



Carbon Based Environmental
Pty Limited
ABN 74 102 920 285

Rocla Quarry Products Calga Quarry

Environmental Monitoring

Dust Deposition Gauges, Surface and Ground Waters and Meteorological Station

March 2011

A handwritten signature in black ink that reads 'Colin Davies'.

Colin Davies BSc MEIA CENVP
Environmental Scientist
18 April 2011

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Executive Summary

Carbon Based Environmental is contracted by Rocla Quarry Products to conduct environmental monitoring at the Calga Sand Quarry.

The monitoring includes;

- Dust Deposition Gauges;
- Surface Waters;
- Groundwaters; and
- Meteorological Station.

This report was prepared by Carbon Based Environmental and includes the following;

- Dust Deposition results for March 2011;
- Surface Water quality results for March 2011;
- Groundwater depth and quality results for March 2011; and
- Meteorological report for March 2011.

The March 2011 dust deposition results were generally lower than February 2011. All sites, on a year to date average basis, are currently below the Air Quality Management Plan exceedence level of 3.7g/m².month. Results were found to be representative of dust levels as determined by the Australian Standard.

Surface water samples were collected for the normal monthly sampling event on the 1 April 2011 at sites A, D and F. Site B was dry and there was no access to site C. At the time of sample collection, there was no water discharge observed from the site. Samples were also collected from sites A, B, C, D, F and Site Inflow on 21 March 2011 during a high rainfall event. Results show generally good quality water with both sites sampled maintaining low Electrical Conductivity, low Total Dissolved Solids, low Total Suspended Solids and no detectable Oil and Grease. pH levels remained stable and were within the slightly acidic range.

Groundwaters were sampled for normal monthly monitoring on 1 April 2011. Groundwater depths increased at the majority of monitoring bores this month, indicating water away from the surface. EC remained relatively steady at all sites. pH remained steady at most sites with the exception of slight decreases at CQ1 and CQ10 and slight increases at CQ8 and CP7.

The meteorological station data recovery for the month was 100% with the exception of wind speed which was unavailable from the 23 March to 31 March due to wind sensor damage. The predominant winds were from the ESE, with strongest winds from the SW-WSW. Recorded rainfall on site for March was 134.4 mm, which was lower than that recorded at the BOM Peats Ridge Station and similar to the the Peats Ridge long-term average for March. Results are detailed below:

Rocla Calga Quarry	134.4 mm
BOM Peats Ridge*	177.8 mm
BOM Gosford*	216.6 mm
BOM Peats Ridge Long term mean for March*	138.5 mm

*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au).

Note: Differences in the daily rainfall readings between BOM and the Rocla station may occur due to BOM stations reporting rainfall at 9am and the Rocla station recording rainfall at midnight.

1.0 Sampling Program

Rocla Calga Quarry conducts environmental monitoring in accordance to Development Consent, DEC (EPA) licence and Environmental Management Plans. Carbon Based Environmental are contracted to undertake dust deposition gauge, surface and groundwater and meteorological monitoring for the project. Carbon Based Environmental commenced monitoring from the April 2006 monitoring period.

Dust deposition gauges are operated to the Australian Standard AS3580.10.1 “Methods for Sampling and Analysis of Ambient Air Method 10.1 Determination of Particulates—Deposited Matter—Gravimetric Method”. Sampling is undertaken every 30 +/- 2 days and each gauge is analysed for insoluble solids and ash residue. The results are reported as g/m².month.

Surface waters are sampled in accordance with Australian Standards AS5667.1 “Guidance on the Design of Sample Programs, Sampling Techniques and the Preservation and Handling of Samples”, AS5667.6 “Water Quality Sampling—Guidance on sampling of rivers and streams” and AS5667.4 “Water Quality Sampling—Guidance on sampling from lakes, natural and man-made”. Surface water monitoring sites include local streams and dams. Basic analysis including pH, Electrical Conductivity, Total Suspended Solids, Total Dissolved Solids and Total Oil and Grease is conducted monthly at Sites A and F (dams) and when Sites B, C and D are flowing. Additional samples are collected when daily rainfall exceeds 50mm.

Groundwaters are sampled in accordance with Australian Standards AS5667.1 “Guidance on the Design of Sample Programs, Sampling Techniques and the Preservation and Handling of Samples” and AS5667.11 “Water Quality Sampling—Guidance on sampling of ground waters”. Groundwater monitoring sites are sampled at least bi-monthly for water quality and at least quarterly for water level. Groundwater monitoring loggers continuously record water levels in a selection of bores.

Meteorological monitoring is conducted at the quarry and displayed on the site computer with a real time display. Wind parameters are measured according to Australian Standard AS 2923 “Ambient Air— Guide for Measurement of Horizontal Wind for Air Quality Applications”.

The weather stations have the following sensor configuration;

- Air temperature
- Humidity
- Rainfall
- Atmospheric pressure
- Evaporation
- Solar radiation
- Wind speed
- Wind direction

Carbon Based Environmental continued to operate the monitoring equipment and utilise site collections at their existing locations.

2.0 Monthly Results

2.1 Dust Deposition Gauges

Table 1 displays the results for March 2011 and the project average. Results are in g/m².month.

Table 1: Dust Deposition results: 1-March 2011 to 1-April 2011

Site	Monthly Insoluble Solids g/m ² .month	Monthly Ash Residue g/m ² .month	Monthly Combustible Matter g/m ² .month	Monthly Ash Residue/ Insoluble Solids %	Rolling Annual Average Insoluble Solids g/m ² .month
CD1	1.4	0.8	0.6	57	1.6
CD2c	1.6	1.6	<0.1	100	1.1
CD3	1.0	1.0	<0.1	100	0.5
CD4	0.2	0.2	<0.1	100	0.5
CD5	0.1	0.1	<0.1	100	0.4
CD6	0.2	0.2	<0.1	100	0.5

Insoluble Solids marked with an * indicate an excessively contaminated gauge. Contamination can include bird droppings, vegetation (such as plant matter, algae, pollen and seeds) and insects. Results in bold indicate insoluble solids levels above 3.7 g/m².month; the Development Consent’s annual average amenity criteria at residential locations. The current rolling annual average is calculated from April 2010 to March 2011.

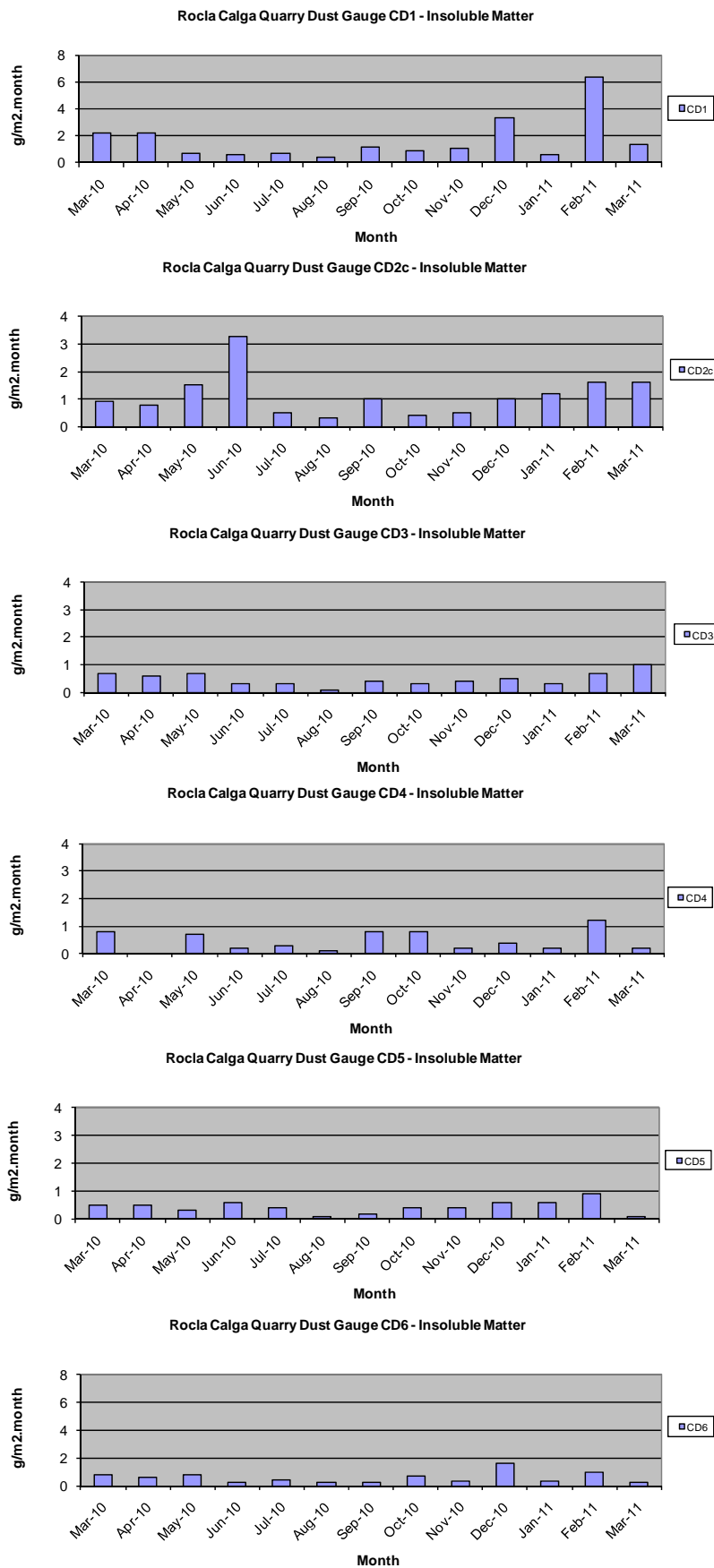
NA= Not Available.

CD1 was installed on the 1 May 2006. CD2a was discontinued at the start of August 2006 due to quarry operations “mining out” the site of the gauge. The replacement gauge, Site CD2b, was located in a position adjacent to the boundary between B. Kashouli and F. & J. Gazzana in conformance with the Air Quality Management Plan. CD4 was installed on 3 October 2006, to gauge air quality impacts to the south of the site operations, as were CD5 and CD6 which were installed on the 14 December 2006. CD2b was discontinued at the end of January 2010 due to contamination of the gauge by non-quarry related vehicle movements on a track adjacent to the gauge. The replacement gauge, CD2c, was located on a rehabilitated section of land between the extraction area and adjacent resident.

Dust deposition charts for all dust gauge sites appear in **Figure 1** below. The laboratory analysis is provided in **Appendix 1**.

The predominant winds were from the ESE, with strongest winds from the SW-WSW.

Figure 1: Dust Deposition Charts



2.2 Water Monitoring

2.2.1 Surface Waters

Monthly surface water monitoring was conducted on the 1 April 2011 and results are listed in **Table 2**. Additional sampling was conducted during a high rainfall event on 21 March 2011. The laboratory analysis sheets for both sampling events are provided in **Appendix 1**.

Table 2: Monthly surface water monitoring – March grab sample results

Site	Observed Flow Rate	Water Colour	Turbidity	pH	EC (µS/cm)	TDS (mg/L)	TSS (mg/L)	Oil and Grease (mg/L)
A	Dam	Clear	Clear	---	---	---	---	<5
B	Dry	---	---	---	---	---	---	---
C	NO ACCESS							
D	Dam	Clear	Clear	4.98	156	112	6	<5
F	Dam	Clear	Clear	4.75	90	37	24	<5

Note: pH, EC, TSS and TDS analysis could not be conducted for site A as the sample bottle was lost by the laboratory during transit.

At the time of sampling, there were no water discharges off site from any sampling location. Samples were collected at sites A, D and F. Site B was dry and there was no access to site C. The samples were collected and analysed for a monthly sampling event. Results show pH within the slightly acidic range, low Electrical Conductivity, low Total Dissolved Solids, low Total Suspended Solids and no detectable Oil and Grease.

2.2.2 Groundwaters

Groundwaters were sampled on 1 April 2011. Water quality tests for pH and electrical conductivity were conducted by Carbon Based Environmental Pty Limited. For water quality purposes, water was purged from the bore until constant pH (+/- 0.1 pH units) and Electrical Conductivity (+/- 5%) was obtained between samples. Data is displayed in **Table 3** and **Figures 2 to 5**.

Groundwater depths increased at the majority of monitoring bores this month, indicating water moving away from the surface. Longer term monitoring is required to fully evaluate groundwater depth trends.

EC remained relatively steady at all sites. pH remained steady at most sites with the exception of slight decreases at CQ1 and CQ10 and slight increases at CQ8 and CP7. Detailed biannual water quality monitoring is next due in April 2011.

Table 3: Groundwater Quality Data

Reference	Bore	Type	Depth to water TOC (m) April 06	Depth to water TOC (m) This report	pH This report	Electrical Conductivity (µS/cm) This report
CQ1	Voutos	* Monitor	20.59	20.50	4.1	130
CQ3	Voutos	* Monitor	10.53	11.39	5.5	120
CQ4	Voutos	* Monitor	8.78	8.66	4.5	100
CQ5	Gazzana	DIP Only	8.69	7.14	4.0	150
CQ6	Gazzana	DIP Only	16.00	14.14	3.9	170
CQ7	Gazzana	* Monitor	6.89	6.74	4.6	100
CQ8	Gazzana	* Monitor	11.03	9.36	4.5	160
CQ9	Gazzana	DIP Only	10.10	9.52	4.4	110
CQ10	Voutos	* Monitor	NI	22.93	4.7	170
CQ11S	Gazzana	* Monitor	NI	10.13	3.9	160
CQ11D	Gazzana	* Monitor	NI	11.36	4.9	140
CQ12	Gazzana	* Monitor	NI	5.85	4.3	130
CQ13	Kashouli	* Monitor	NI	14.17	4.9	200
CP3	Gazzana	Domestic	10.40	8.74	3.8	150
CP4	Kashouli	Domestic	13.63	22.21	4.7	210
CP5	Kashouli	Domestic	16.61	9.04	3.9	250
CP6	Kashouli	Domestic	16.27	11.13	4.2	210
CP7	Kashouli	Production	8.56	3.45	5.3	130
CP8	Rozmanec	Domestic	22.17	NR	NR	NR
MW7	Rocla Bore	* Monitor	15.76	16.40	4.3	120
MW8	Rocla Bore	* Monitor	9.82	8.32	4.8	90
MW9	Rocla Bore	* Monitor	22.44	22.08	3.9	90
MW10	Rocla Bore	* Monitor	15.41	14.85	4.0	130
MW13	Rocla Bore	DIP Only	NI	8.08	4.1	100
MW16	Rocla Bore	DIP Only	NI	8.61	4.6	110

Notes:

TOC = Water level measured from top of bore case to water.

NM = Not Monitored – unable to sample water due to access restrictions.

NR = Not Required by resident.

* = Logger Installed.

NI = These bores were not installed in April 2006 but are now operational. April 2006 was the first set of measurements taken by Carbon Based Environmental Pty Limited.

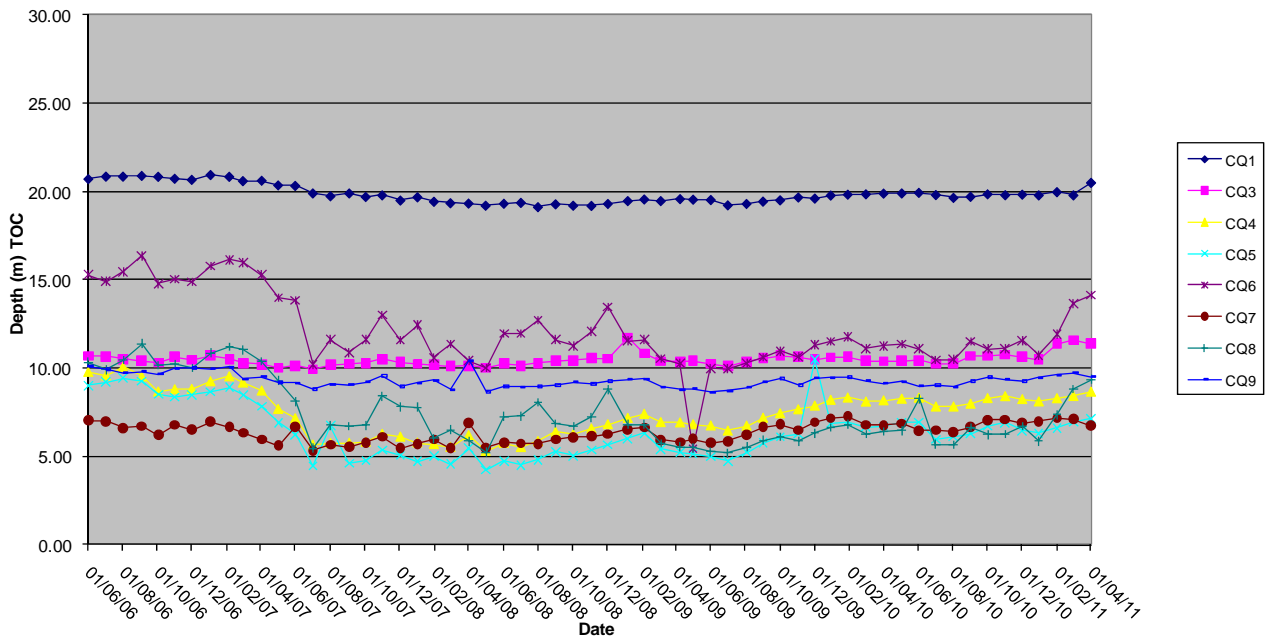
Shading is used to indicate the following trends in water depth (compared to the last reading):

	Increase to ground water depth (water moved away from surface)
	Decrease to ground water depth (water moved towards surface)
	Stable water depth (+/- 0.01m)

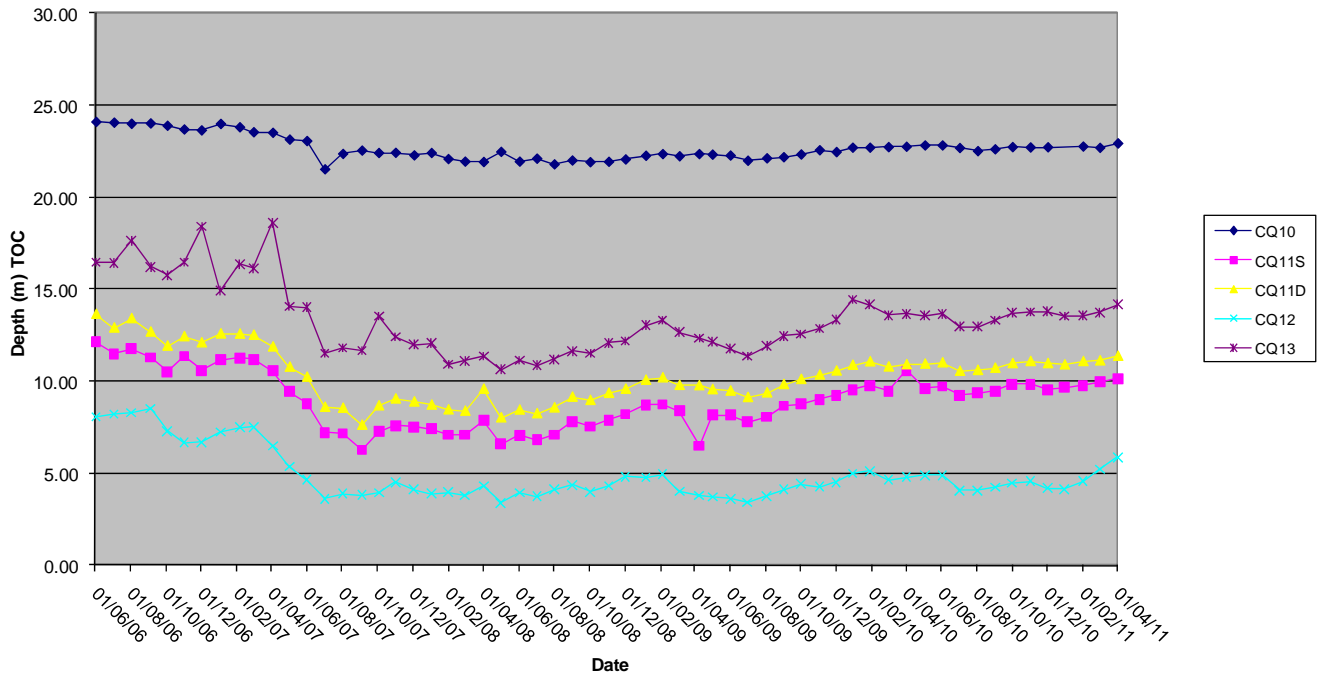
Available groundwater loggers were downloaded and will be forwarded to the Rocla Calga Quarry groundwater consultant.

Figures 2 to 5: Groundwater Depth Charts.

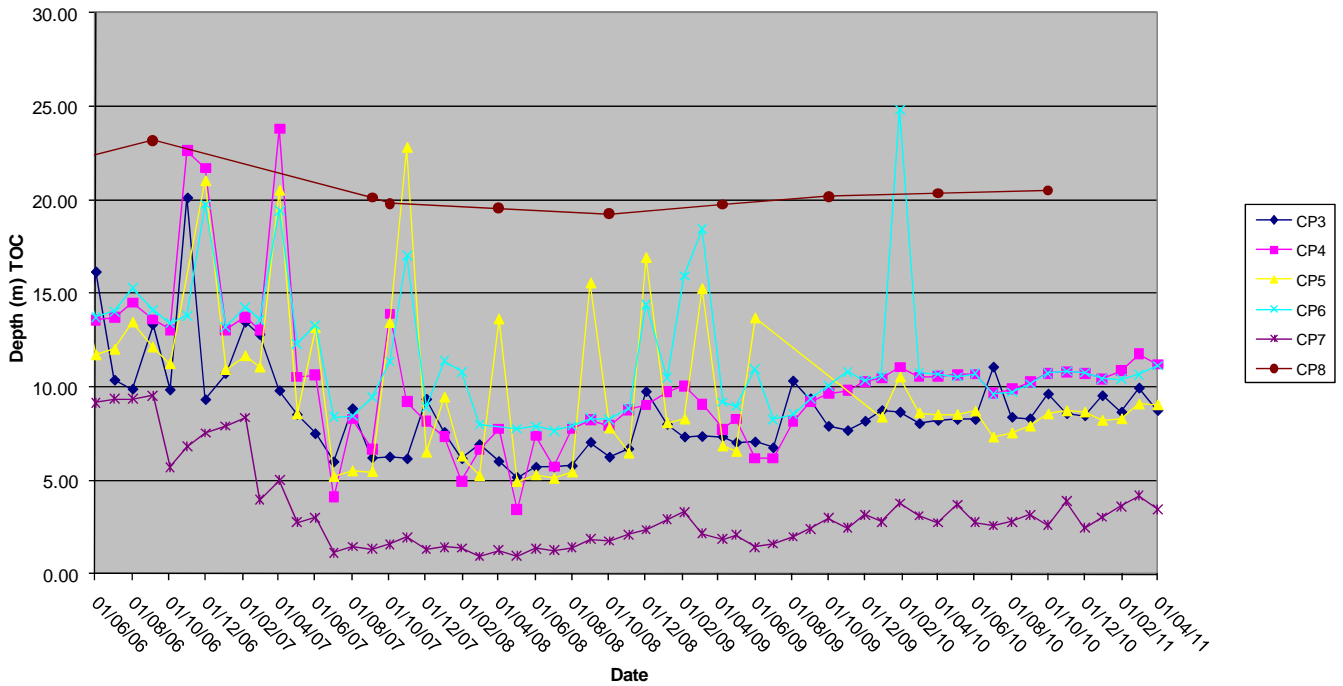
Rocla Calga Groundwaters - Quarry Bores CQ1 to CQ9
Water Depth TOC



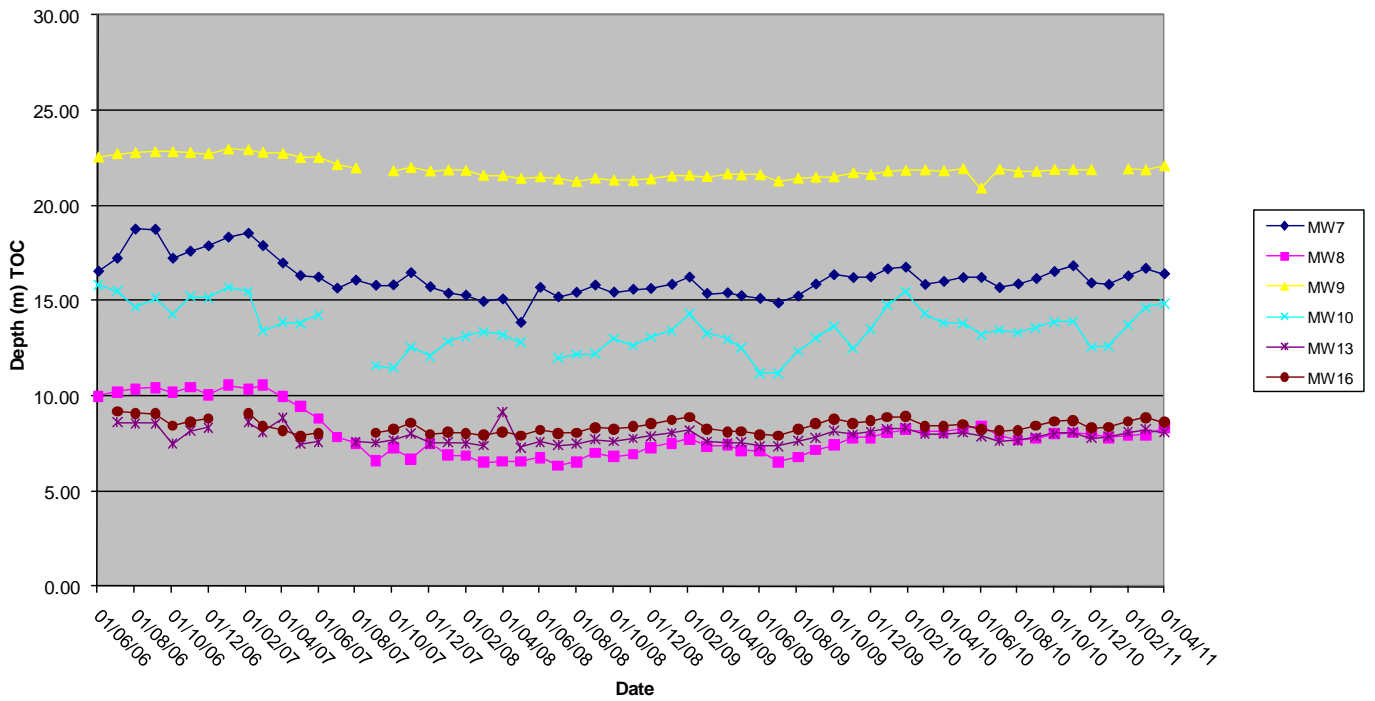
Rocla Calga Groundwaters - Quarry Bores CQ10 to CQ13
Water depth TOC



Rocla Calga Groundwaters - Quarry Bores CP3 to CP8
Water Depth TOC



Rocla Calga Groundwaters - Quarry Bores MW7 to MW16
Water Depth TOC



2.3 Meteorological Monitoring

The Rocla Calga Quarry weather station data recovery in March was 100% with the exception of wind speed which was unavailable from the 23 March to 31 March due to a damaged wind sensor. The weather station data follows and includes;

- Monthly data numerical summary;
- Weather charts of air temperature, humidity, heat index and wind chill, atmospheric pressure, solar radiation, evapotranspiration, rain, wind speed and data reception; and
- Wind rose (frequency distribution diagram of wind speed and direction).

Monthly weather statistics from two nearby Bureau of Meteorology (BOM) stations, Peats Ridge and Gosford are included in **Appendix 2** for comparison purposes.

Data for March 2011 shows rainfall recorded at the Rocla Calga Quarry was lower than that recorded at nearby Peats Ridge and Gosford BOM stations and similar to the Peats Ridge long term mean rainfall for March. The rainfall comparison is provided below:

Rocla Calga Quarry	134.4 mm
BOM Peats Ridge*	177.8 mm
BOM Gosford*	216.6 mm
BOM Peats Ridge Long term mean for March*	138.5 mm

*Data sourced from Bureau of Meteorology (BOM) website (www.bom.gov.au).

Results are displayed in the following table and figures.

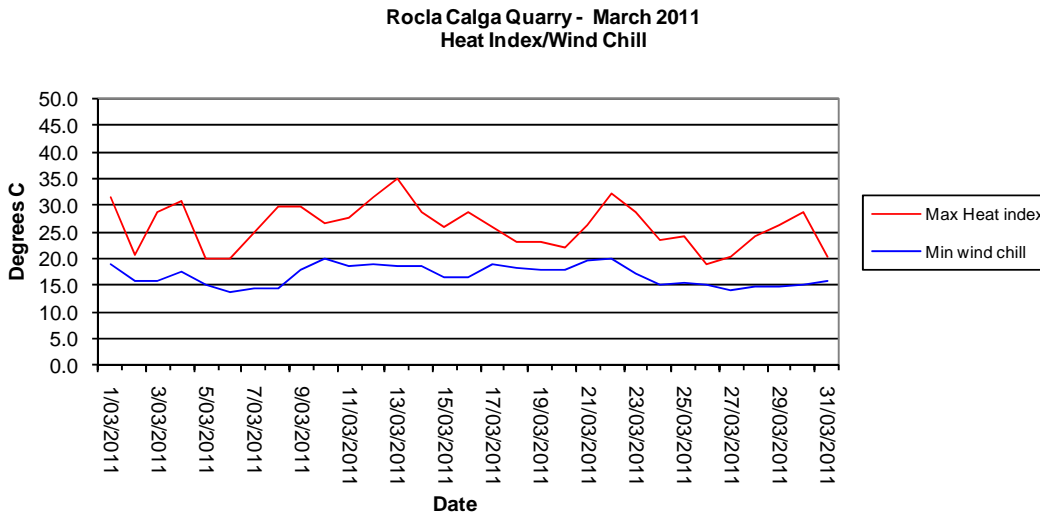
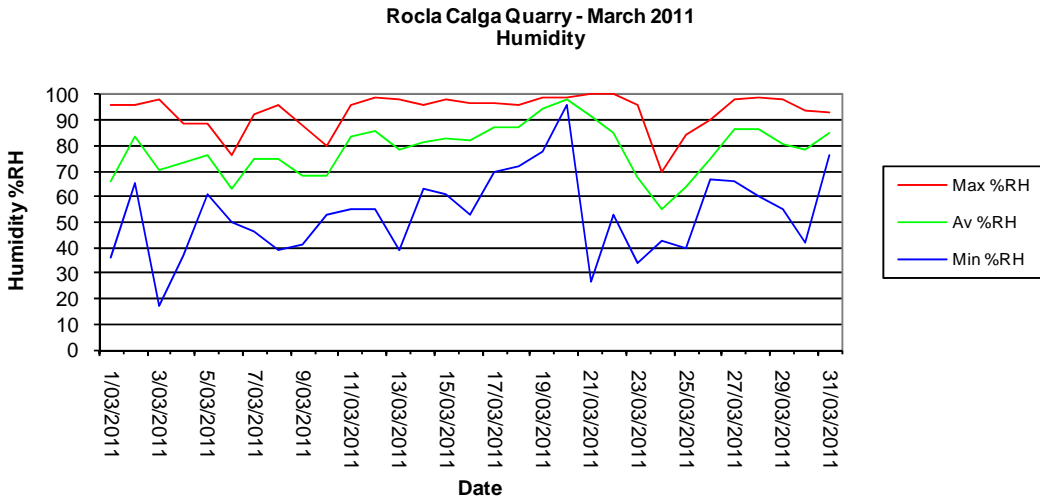
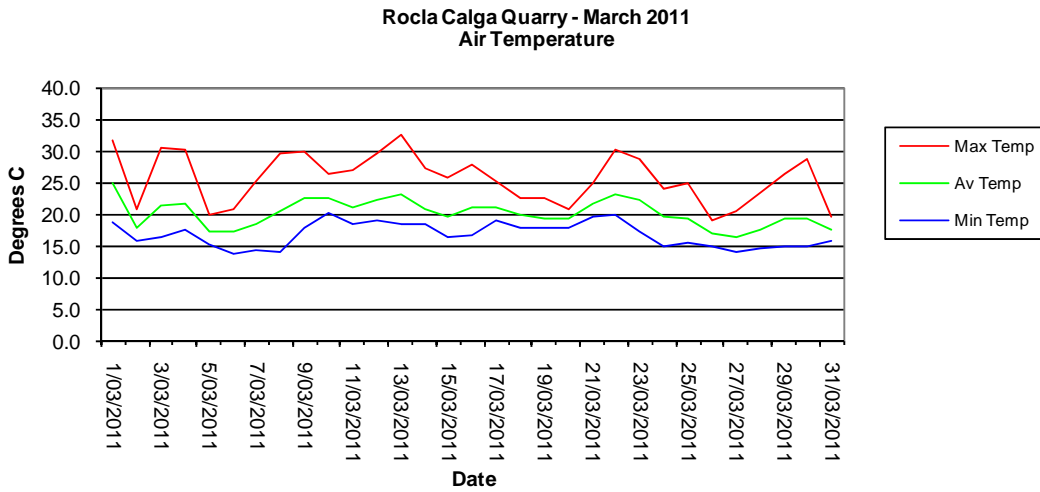
2.3.1 Monthly Meteorological Data Summary

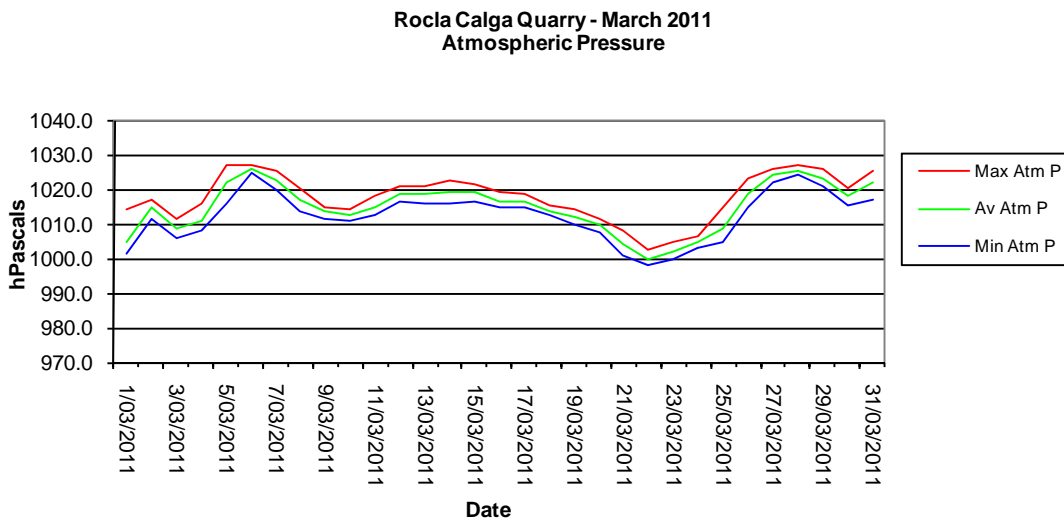
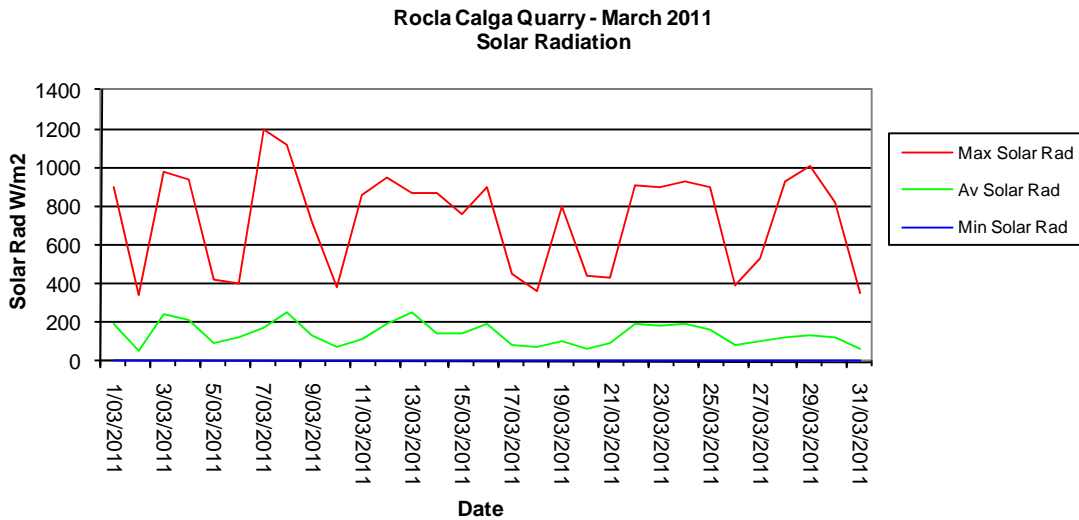
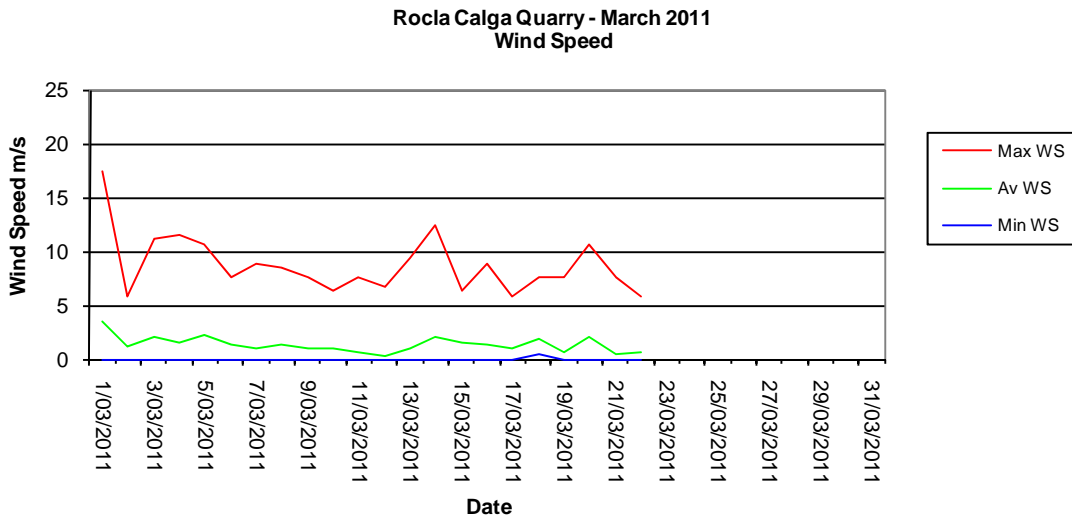
Summary Mar-11 Rocla - Calga

Date	Min Temp	Av Temp	Max Temp	Min %RH	Av %RH	Max %RH	RAIN mm	ET mm	Min WS	Av WS	Max WS	Min wind chill	Max Heat index	Min Atm P	Av Atm P	Max Atm P	Min Solar Rad	Av Solar Rad	Max Solar Rad	Min Data %	Av data %	Max Data %
1/03/2011	18.7	25.1	31.7	36	66	96	0.0	5.4	0	3.5	17.4	18.9	31.6	1001.3	1004.6	1014.2	0	189.2	896	96.2	98.7	100
2/03/2011	15.9	17.8	20.8	65	83	96	2.4	1.1	0	1.2	5.8	15.8	20.8	1011.5	1014.5	1016.8	0	54.2	346	100	100.0	100
3/03/2011	16.3	21.4	30.6	17	70	98	0.0	5.1	0	2.0	11.2	15.8	28.6	1006.0	1008.7	1011.3	0	245.9	975	99.1	100.0	100
4/03/2011	17.5	21.7	30.2	37	74	89	0.0	4.0	0	1.4	11.6	17.5	30.8	1008.0	1010.9	1015.7	0	210.5	943	98.5	100.0	100
5/03/2011	15.2	17.2	20.1	61	76	89	1.6	2.1	0	2.3	10.7	15.3	20.1	1015.8	1021.7	1027.0	0	97.2	421	98.8	100.0	100
6/03/2011	13.8	17.4	20.9	50	63	76	0.0	2.5	0	1.3	7.6	13.8	20.0	1024.8	1025.8	1027.2	0	121.2	404	98.8	100.0	100
7/03/2011	14.5	18.6	25.3	46	75	92	0.4	3.2	0	1.0	8.9	14.6	25.1	1020.0	1022.7	1025.5	0	176.8	1195	98.8	100.0	100
8/03/2011	14.2	20.6	29.7	39	75	96	0.0	4.5	0	1.4	8.5	14.3	29.9	1013.8	1016.8	1020.5	0	255.4	1114	98.2	100.0	100
9/03/2011	18.0	22.7	29.9	41	69	88	0.0	2.7	0	1.0	7.6	18.0	29.9	1011.5	1013.4	1015.0	0	130.1	724	99.7	100.0	100
10/03/2011	20.2	22.6	26.4	53	68	80	0.0	1.7	0	1.0	6.3	20.2	26.8	1010.9	1012.3	1013.9	0	70.7	381	87.4	99.8	100
11/03/2011	18.6	21.2	27.1	55	84	96	3.2	1.9	0	0.6	7.6	18.6	27.8	1012.3	1014.8	1017.8	0	113.1	861	94.2	99.9	100
12/03/2011	19.0	22.2	29.7	55	86	99	0.0	3.0	0	0.2	6.7	19.0	31.6	1016.6	1018.6	1020.8	0	194.8	951	92.7	99.6	100
13/03/2011	18.5	23.2	32.7	39	78	98	0.2	4.3	0	0.9	9.4	18.5	35.2	1015.8	1018.5	1021.0	0	251.5	864	97.1	99.6	100
14/03/2011	18.5	20.9	27.4	63	82	96	0.0	2.8	0	2.1	12.5	18.6	28.7	1016.0	1019.3	1022.5	0	146.7	870	96.8	99.7	100
15/03/2011	16.4	19.6	25.7	61	83	98	0.4	2.5	0	1.5	6.3	16.4	26.1	1016.4	1019.0	1021.4	0	139.8	764	95.3	99.8	100
16/03/2011	16.6	21.0	27.9	53	82	97	0.0	3.5	0	1.4	8.9	16.7	28.6	1015.0	1016.4	1019.0	0	197.5	894	98.8	100.0	100
17/03/2011	19.1	21.1	25.1	70	87	97	0.0	1.5	0	0.9	5.8	19.1	26.1	1014.8	1016.6	1018.7	0	83.7	448	100	100.0	100
18/03/2011	18.0	19.8	22.7	72	87	96	2.8	1.5	0.4	2.0	7.6	18.2	23.2	1012.6	1013.8	1015.1	0	76.9	359	99.7	100.0	100
19/03/2011	17.8	19.5	22.6	78	94	99	19.0	1.5	0	0.6	7.6	17.8	23.2	1009.8	1012.0	1014.1	0	99.4	800	88.3	99.6	100
20/03/2011	18.0	19.2	20.7	96	98	99	65.0	0.8	0	2.0	10.7	18.0	22.1	1007.6	1009.6	1011.3	5	60.7	441	81	96.7	100
21/03/2011	19.7	21.6	24.9	27	92	100	33.0	1.5	0	0.5	7.6	19.7	26.5	1000.8	1004.0	1007.9	5	95.3	428	74.6	97.4	100
22/03/2011	20.0	23.2	30.2	53	85	100	0.2	3.1	0	0.5	5.8	20.0	32.4	998.0	999.9	1002.4	5	198.2	904	91.5	99.2	100
23/03/2011	17.3	22.4	28.9	34	67	96	0.0	3.0				17.4	28.9	999.8	1002.0	1004.8	0	182.7	897	94.4	99.5	100
24/03/2011	15.0	19.6	24.0	43	55	70	0.0	2.9				15.0	23.6	1003.1	1004.7	1006.4	0	192.5	933	96.2	99.5	100
25/03/2011	15.4	19.3	24.9	40	64	84	0.6	2.8				15.4	24.3	1004.5	1008.5	1014.7	0	168.0	895	96.8	99.9	100
26/03/2011	14.9	17.0	19.1	67	75	90	0.2	1.2				15.0	19.1	1014.7	1018.8	1022.8	0	79.9	393	92.7	99.8	100
27/03/2011	14.1	16.5	20.4	66	87	98	2.4	1.5				14.1	20.5	1021.8	1024.1	1025.9	0	104.5	529	92.7	99.9	100
28/03/2011	14.7	17.7	23.6	60	86	99	0.4	1.8				14.7	24.1	1024.1	1025.5	1027.1	0	124.2	932	95.3	99.9	100
29/03/2011	14.9	19.4	26.3	55	81	98	0.2	2.1				14.9	26.5	1020.6	1023.1	1025.6	0	130.1	1005	92.1	99.3	100
30/03/2011	15.0	19.3	28.9	42	78	94	1.2	1.9				15.1	28.9	1015.5	1017.9	1020.4	0	119.4	822	94.7	99.8	100
31/03/2011	15.7	17.7	19.7	76	85	93	1.2	0.9				15.7	20.3	1016.9	1022.0	1025.2	0	63.1	354	94.2	99.6	100
Monthly	13.8	20.2	32.7	17	79	100	134.4	78.0	0	1.3	17.4	13.8	35.2	998	1014.9	1027.2	0	141.1	1195	74.6	99.6	100

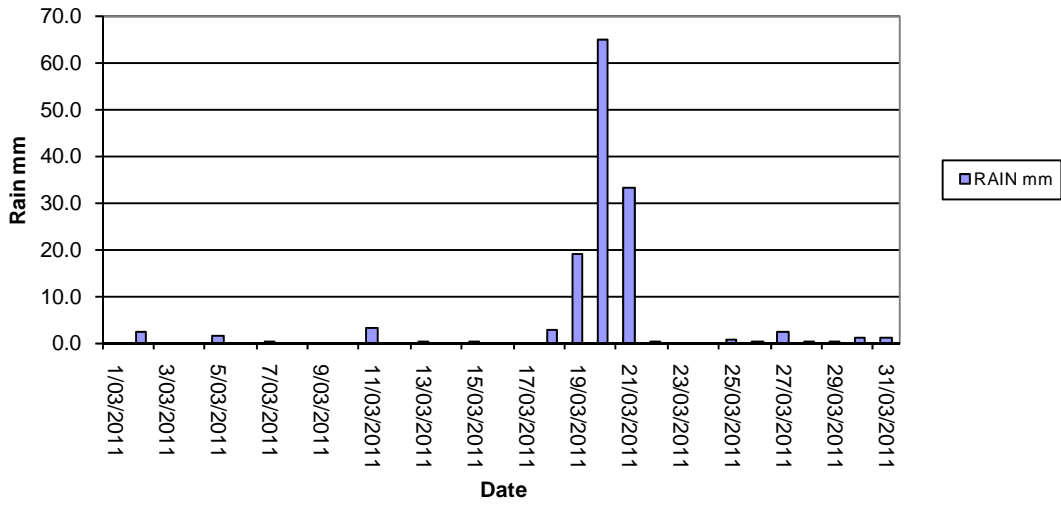
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2.3.2 Monthly Weather Charts

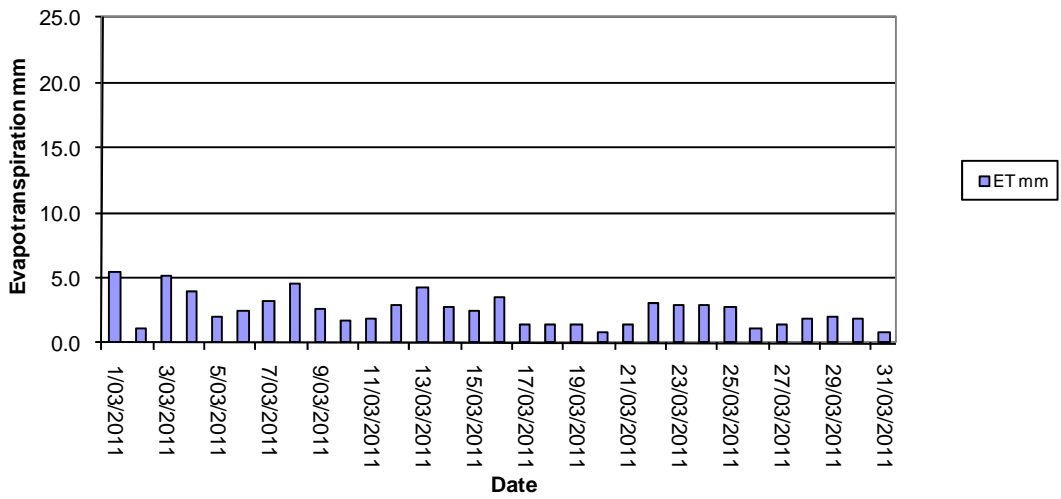




Rocla Calga Quarry - March 2011
Rainfall



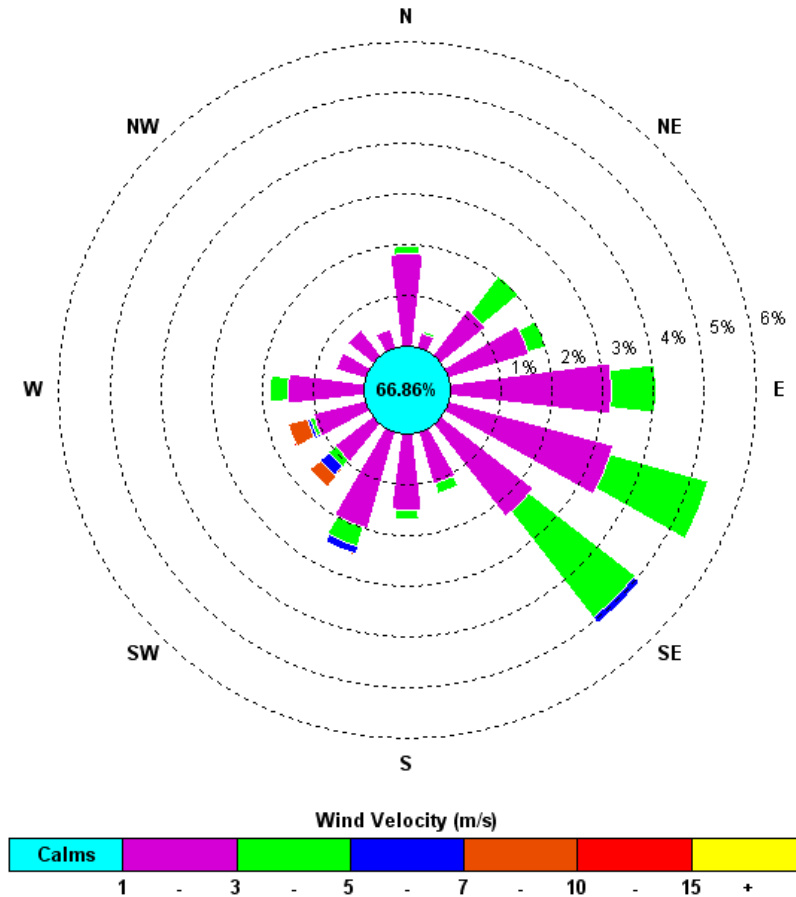
Rocla Calga Quarry - March 2011
Evapotranspiration



2.3.3 Monthly Windrose Plot

Frequency plot of the average wind speed and average direction over each 15 minute sampling period. Wind is considered to be calm when less than a 15 minute average of 1m/s.

00:15, 1 March 2011 – 20:15, 22 March 2011



The predominant winds were from the ESE, with strongest winds from the SW-WSW. The maximum wind speed was 17.4m/s from the WSW.

Appendix 1
Laboratory Certificates

Appendix 2

Additional Bureau of Meteorology Data from Peats Ridge and Gosford Monitoring Stations

