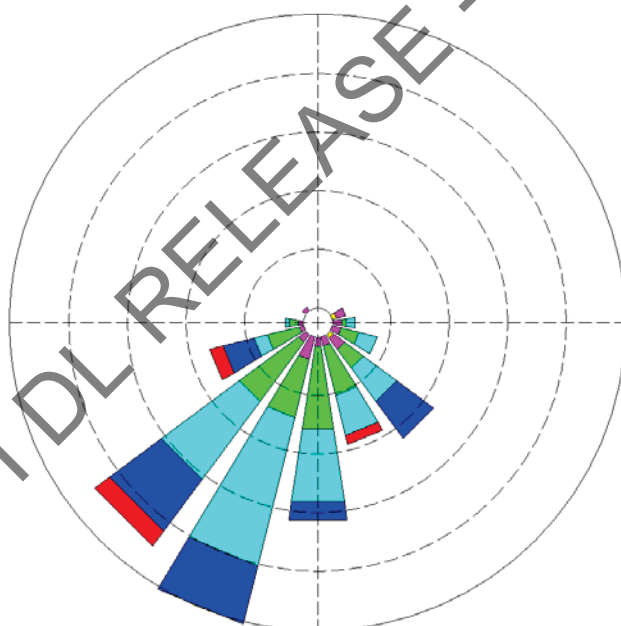
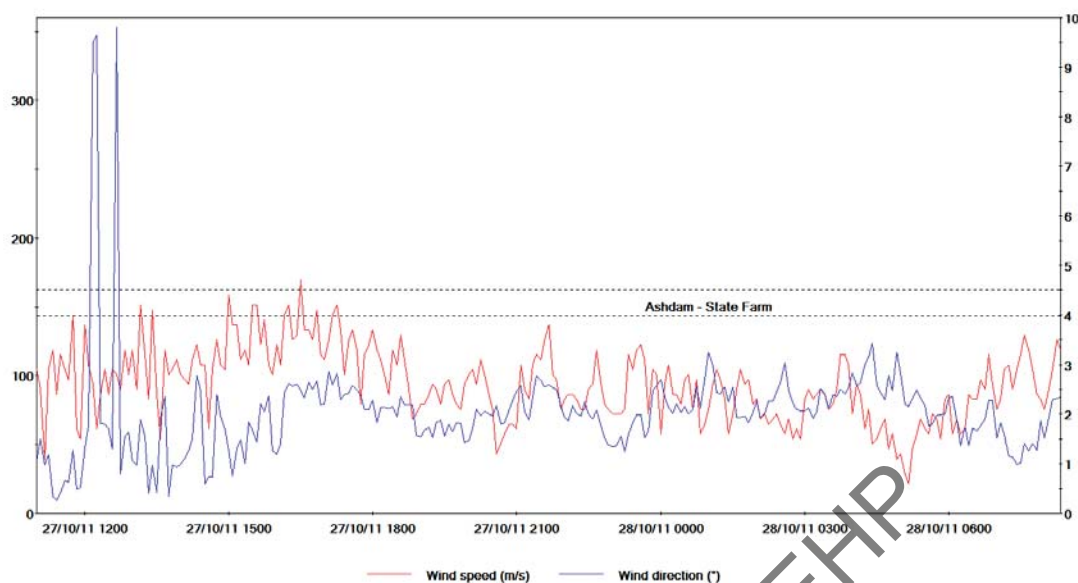


Figure 35 27 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 27/10/11 11:00 – 28/10/11 08:20	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 257	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

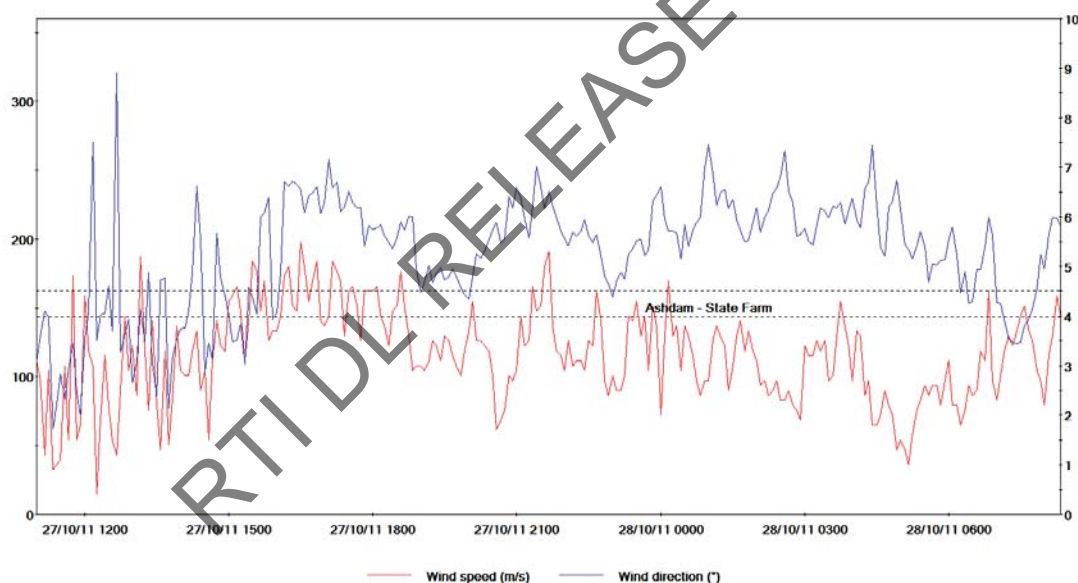
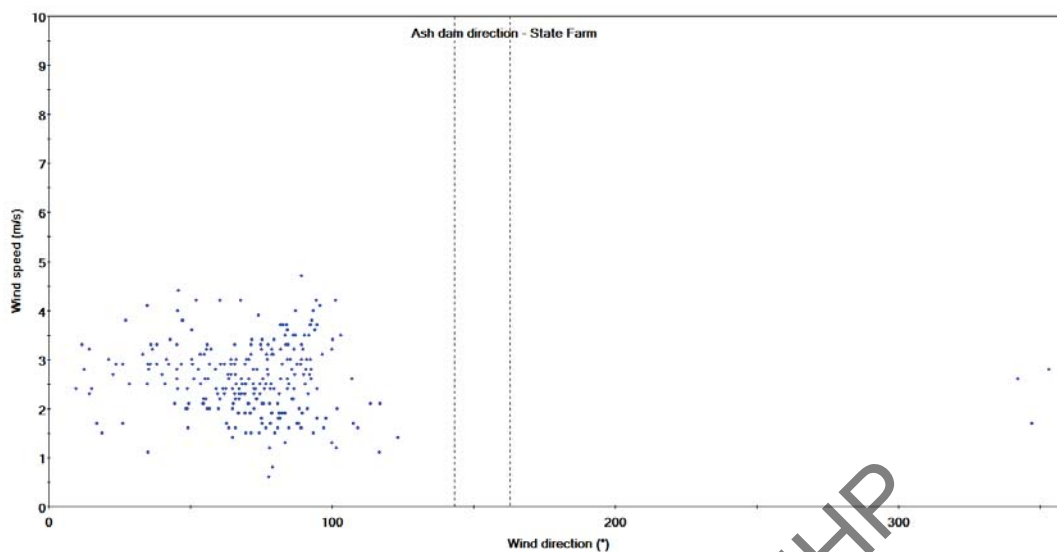


Figure 36 27 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 27/10/11 11:00 – 28/10/11 08:20	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 257	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

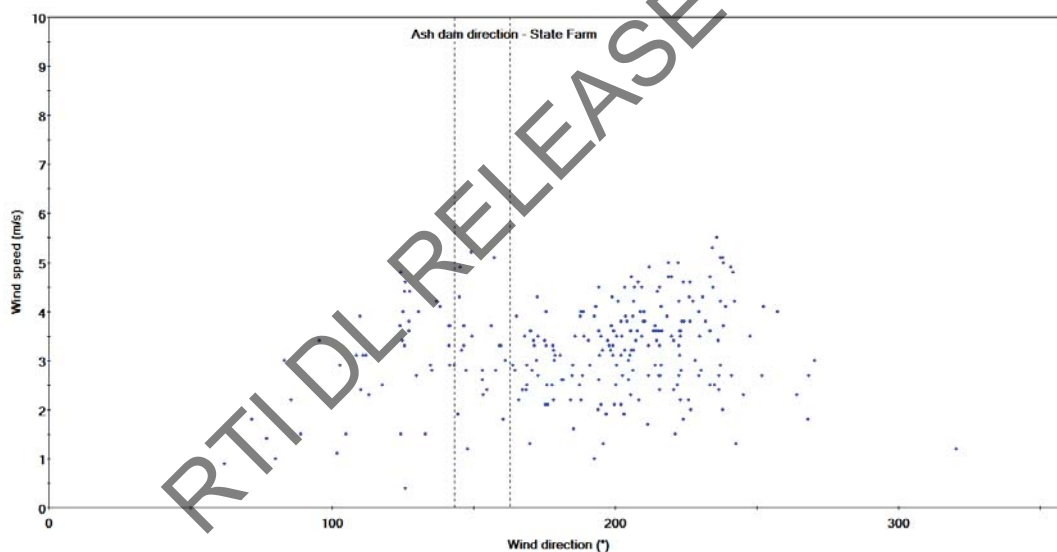


Figure 37 27 October 2011 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 27/10/11 11:00 – 28/10/11 08:20	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 257	Prepared by: K. Wright	Date: August 2012

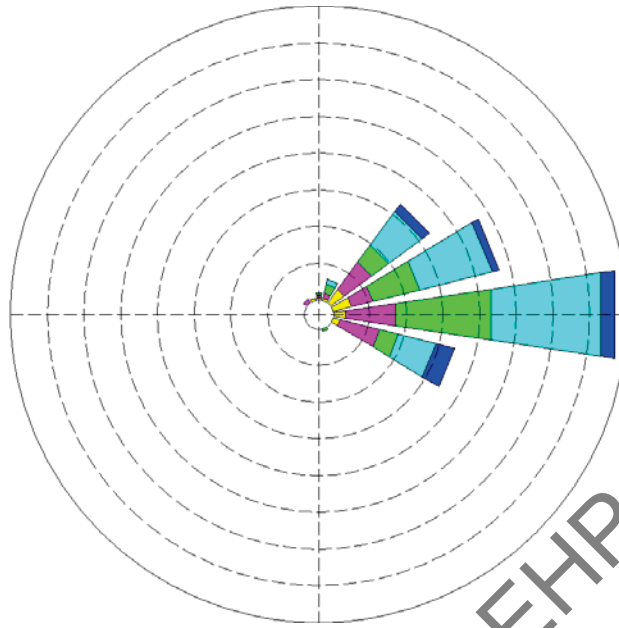
(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 9.0	
8.0 to < 8.0	
7.0 to < 7.0	
6.0 to < 6.0	
5.0 to < 5.0	
4.0 to < 4.0	
3.0 to < 3.0	
2.0 to < 2.0	
1.0 to < 1.0	
0.0 to < 0.0	

Calms = 0
Missing = 0
Total valid = 308



(b) 30m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 9.0	
8.0 to < 8.0	
7.0 to < 7.0	
6.0 to < 6.0	
5.0 to < 5.0	
4.0 to < 4.0	
3.0 to < 3.0	
2.0 to < 2.0	
1.0 to < 1.0	
0.0 to < 0.0	

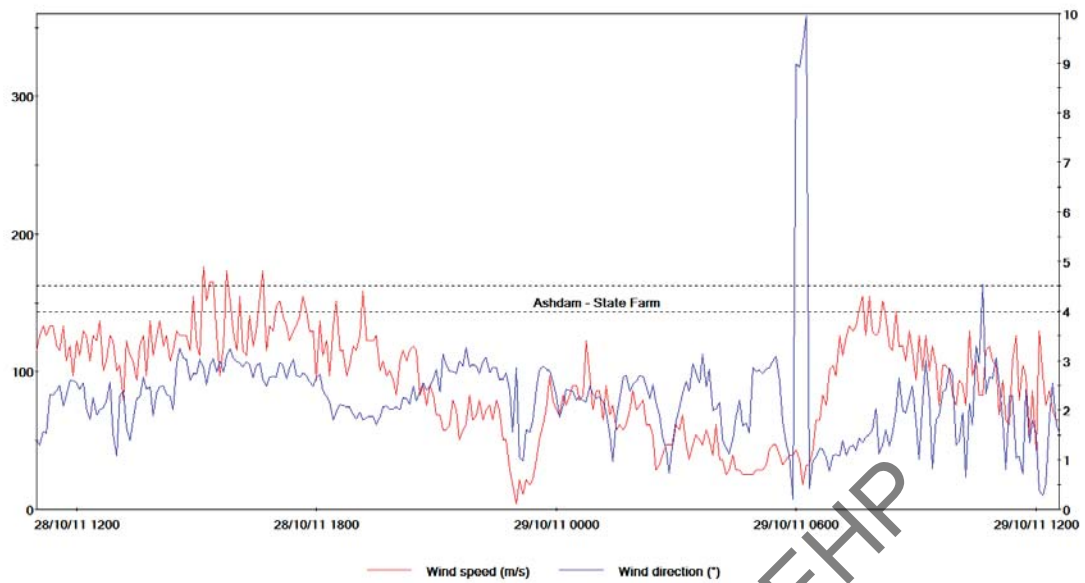
Calms = 0
Missing = 0
Total valid = 308



Figure 38 28 October 2011 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 28/10/11 11:00 – 29/10/11 12:35	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 308	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

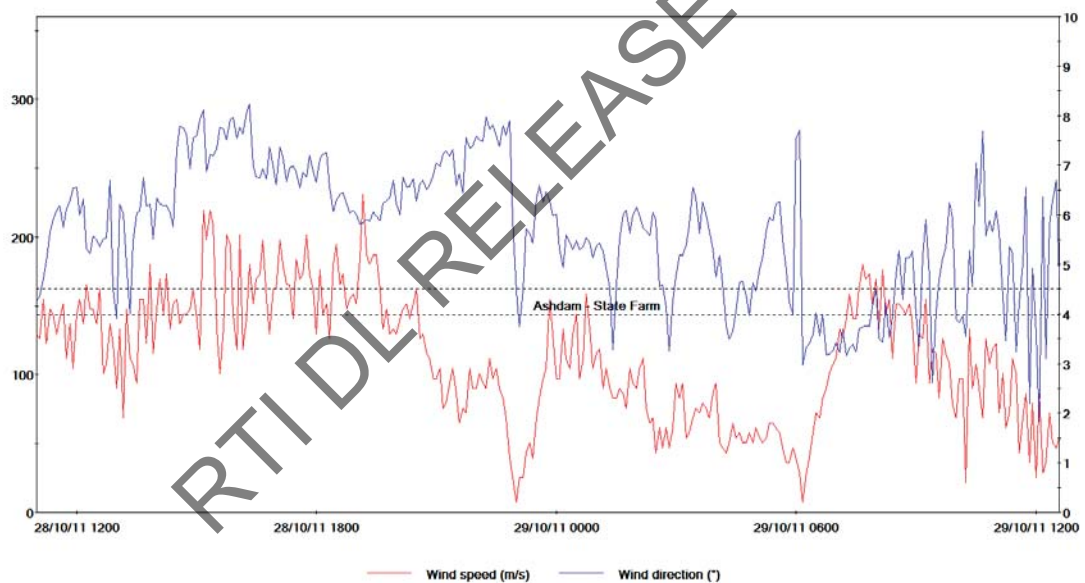
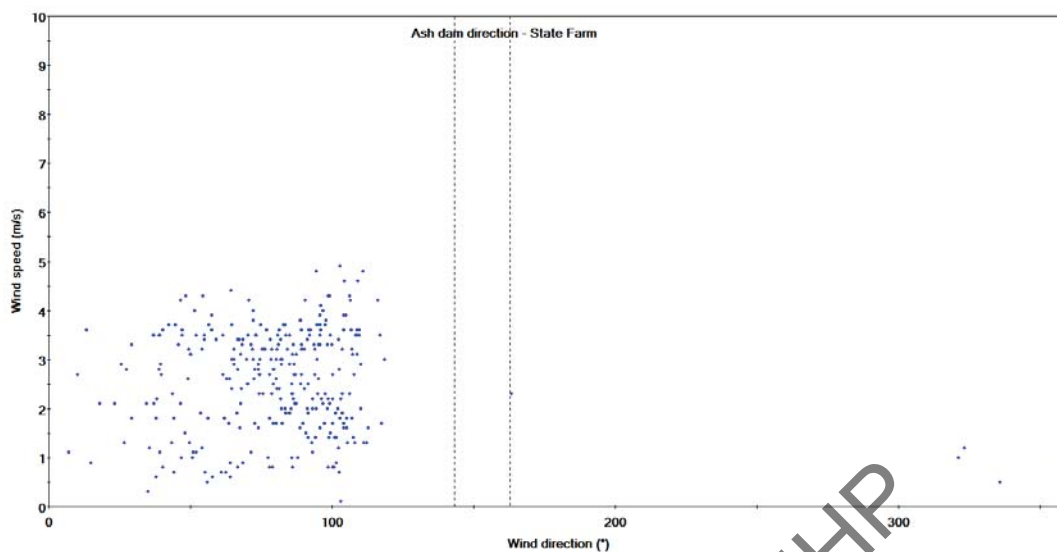


Figure 39 28 October 2011 - Wind speed and wind direction (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 28/10/11 11:00 – 29/10/11 12:35	Data source: Stanwell	Units: m/s and °
Type: Time series	Number of 5 min. records: 308	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

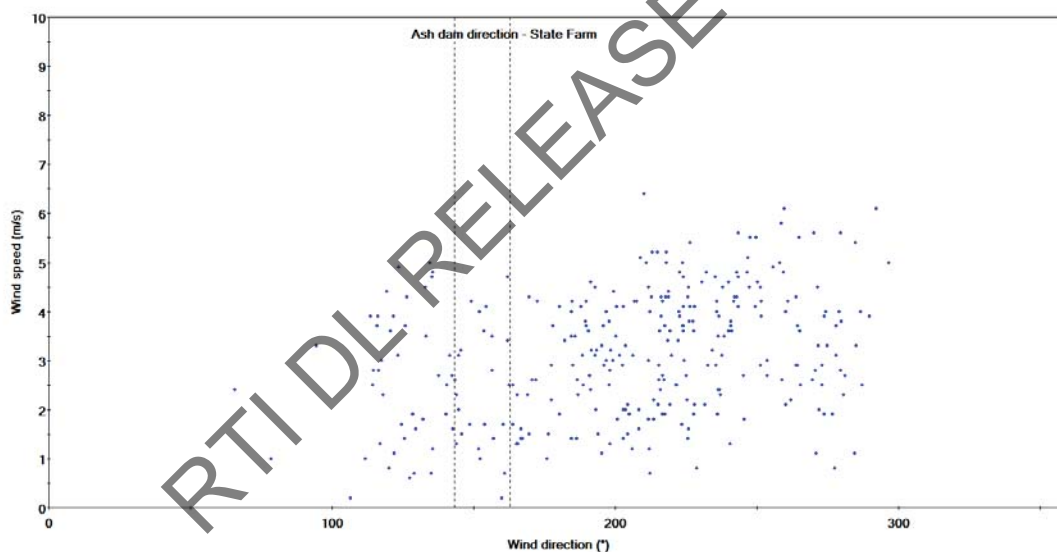


Figure 40 28 October 2011 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 28/10/11 11:00 – 29/10/11 12:35	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 308	Prepared by: K. Wright	Date: August 2012

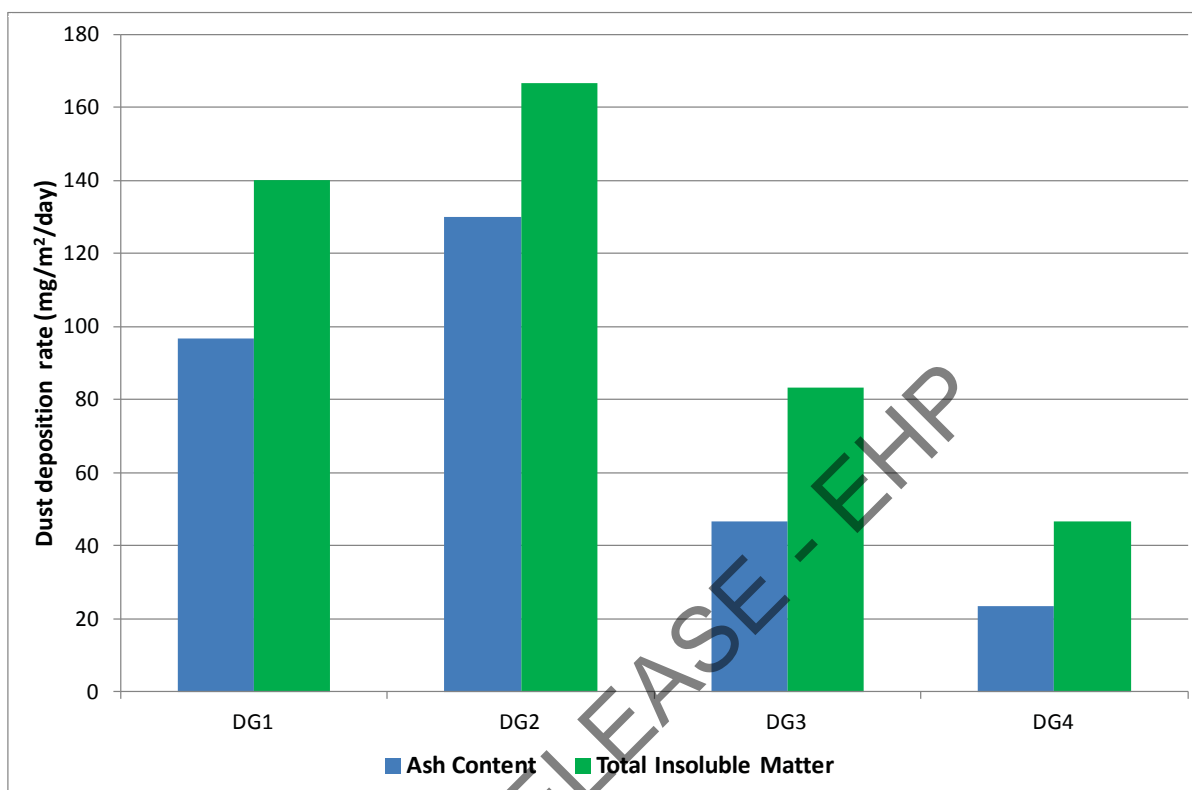


Figure 41 21 Dec 2011 to 20 Jan 2012 - Dust deposition rate as measured at DG1, DG2, DG3 and DG4

Location: Stanwell	Averaging period: monthly	Data source: Ecotech	Units: mg/m ² /day
Type: Bar graph	Guideline: 120 mg/m ² /day	Prepared by: N. Shaw	Date: August 2012

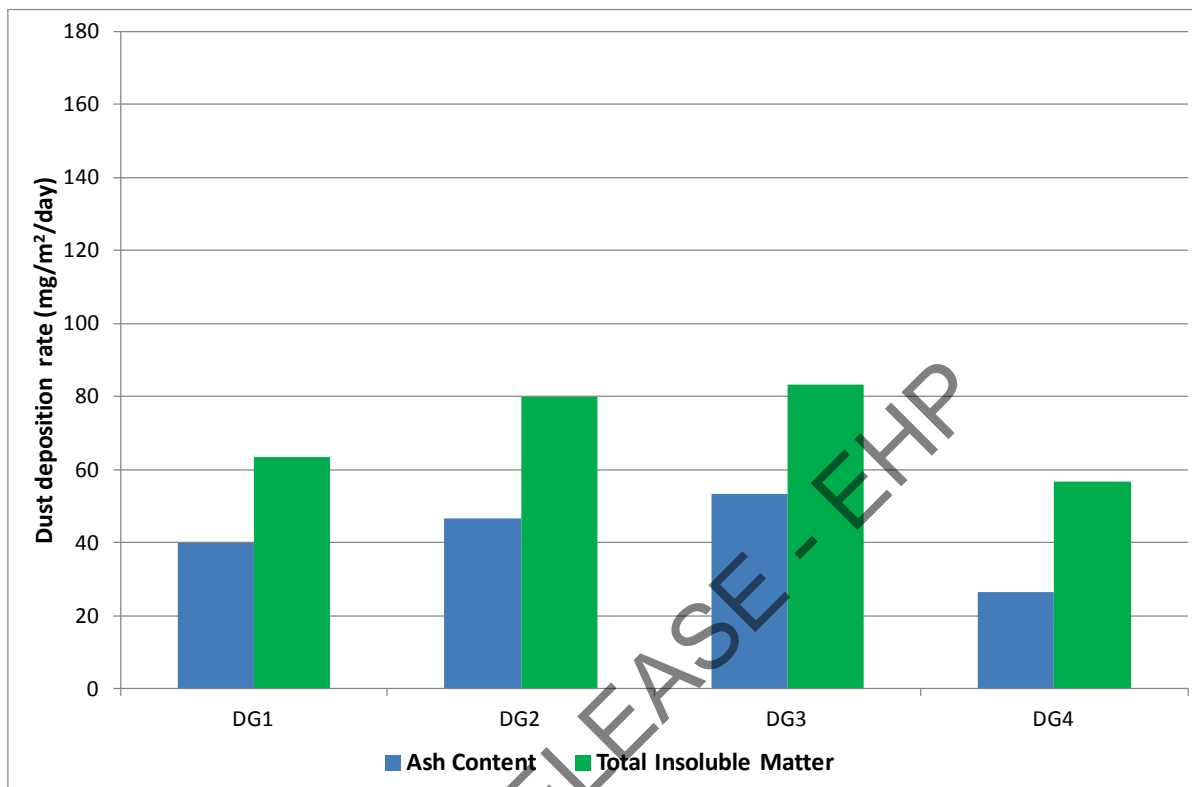


Figure 42 20 Jan to 27 Jan 2012 - Dust deposition rate as measured at DG1, DG2, DG3 and DG4

Location: Stanwell	Averaging period: monthly	Data source: Ecotech	Units: mg/m ² /day
Type: Bar graph	Guideline: 120 mg/m ² /day	Prepared by: N. Shaw	Date: August 2012

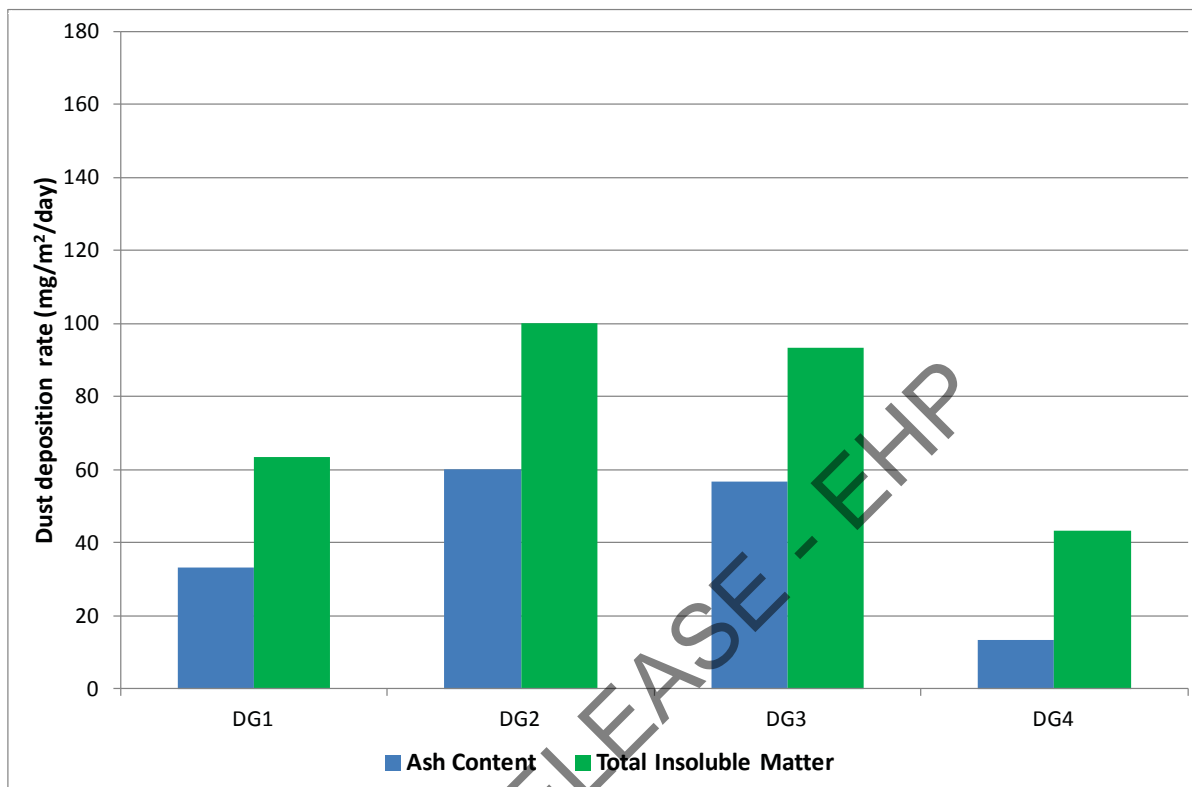


Figure 43 27 Jan to 8 Feb 2012 - Dust deposition rate as measured at DG1, DG2, DG3 and DG4

Location: Stanwell	Averaging period: Monthly	Data source: Ecotech	Units: mg/m ² /day
Type: Bar graph	Guideline: 120 mg/m ² /day	Prepared by: N. Shaw	Date: August 2012

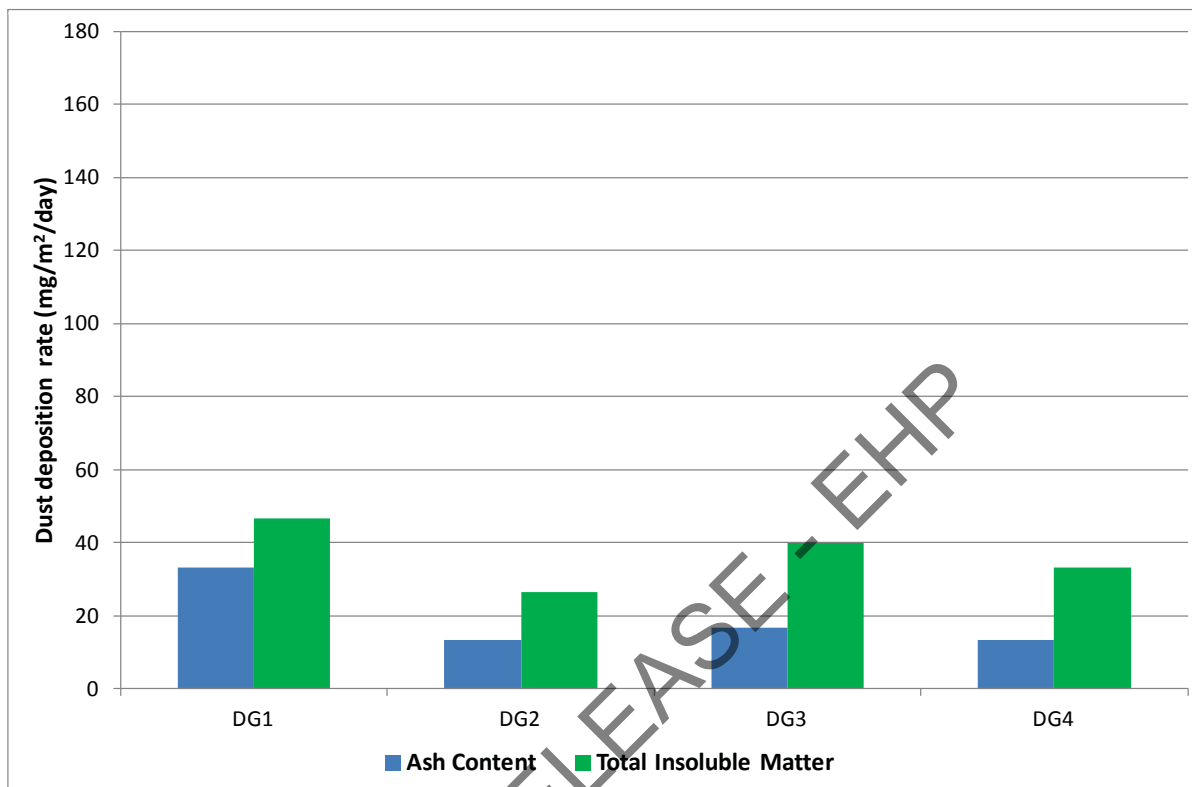


Figure 44 1 to 30 Apr 2012 - Dust deposition rate as measured at DG1, DG2, DG3 and DG4

Location: Stanwell	Averaging period: Monthly	Data source: Ecotech	Units: mg/m ² /day
Type: Bar graph	Guideline: 120 mg/m ² /day	Prepared by: N. Shaw	Date: August 2012

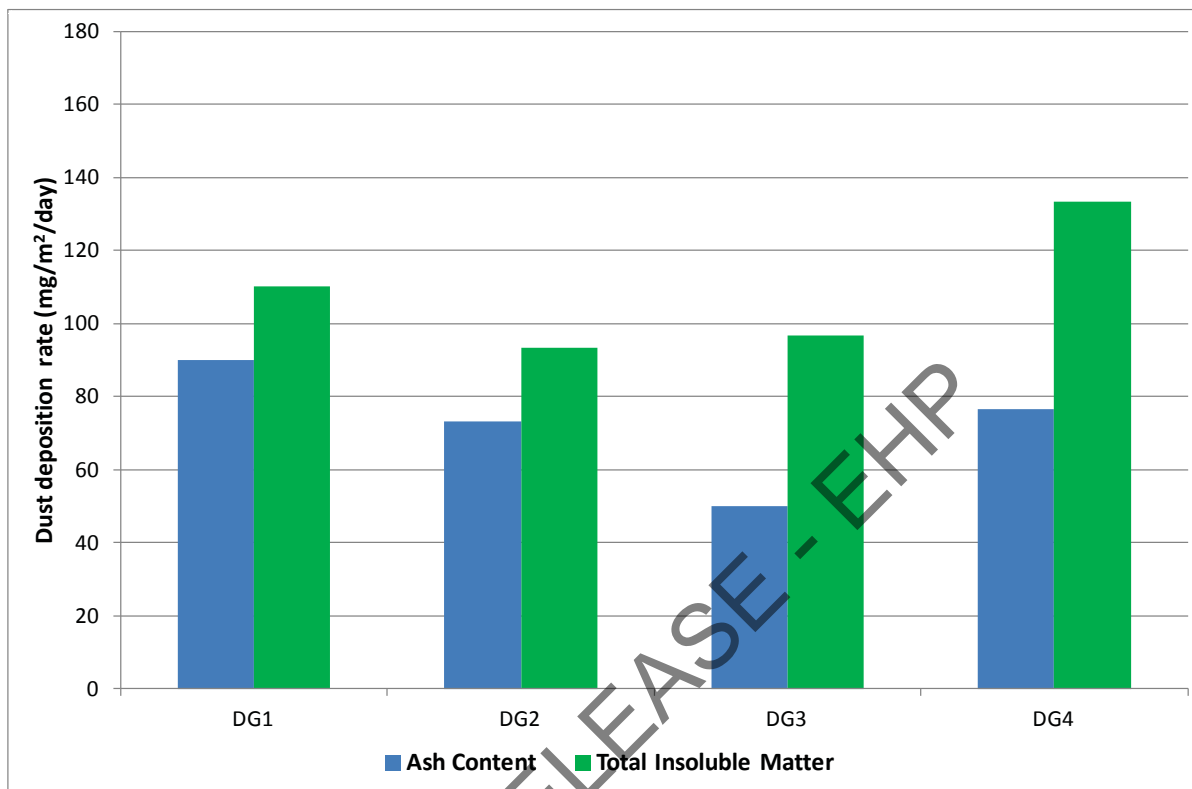


Figure 45 1 to 31 May 2012 - Dust deposition rate as measured at DG1, DG2, DG3 and DG4

Location: Stanwell	Averaging period: Monthly	Data source: Ecotech	Units: mg/m ² /day
Type: Bar graph	Guideline: 120 mg/m ² /day	Prepared by: N. Shaw	Date: August 2012

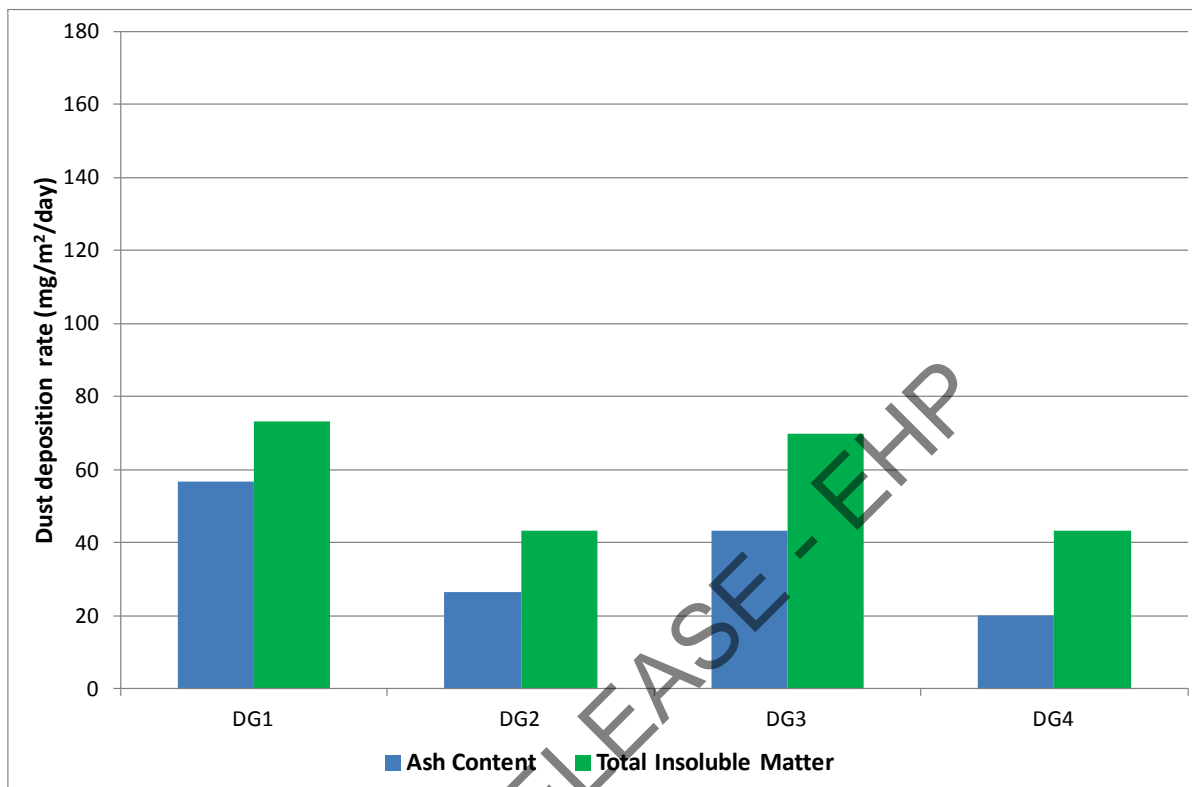


Figure 46 1 to 30 June 2012 - Dust deposition rate as measured at DG1, DG2, DG3 and DG4

Location: Stanwell	Averaging period: Monthly	Data source: Ecotech	Units: mg/m ² /day
Type: Bar graph	Guideline: 120 mg/m ² /day	Prepared by: N. Shaw	Date: August 2012

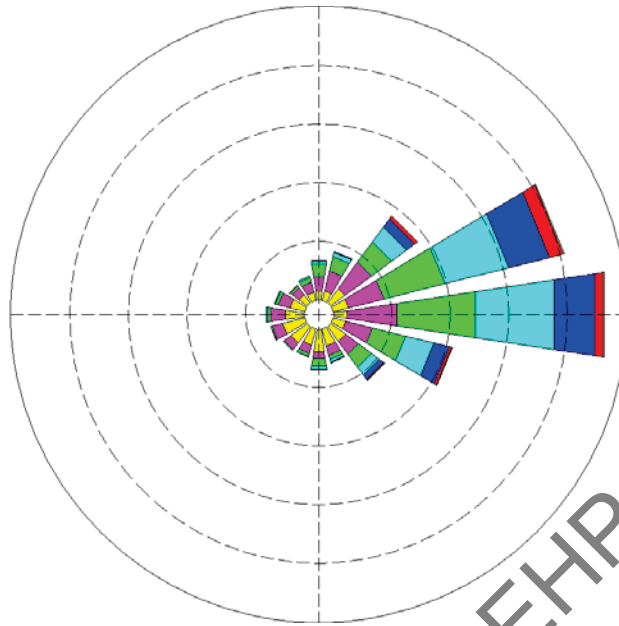
(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

Calm = 21
Missing = 145
Total valid = 8496



(b) 30m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	
9.0 to < 10.0	
8.0 to < 9.0	
7.0 to < 8.0	
6.0 to < 7.0	
5.0 to < 6.0	
4.0 to < 5.0	
3.0 to < 4.0	
2.0 to < 3.0	
1.0 to < 2.0	
0.0 to < 1.0	

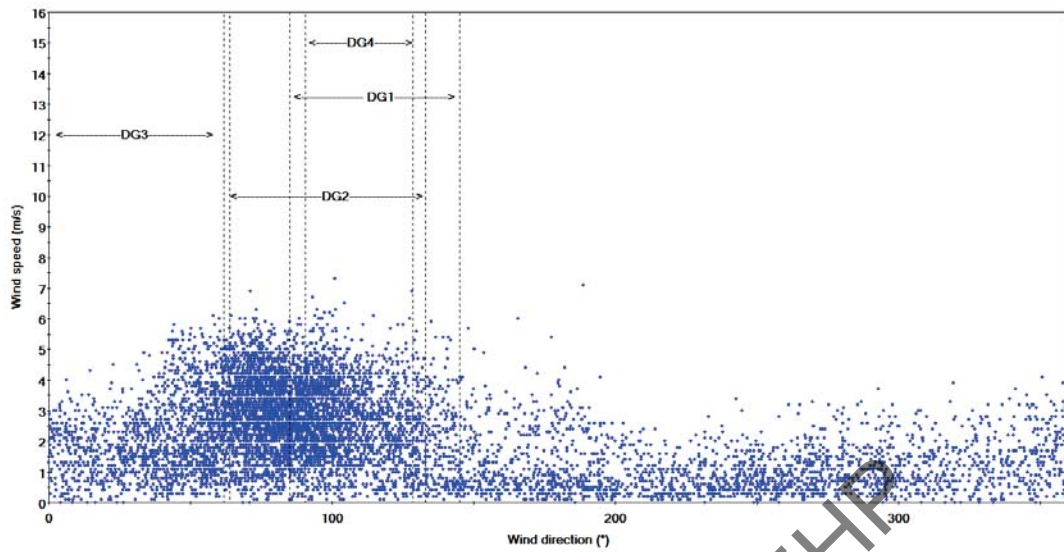
Calm = 11
Missing = 146
Total valid = 8495



Figure 47 21 Dec 2011 to 20 Jan 2012 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 21/12/11 11:00 – 20/01/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 8641	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

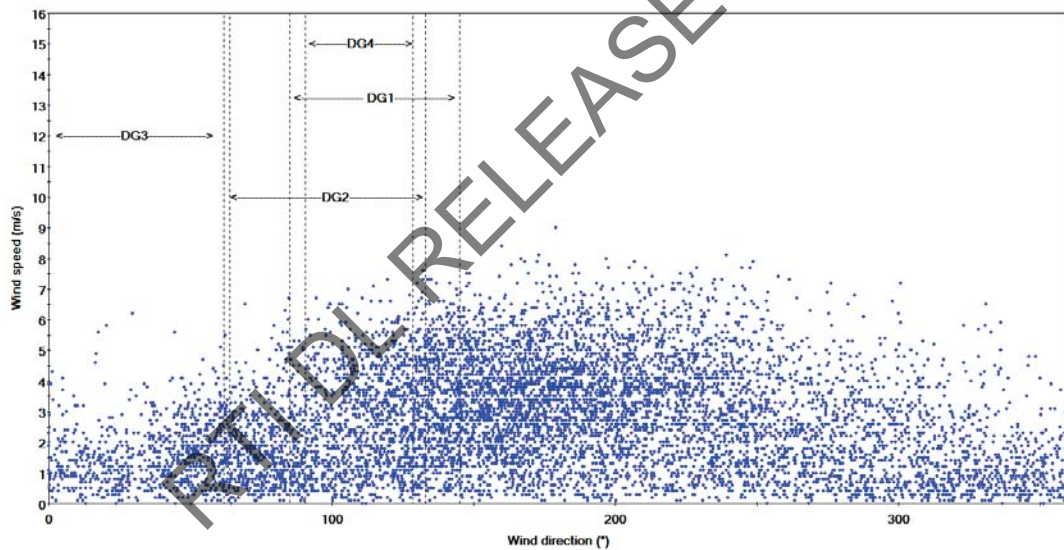
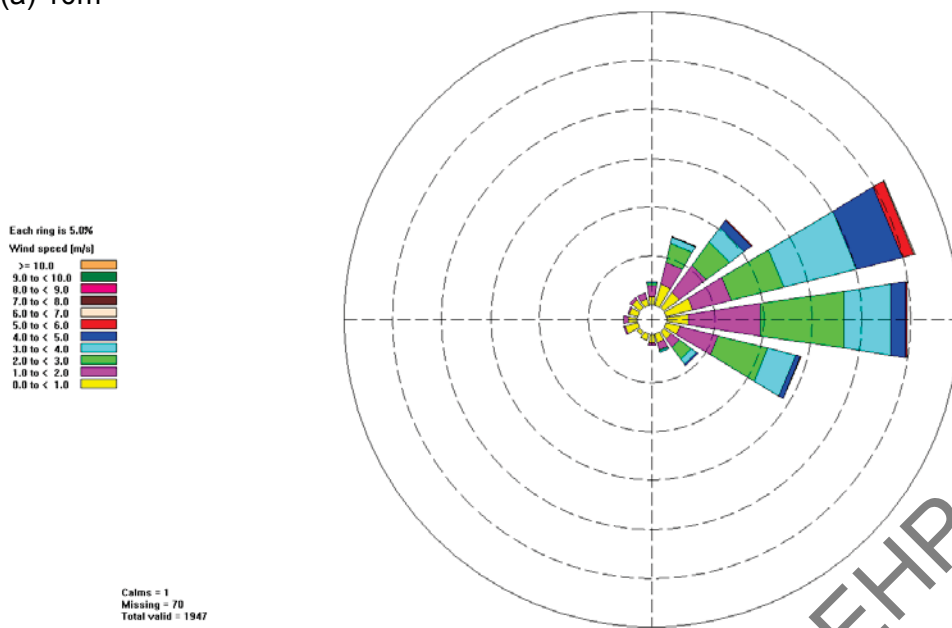


Figure 48 21 Dec 2011 to 20 Jan 2012 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 21/12/11 11:00 – 20/01/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 8641	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

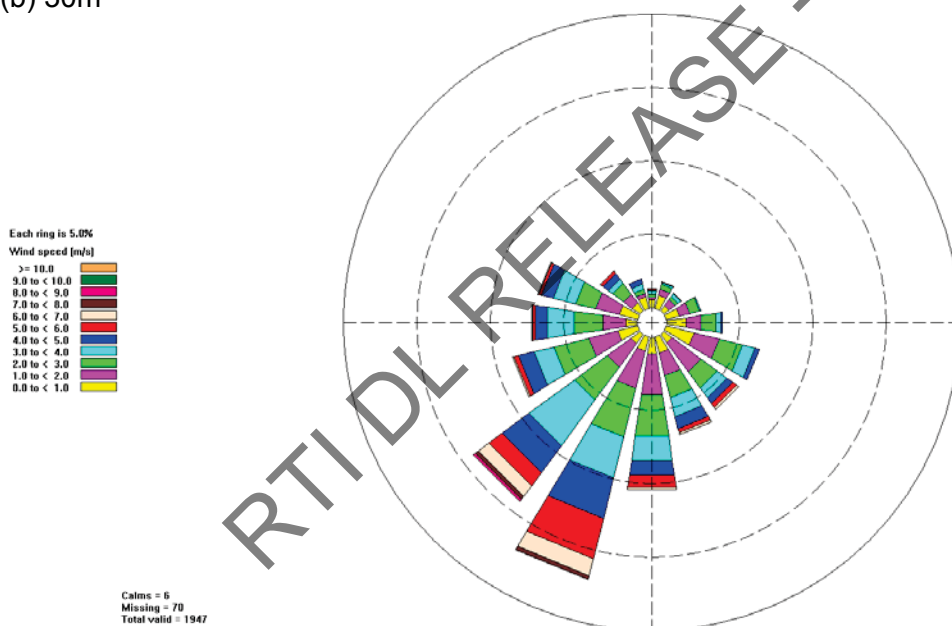
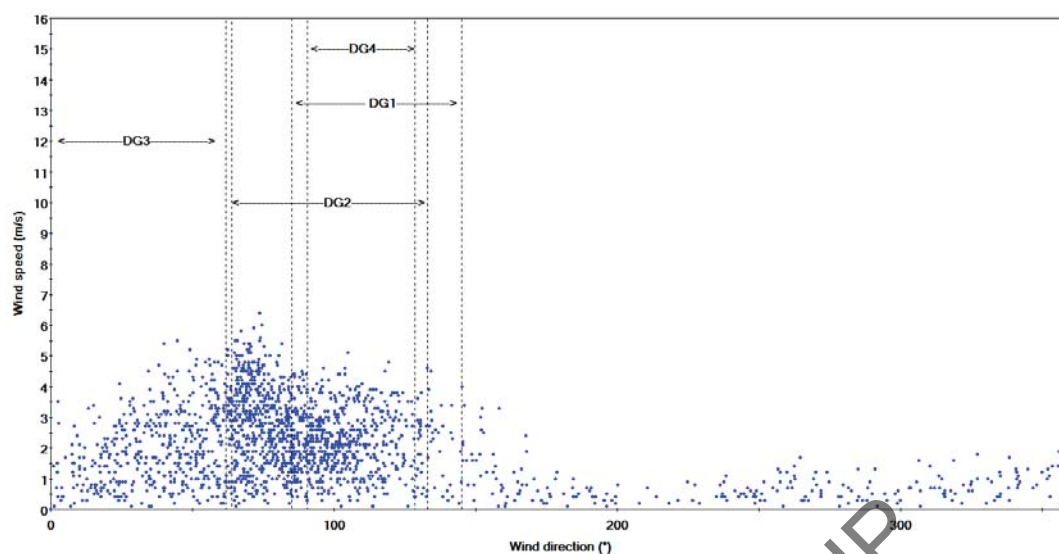


Figure 49 20 to 27 Jan 2012 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 20/01/12 11:00 – 27/01/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 2071	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

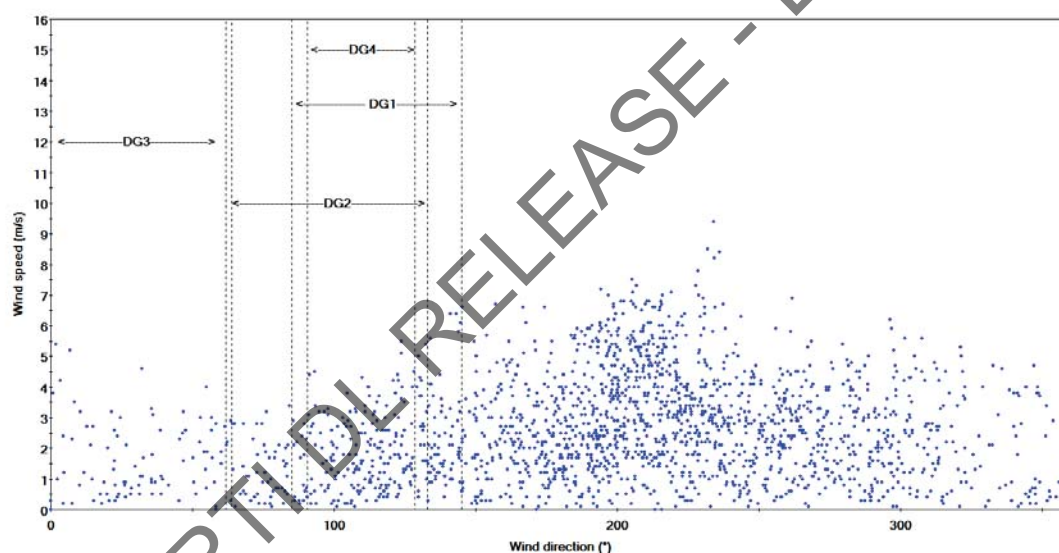


Figure 50 20 to 27 Jan 2012 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 20/01/12 11:00 – 27/01/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 2071	Prepared by: K. Wright	Date: August 2012

(a) 10m

Each ring is 5.0%

Wind speed (m/s)

>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Dark Red
7.0 to < 8.0	Red-Orange
6.0 to < 7.0	Orange
5.0 to < 6.0	Yellow-Orange
4.0 to < 5.0	Yellow
3.0 to < 4.0	Light Green
2.0 to < 3.0	Green
1.0 to < 2.0	Dark Green
0.0 to < 1.0	Blue

Calms = 4
Missing = 93
Total valid = 3364

(b) 30m

Each ring is 5.0%

Wind speed (m/s)

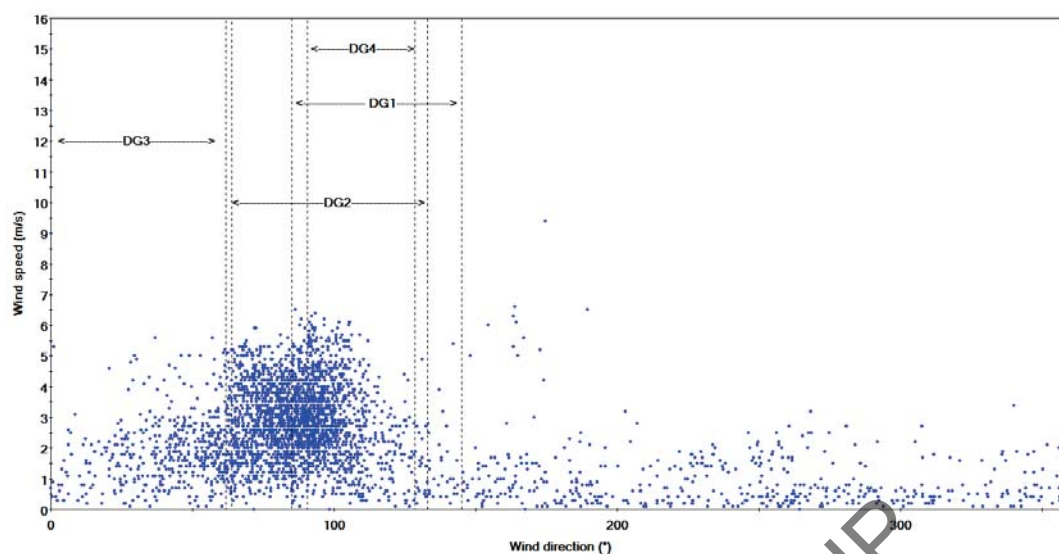
>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Dark Red
7.0 to < 8.0	Red-Orange
6.0 to < 7.0	Orange
5.0 to < 6.0	Yellow-Orange
4.0 to < 5.0	Yellow
3.0 to < 4.0	Light Green
2.0 to < 3.0	Green
1.0 to < 2.0	Dark Green
0.0 to < 1.0	Blue

Calms = 9
Missing = 94
Total valid = 3363

Figure 51 27 Jan to 8 Feb 2012 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 27/01/12 11:00 – 08/02/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 3457	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

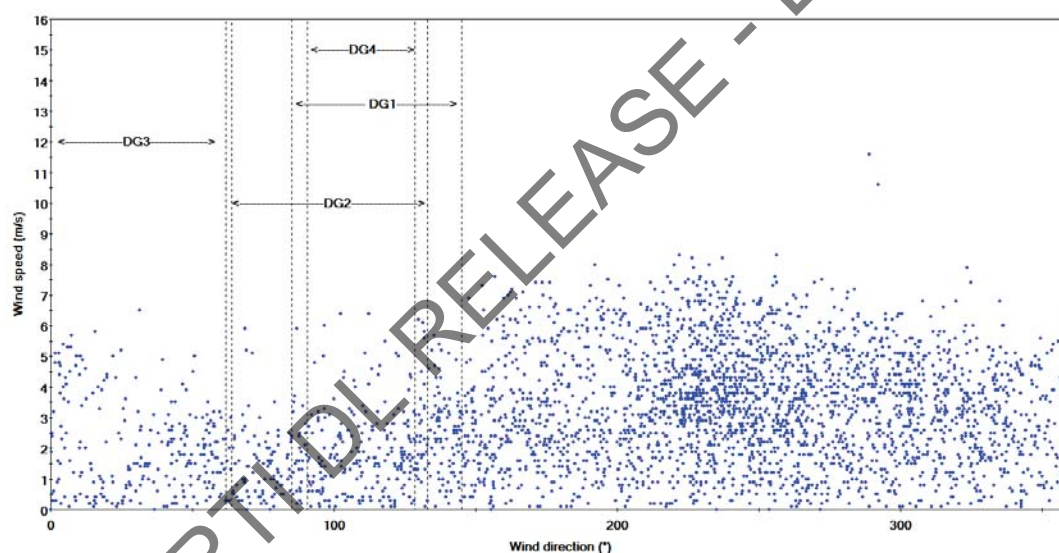


Figure 52 27 Jan to 8 Feb 2012 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 27/01/12 11:00 – 08/02/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 3457	Prepared by: K. Wright	Date: August 2012

(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Dark Red
7.0 to < 8.0	Brown
6.0 to < 7.0	Dark Green
5.0 to < 6.0	Green
4.0 to < 5.0	Light Green
3.0 to < 4.0	Yellow
2.0 to < 3.0	Light Blue
1.0 to < 2.0	Blue
0.0 to < 1.0	Purple

Calms = 231
Missing = 1
Total valid = 8352

(b) 30m

Each ring is 5.0%

Wind speed [m/s]

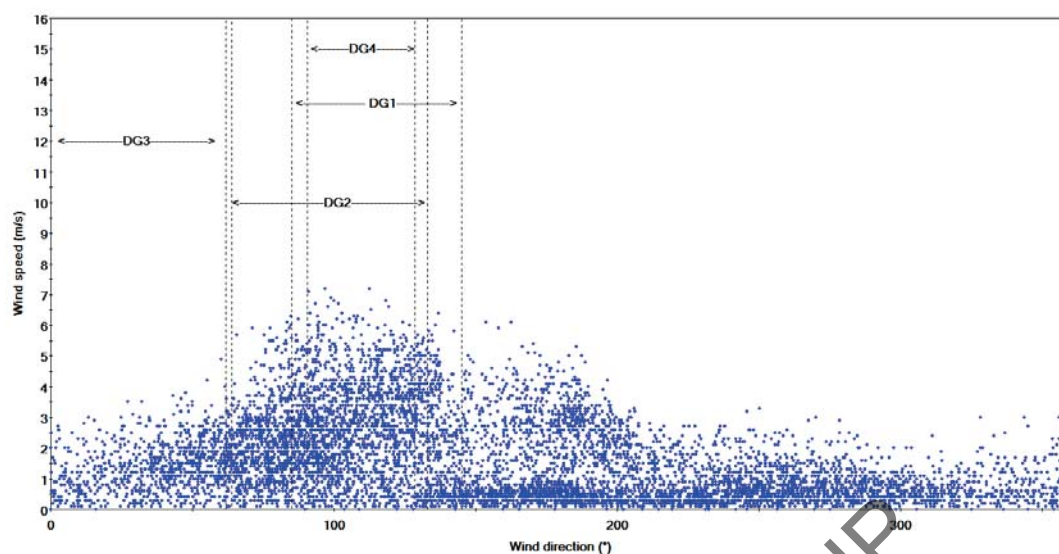
>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Dark Red
7.0 to < 8.0	Brown
6.0 to < 7.0	Dark Green
5.0 to < 6.0	Green
4.0 to < 5.0	Light Green
3.0 to < 4.0	Yellow
2.0 to < 3.0	Light Blue
1.0 to < 2.0	Blue
0.0 to < 1.0	Purple

Calms = 222
Missing = 7
Total valid = 8346

Figure 53 1 to 30 April 2012 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 01/04/12 11:00 – 30/04/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 8353	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

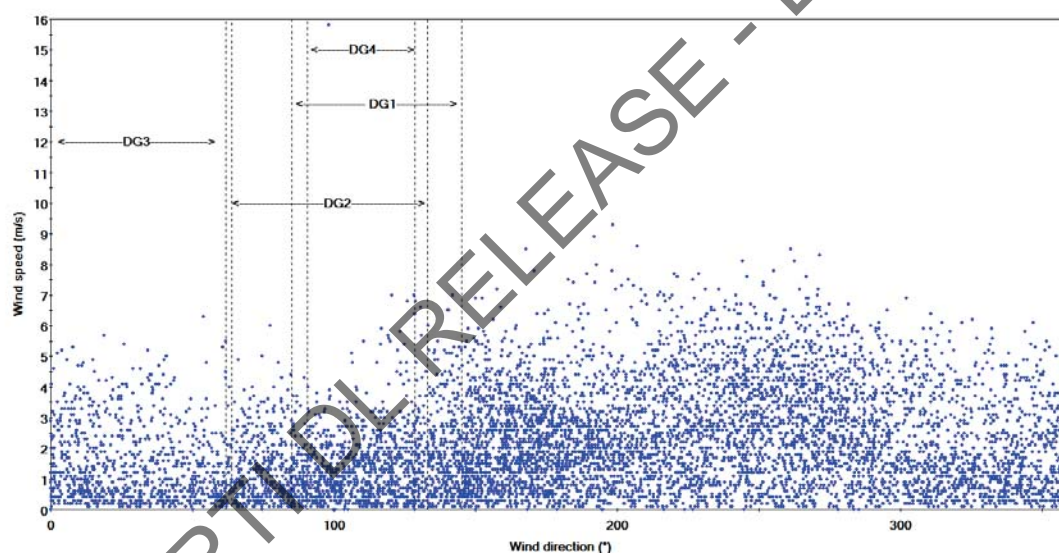


Figure 54 1 to 30 Apr 2012 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 01/04/12 11:00 – 30/04/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 8353	Prepared by: K. Wright	Date: August 2012

(a) 10m

Each ring is 5.0%

Wind speed [m/s]

>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Dark Red
7.0 to < 8.0	Brown
6.0 to < 7.0	Dark Green
5.0 to < 6.0	Green
4.0 to < 5.0	Light Green
3.0 to < 4.0	Yellow
2.0 to < 3.0	Light Blue
1.0 to < 2.0	Blue
0.0 to < 1.0	Dark Blue

Calms = 677
Missing = 206
Total valid = 8435

(b) 30m

Each ring is 5.0%

Wind speed [m/s]

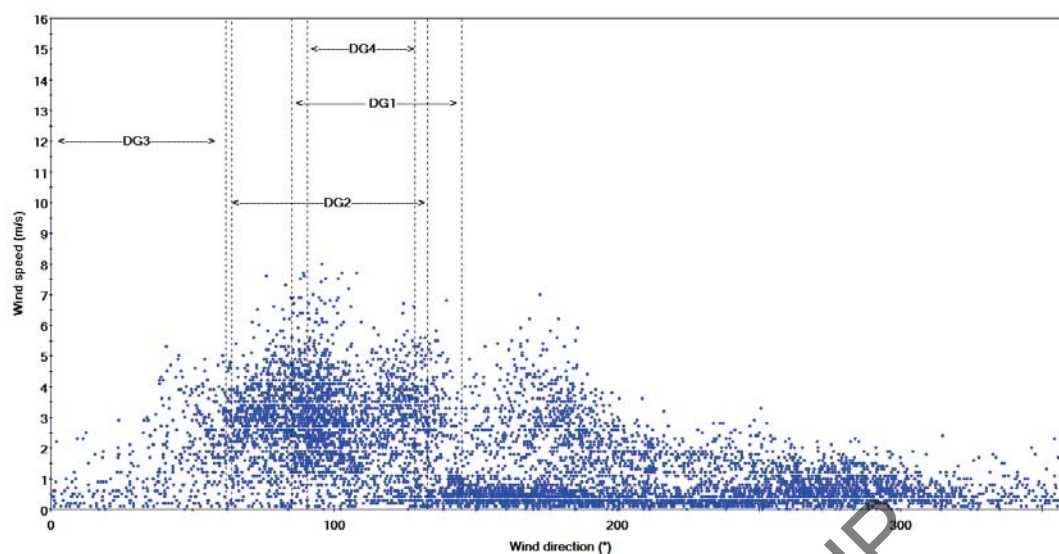
>= 10.0	Orange
9.0 to < 10.0	Red
8.0 to < 9.0	Dark Red
7.0 to < 8.0	Brown
6.0 to < 7.0	Dark Green
5.0 to < 6.0	Green
4.0 to < 5.0	Light Green
3.0 to < 4.0	Yellow
2.0 to < 3.0	Light Blue
1.0 to < 2.0	Blue
0.0 to < 1.0	Dark Blue

Calms = 642
Missing = 206
Total valid = 8435

Figure 55 1 to 31 May 2012 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 01/05/12 11:00 – 31/05/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 8641	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

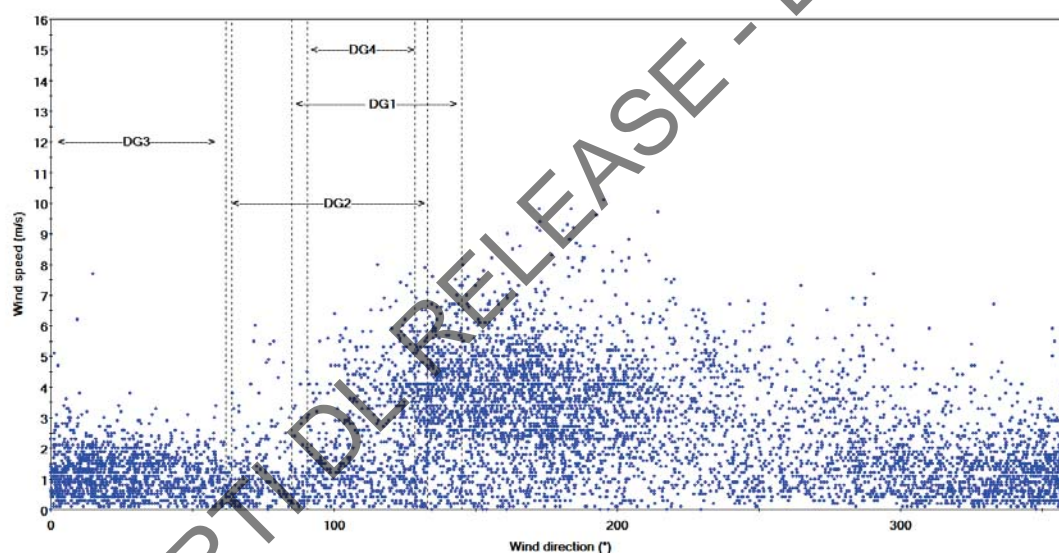


Figure 56 1 to 31 May 2012 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 01/05/12 11:00 – 31/05/12 11:00	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 8641	Prepared by: K. Wright	Date: August 2012

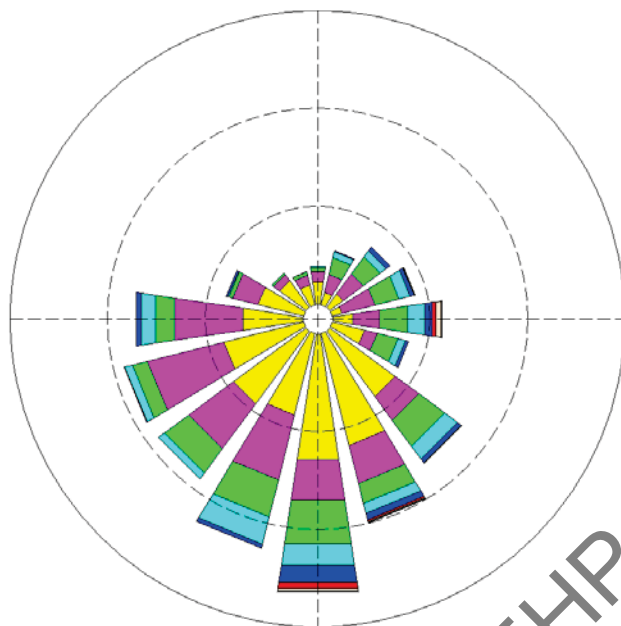
(a) 10m

Each ring is 5.0%

Wind speed (m/s)



Calms = 000
Missing = 121
Total valid = 6136



(b) 30m

Each ring is 5.0%

Wind speed (m/s)



Calms = 054
Missing = 121
Total valid = 6136

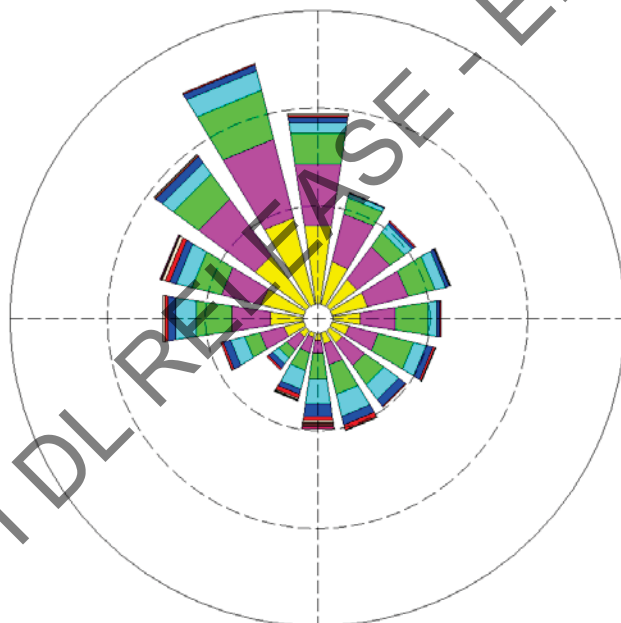
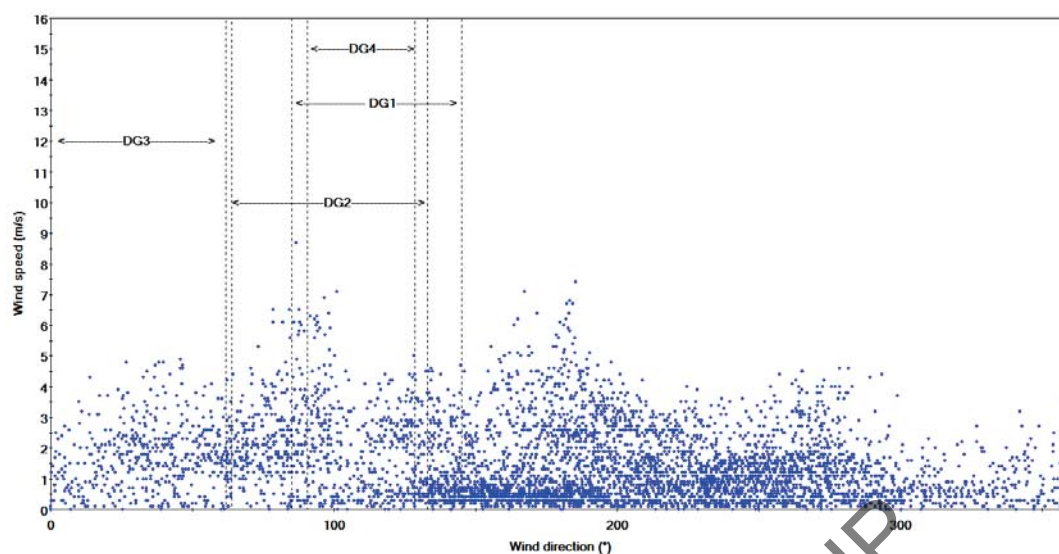


Figure 57 1 to 23 June 2012 - Wind rose (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 01/06/12 11:00 – 23/06/12 04:20	Data source: Stanwell	Units: m/s and °
Type: Wind rose	Number of 5 min. records: 6257	Prepared by: K. Wright	Date: August 2012

(a) 10m



(b) 30m

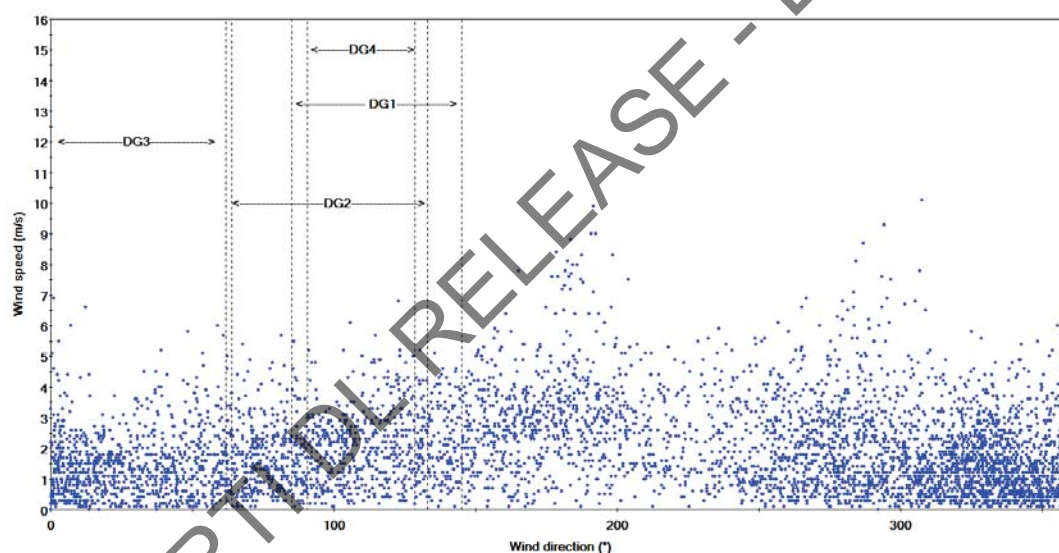


Figure 58 1 to 23 June 2012 – Wind direction vs. wind speed (a) 10 metres and (b) 30 metres

Location: Grape Farm	Period: 01/06/12 11:00 – 23/06/12 04:20	Data source: Stanwell	Units: m/s and °
Type: Scatter plot	Number of 5 min. records: 6257	Prepared by: K. Wright	Date: August 2012

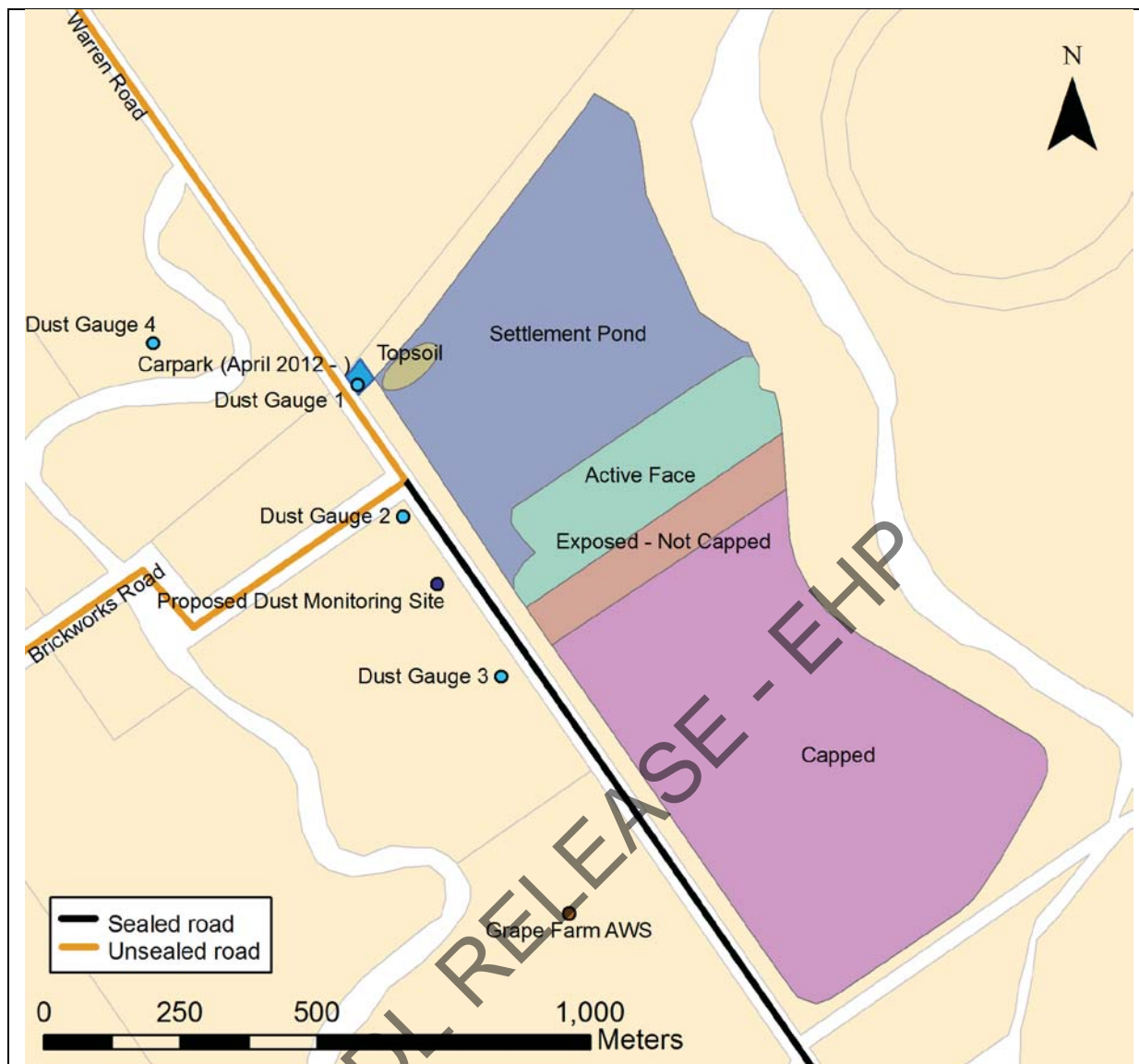


Figure 59 Location of dust sources and proposed dust monitoring site

Location: Stanwell	Data source: Site inspection	Units: NA
Type: Schematic	Prepared by: Bob Rye	Date: August 2012

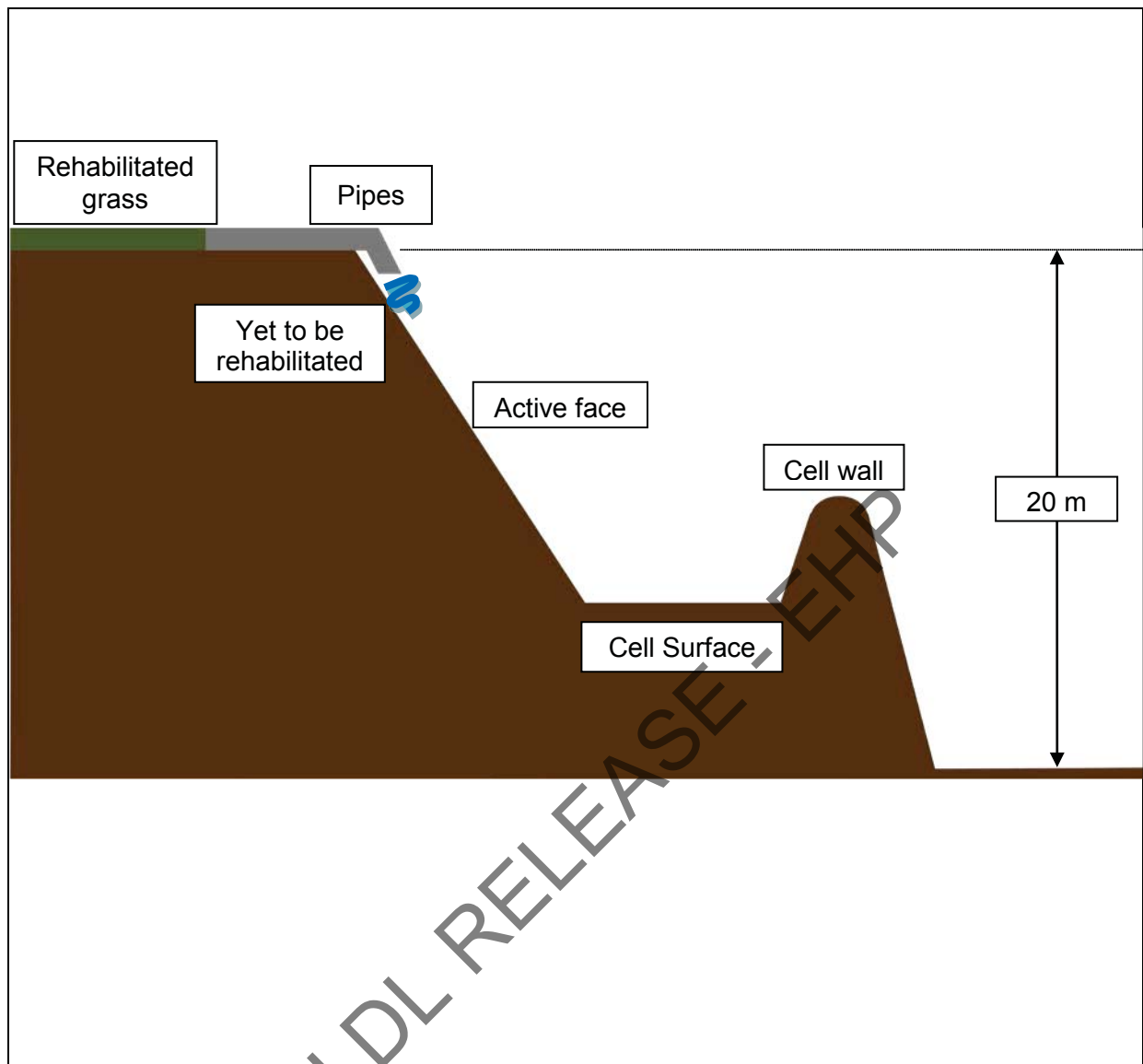


Figure 60 Cross-sectional schematic of ash storage area

Location:

Stanwell

Data source:

Site inspection

Units:

NA

Type:

Schematic

Prepared by:

Bob Rye

Date:

August 2012



Figure 61 Photo showing the active face of the ash storage area

Location: Stanwell, ash storage area	Data source: Site inspection	Units: NA
Type: Photo	Prepared by: Christine Killip	Date: August 2012



Figure 62 Photo showing active cell (left) and dried out cell (right)

Location: Stanwell, ash storage area	Data source: Site inspection	Units: NA
Type: Photo	Prepared by: Christine Killip	Date: August 2012



Figure 63 Photo showing final contoured ash storage area ready for rehabilitation

Location: Stanwell, ash storage area	Data source: Site inspection	Units: NA
Type: Photo	Prepared by: Christine Killip	Date: August 2012



Figure 64 Panorama showing proposed dust monitoring site surrounds

Location: Stanwell, ash storage area	Data source: Site inspection	Units: NA
Type: Photo	Prepared by: Christine Killip	Date: August 2012

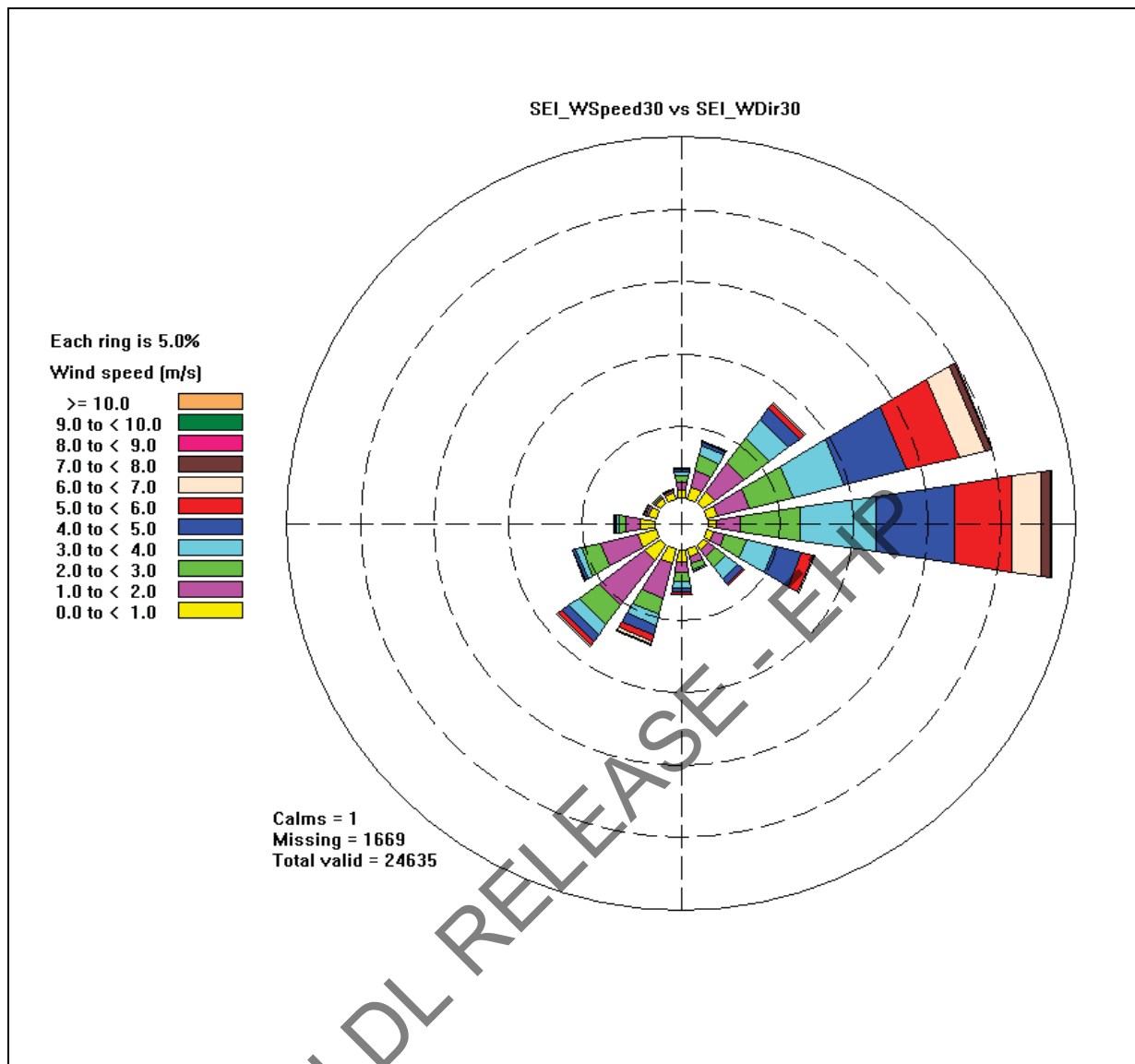


Figure 65 Annual wind roses Stanwell Meteorological Station (30m)

Location: Grape Farm	Data source: Stanwell Power Station	Units: m/s and °
Type: Wind rose	Prepared by: K. Wright	Date: August 2012

Appendix A

Dust Monitoring Matrix

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Table A1 Available Dust Monitors

Monitor Name	BAM1020	TEOM 1400ab/1405	E-BAM	Protinus 1000 (E-Sampler)	Opsis SM200	Nephelometer	Osiris	DustTrak (various models)
Technique employed	beta attenuation (BAM)	microbalance	beta attenuation (BAM)	light scatter	sequential filter sampler, beta attenuation (BAM)+ particle counter	light scatter	light scatter	light scatter
Pollutants measured (eg. TSP, PM10, PM2.5 or other)	TSP, PM10, PM2.5	TSP, PM10, PM2.5	TSP, PM10, PM2.5	"TSP", PM10, PM2.5	PM10, PM2.5	no size selection	"TSP", PM10, PM2.5	"TSP", PM10, PM2.5
Are pollutants measured simultaneously?	no	no	no	no	no	no	one parameter is measured whilst other concentrations are estimated by empirical formula	model specific
Direct Size selection measurement	yes	yes	yes	yes	yes	no	no	model specific
Type of measurements (eg. continuous)	continuous	continuous	continuous	continuous	continuous	continuous	continuous	continuous
Flow rate	16.7 LPM	16.7 LPM	16.7 LPM	2 LPM	16.7 LPM	5 LPM	0.5 LPM	1.7 - 3 LPM
Minimum valid averaging period/data resolution	1 hr	10 min	5min	1min	1min	1min	1min	1min
Is the monitor compliant with Australian Standards? (Y/N)	yes (PM10)	yes (PM10)	no	sampler yes, real time no	yes	yes	no	no
Applicable Australian Std	AS3580.9.11	AS3580.9.8	n/a	n/a	AS3580.9.11	AS3580.12.1	n/a	n/a
Equivalence with US EPA methods? (Y/N)	yes (PM10, PM2.5)	yes (PM10)	no	no	yes	no	no	no
Estimated Reliability of measurements (score out of 5)	4	3	4	4	4	4	2	3
Maintenance/calibration frequency/requirements (1 =	4	3	4	3	3	4	4	4

Monitor Name	BAM1020	TEOM 1400ab/1405	E-BAM	Protinus 1000 (E-Sampler)	Opsis SM200	Nephelometer	Osiris	DustTrak (various models)
high maintenance requirement, 5 = low maintenance requirement)								
Easy to relocate (5=easy, 1=labour & equipment intensive)	3	2	5	5	3	3	4	5
Power requirement including a/c (score out of 5)	3 (typically mains, but solar possible)	2 (mains)	4 (mains, battery, solar)	5 (mains, battery, solar)	3 (mains)	4 (mains, battery, solar)	4 (mains, battery, solar)	4 (mains, battery, solar)
Footprint size of monitor and associated equipment	full enclosure	full enclosure	tripod	tripod	full enclosure	full enclosure	small enclosure	tripod
Does the monitor have to be located in an air conditioned hut?	typically yes (solar options are possible without a/c)	yes	no	no	yes	no	no	no
Level of noise from the pump/air conditioner	a/c noise, typically ~65dB	a/c noise, typically ~65dB	low	very low	a/c noise, typically ~65dB	low	very low	very low
Communication requirements	requires data modem (various options available eg RS232 to modem, ethernet, MODBUS, SDI-12 etc	requires data modem (various options available eg RS232 to modem, ethernet, MODBUS, SDI-12 etc	requires data modem (various options available eg RS232 to modem, ethernet, MODBUS, SDI-12 etc	requires data modem (various options available eg RS232 to modem, ethernet, MODBUS, SDI-12 etc	requires data modem (various options available eg RS232 to modem, ethernet, MODBUS, SDI-12 etc	requires data modem (various options available eg RS232 to modem, ethernet, MODBUS, SDI-12 etc	requires data modem (various options available eg RS232 to modem, ethernet, MODBUS, SDI-12 etc	requires data modem (various options available eg RS232 to modem, ethernet, MODBUS, SDI-12 etc
Negative aspects of monitor	relative high cost	relative high cost & high maintenance than BAM. Generally under reports mass concentrations	non AS method at moment	non AS method	relative high cost	relative high cost	very low flow rate limits ability to take representative sample, side scatter better suited as particle counter than monitor. Requires individual calibration of each size fraction which is very time consuming	non AS method
Positive aspects of monitor	simple design & reliable. USEPA approved for	good data resolution	highly transportable, traceable to	relative low cost, highly transportable,	all in one unit that is approved method for PM10	highly reliable, recognised as good surrogate for	relative low cost, reports multiple size fraction	relative low cost

Monitor Name	BAM1020	TEOM 1400ab/1405	E-BAM	Protinus 1000 (E-Sampler)	Opsis SM200	Nephelometer	Osiris	DustTrak (various models)
	PM10 & PM2.5 & PM10-2.5 (coarse). Addition of RTPM allows for 1 minute data resolution		approved method. New certifications imminent	integral low volume sampler is AS method for PM10 & PM2.5	(BAM), sampler, and real time capabilities	direct PM2.5 measurements	concentrations	
Installation and commissioning costs	1-2 days	1-2 days	1/2 day	1/2 day	2 days	1-2 days	1 day	1/2 day
Estimated Equipment price (purchased)	25K	25K	20K	10K	35K	20K	15K	15K
Decommissioning costs	1-2 days	1-2 days	1/2 day	1/2 day	2 days	1-2 days	1 day	1/2 day
Is there a warranty?	12 months standard	12 months standard	12 months standard	12 months standard	12 months standard	12 months standard	12 months standard	12 months standard

Table A2 Available Dust Samplers

Sampler Name	High Volume Sampler	Low Volume Sampler	Protinus 1000 (E-Sampler)	Sequential Sampler	SM200
Monitoring characteristic					
Technique employed	manual gravimetric	manual gravimetric	combination real time with manual gravimetric	manual gravimetric, with filter magazine	combination real time with manual gravimetric & BAM
Filter size	A4	47mm	47mm	47mm	47mm
Typical model	Ecotech HVS3000	Ecotech MicroVol 1100	Protinus 1000	Partisol (various models)	Opsis
Pollutants measured (eg. TSP, PM10, PM2.5 or other)	TSP, PM10, PM2.5	TSP, PM10, PM2.5	"TSP", PM10, PM2.5	TSP, PM10, PM2.5	PM10, PM2.5
Are pollutants measured simultaneously?	no	no	no	no	no
Direct Size selection measurement	yes	yes	yes	yes	yes
Flow rate	typically 68m ³ /h or ~1100 LPM	1-4.5 LPM	2 LPM	16.7 LPM	16.7 LPM
Data period/data resolution	24 hr	24 hr	24 hr	24 hr	24 hr
Is the monitor compliant with Australian Standards? (Y/N)	yes (TSP, PM10). Note only AS method for TSP	yes (PM10, PM2.5)	yes (sampler only for PM10 & PM2.5)	yes (PM10, PM2.5)	yes (PM10, PM2.5)
Applicable Australian Std	AS3580.9.3 (TSP) & 9.6 (PM10)	AS3580.9.9 (PM10) & 9.10 (PM2.5)	AS3580.9.9 (PM10) & 9.10 (PM2.5)	AS3580.9.9 (PM10) & 9.10 (PM2.5)	AS3580.9.9 (PM10) & 9.10 (PM2.5)
Estimated Reliability of	5	5	4	2	4

Sampler Name	High Volume Sampler	Low Volume Sampler	Protinus 1000 (E-Sampler)	Sequential Sampler	SM200
Monitoring characteristic					
measurements (score out of 5)					
Maintenance/calibration frequency/ requirements (score out of 5)	1	2	2	5	5
Easy to relocate (score out of 5)	2	5	5	2	1
Power requirement including a/c (score out of 5)	1 (10A power point required, can be run off generator for short measurement surveys)	5 (generally run off battery / solar power, mains option standard)	4 (Can be run from battery or solar power and mains power supply as standard)	3 (mains power required)	3 (mains power required as well as power for air conditioned enclosure)
Footprint size of monitor and associated equipment	medium, weighs 50kg	very small, weighs 5 kg	small, weighs 5 kg	medium, weighs 50kg	requires enclosure
Does the monitor have to be located in an air conditioned hut?	no, integral outdoor enclosure	no, integral outdoor enclosure	no, integral outdoor enclosure	no, integral outdoor enclosure	yes
Level of noise from the pump/air conditioner (score out of 5)	2 (noise can be reduced by addition of muffler at minimal cost)	5 (suitable for indoor sampling as well)	5	3	a/c noise
Communication requirements	manual download, remote data access possible with modem when used with weather station	manual download, remote data access possible with modem when used with weather station	remote data access, requires data modem, sample needs to be manually replaced	manual download	remote data access, requires data modem
Negative aspects of monitor	labour intensive, results are received long after event occurred	labour intensive, results are received long after event occurred	low flow rate will not sample TSP very well	high cost and complexity	relative high cost
Positive aspects of monitor	simple design & reliable. Low cost compliance sampler for TSP, PM10, PM2.5. Sector selectable sampling possible. Can be used as stand alone logger for WS/WD, T, RH. Future developments include more onboard memory as well as addition of Real Time Particulate Monitor (RTPM) for early warning alarm applications	simple design & reliable. Low cost compliance sampler for PM10, PM2.5. Sector selectable sampling possible. Can be used as stand alone logger for WS/WD, T, RH. Future developments include more onboard memory as well as addition of Real Time Particulate Monitor (RTPM) for early warning alarm applications	Combined gravimetric and real time monitor. Relative low cost	Sequential function allows samples to be collected without a visit to change filter after each sample	combination real time with manual gravimetric & BAM. Includes sequential function 47mm filters for further analysis if required
Installation and commissioning	simple, 1/2 day max	simple, 1/2 day max	simple, 1/2 day max	1/2 day	1 - 2 days
Estimated Equipment price (purchased)	5 - 10K	5K	10K	20K	35k
Decommissioning costs	simple, 1/2 day max	simple, 1/2 day max	simple, 1/2 day max	1/2 day	1 - 2 days
Is there a warranty?	12 months standard	12 months standard	12 months standard	12 months standard	12 months standard

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