



**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**

NOVEMBER 2009

A handwritten signature in black ink that reads 'Colin Davies'. The signature is written in a cursive style with a horizontal line underneath it.

Colin Davies BSc MEIA CENVP
Environmental Scientist
9 December 2009

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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;
- Ground Waters; and
- Meteorological Station.

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

- Dust Deposition results for November 2009;
- Surface Water quality results for November 2009;
- Ground Water depth and quality results for November 2009; and
- Meteorological report for November 2009.

The November 2009 dust deposition results were generally higher than October 2009. 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 December 2009 at sites A, C and F. Sites B and D were not flowing. At the time of sample collection, there was no water discharge observed from the site. Results show generally good quality water with most sites sampled maintaining pH within the slightly acidic range, low Electrical Conductivity, low Total Dissolved Solids and Total Suspended Solids and no detectable Oil and Grease.

Groundwaters were sampled for normal monthly monitoring on 1 December 2009. Groundwater depths increased at the majority of monitoring bores this month, indicating water moving away from the surface. pH and EC levels remained relatively steady.

The meteorological station data recovery for the month was approximately 100%. The predominant winds were split from the W-WNW and NE-ESE, with strongest winds from the WNW. Recorded rainfall on site for November was 40.2mm, similar to that recorded at the BOM Peats Ridge Station and below the Peats Ridge long-term average for November. Results are detailed below:

Rocla Calga Quarry	40.2mm
BOM Peats Ridge*	34.8mm
BOM Gosford*	39.8mm
BOM Peats Ridge Long term mean for November*	104.8mm

*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 water 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.

Groundwater sites are monitored 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 November 2009 and the project average. Results are in g/m².month.

Table 1: Dust Deposition results: 02-Nov-2009 to 01-Dec-2009

Site	Monthly Insoluble Solids	Monthly Ash Residue	Monthly Combustible Matter	Monthly Ash Residue/ Insoluble Solids %	Current Project Average Insoluble Solids
CD1	2.9	2.4	0.5	83	1.9
CD2b	3.2	2.2	1.0	69	2.8
CD3	1.7	1.3	0.4	76	1.3
CD4	1.2	0.9	0.3	75	1.1
CD5	1.5	1.3	0.2	87	1.0
CD6	4.3	3.0	1.3	70	1.7

Insoluble Solids marked with an * indicate an excessively contaminated gauge. Contamination can include bird droppings, vegetation (such as plant matter, algae, pollen, seeds), and insects. Results in bold indicate insoluble solids levels above 3.7 g/m².month, the Development Consent annual average amenity criteria at residential locations. Project average was calculated from the 28 October 2005 (start of the Development Consent period) from results supplied by Rocla or from the installation date of the gauges.

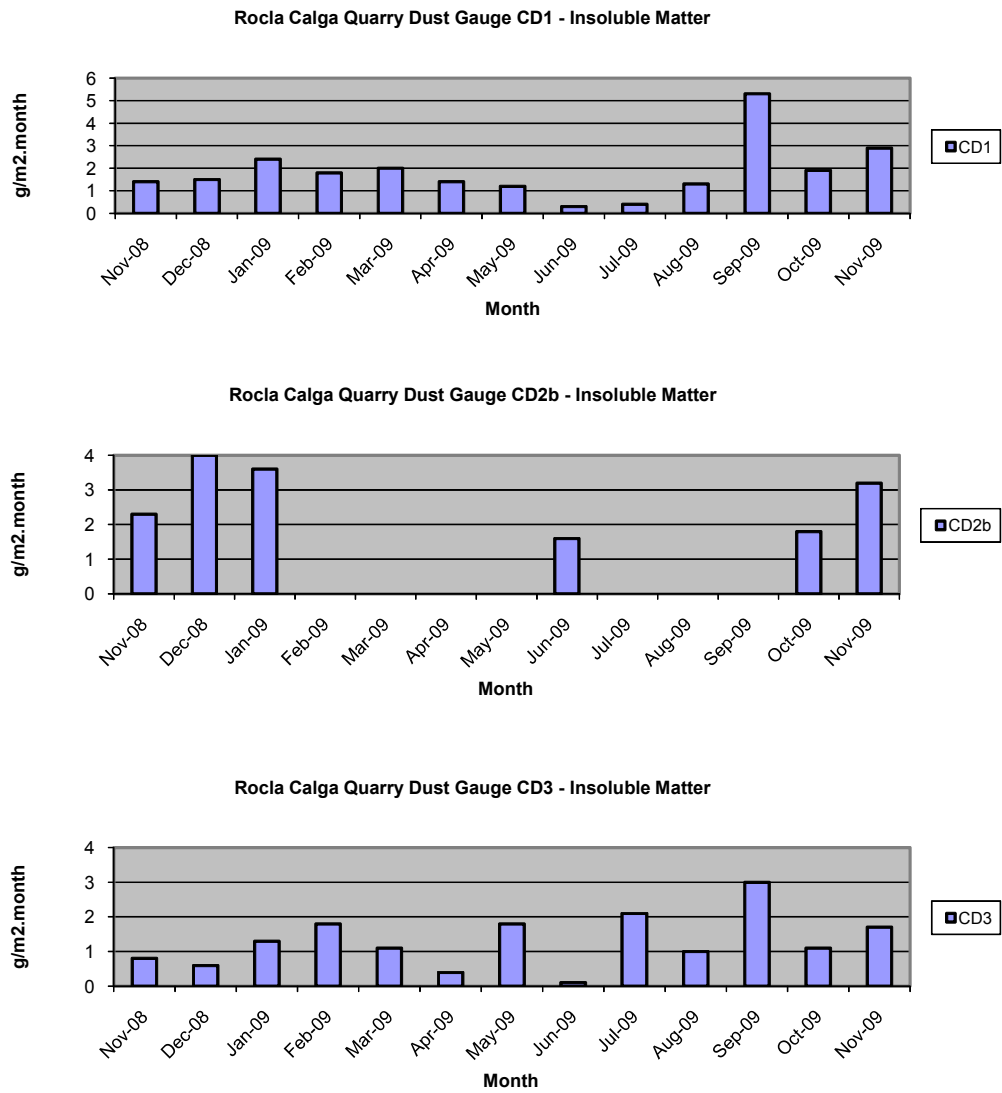
NA= Not Available.

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.

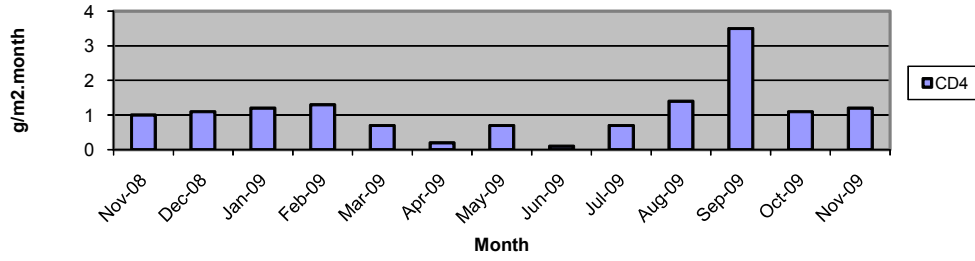
Dust deposition charts for all dust gauge sites appear in **Figure 1** below. The laboratory analysis is provided in **Appendix 1**.

The predominant winds were split from the W-WNW and NE-ESE, with strongest winds from the WNW.

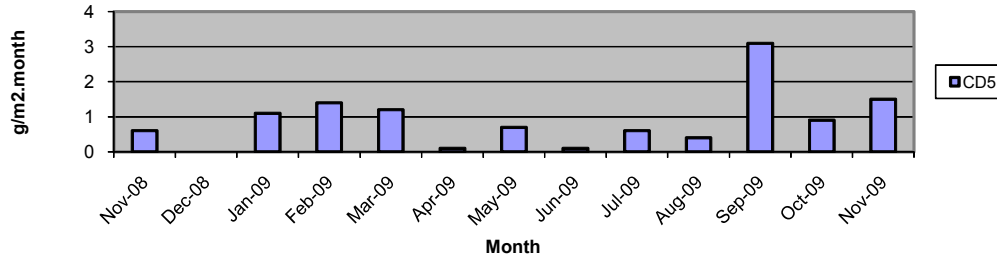
Figure 1: Dust Deposition Charts



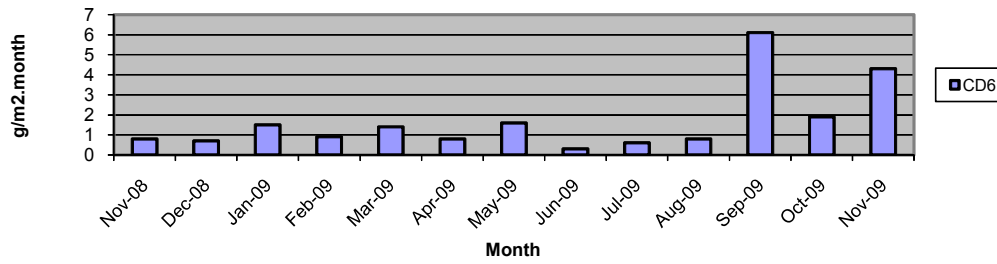
Rocla Calga Quarry Dust Gauge CD4 - Insoluble Matter



Rocla Calga Quarry Dust Gauge CD5 - Insoluble Matter



Rocla Calga Quarry Dust Gauge CD6 - Insoluble Matter



2.2 WATER MONITORING

2.2.1 Surface Waters

Monthly surface water monitoring was conducted on the 1 December 2009 and results are listed in **Table 2**. The laboratory analysis sheets are provided in **Appendix 1**.

Table 2: Monthly surface water monitoring – November 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	5.28	86	67	5	<5
B	Not flowing	---	---	---	---	---	---	---
C	Still	Clear	Clear	6.29	116	75	7	<5
D	Not flowing	---	---	---	---	---	---	---
F	Dam	Clear	Clear	5.59	82	56	5	<5

At the time of sampling, there were no water discharges off site from any sampling location.

Sites C was still at the time of sampling, and two samples were taken from dams A and F. The samples were collected and analysed for a monthly sampling event. Results show generally good water quality with pH within the slightly acidic range, low Electrical Conductivity, low Total Dissolved Solids and Total Suspended Solids and no detectable Oil and Grease.

2.2.2 Ground Waters

Groundwaters were sampled on 1 December 2009. 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. The CP series of bores generally show larger increases and decreases in depth to water due to pumping from the bores. Longer term monitoring is required to fully evaluate groundwater depth trends.

pH and EC levels generally remained steady. Detailed biannual water quality monitoring was conducted during October 2009 and is next due in April 2010.

Table 3: Ground Water Quality Data

Reference	Bore	Type	Depth to water TOC (m) April 06	Depth to water TOC (m) This report	pH This report	Electrical Conductivity (uS/cm) This report
CQ1	Voutos	* Monitor	20.59	19.62	5.3	130
CQ3	Voutos	* Monitor	10.53	10.48	6.1	110
CQ4	Voutos	* Monitor	8.78	7.87	4.6	80
CQ5	Gazzana	DIP Only	8.69	10.48	4.0	160
CQ6	Gazzana	DIP Only	16.00	11.31	3.9	200
CQ7	Gazzana	* Monitor	6.89	6.93	4.3	90
CQ8	Gazzana	* Monitor	11.03	6.30	4.0	160
CQ9	Gazzana	DIP Only	10.10	9.44	4.1	100
CQ10	Voutos	* Monitor	NI	22.46	5.9	200
CQ11S	Gazzana	* Monitor	NI	9.24	4.2	140
CQ11D	Gazzana	* Monitor	NI	10.56	5.3	120
CQ12	Gazzana	* Monitor	NI	4.50	4.0	130
CQ13	Kashouli	* Monitor	NI	13.33	4.9	180
CP3	Gazzana	Domestic	10.40	8.17	4.4	140
CP4	Kashouli	Domestic	13.63	10.29	4.6	220
CP5	Kashouli	Domestic	16.61	NM	4.1	250
CP6	Kashouli	Domestic	16.27	10.34	4.0	210
CP7	Kashouli	Production	8.56	3.15	4.5	240
CP8	Rozmanec	Domestic	22.17	NR	NR	NR
MW7	Rocla Bore	* Monitor	15.76	16.24	4.9	110
MW8	Rocla Bore	* Monitor	9.82	7.82	4.8	80
MW9	Rocla Bore	* Monitor	22.44	21.62	4.2	80
MW10	Rocla Bore	* Monitor	15.41	13.50	4.2	120
MW13	Rocla Bore	DIP Only	NI	8.12	4.6	90
MW16	Rocla Bore	DIP Only	NI	8.68	4.4	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.

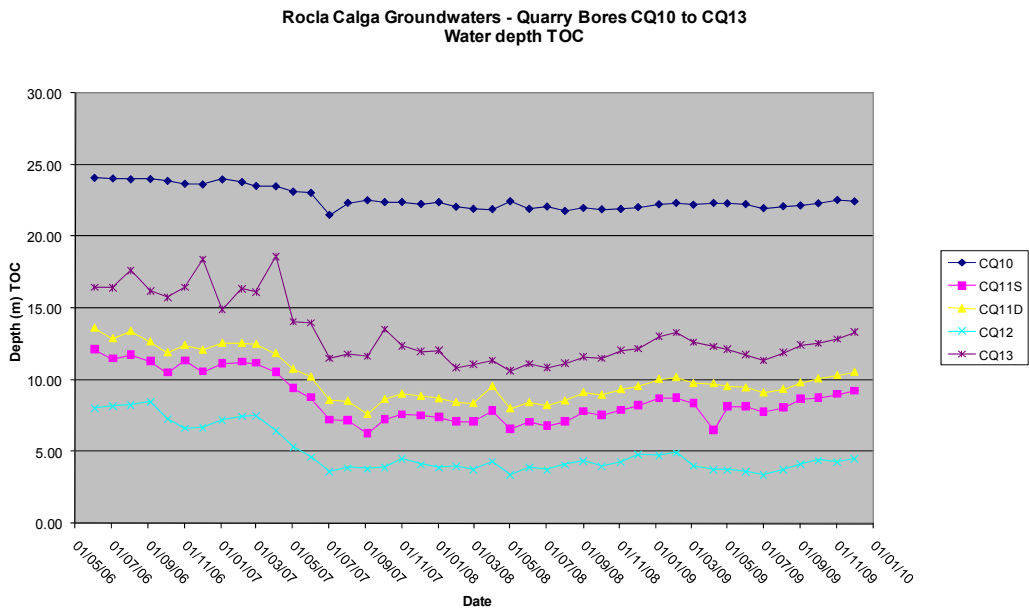
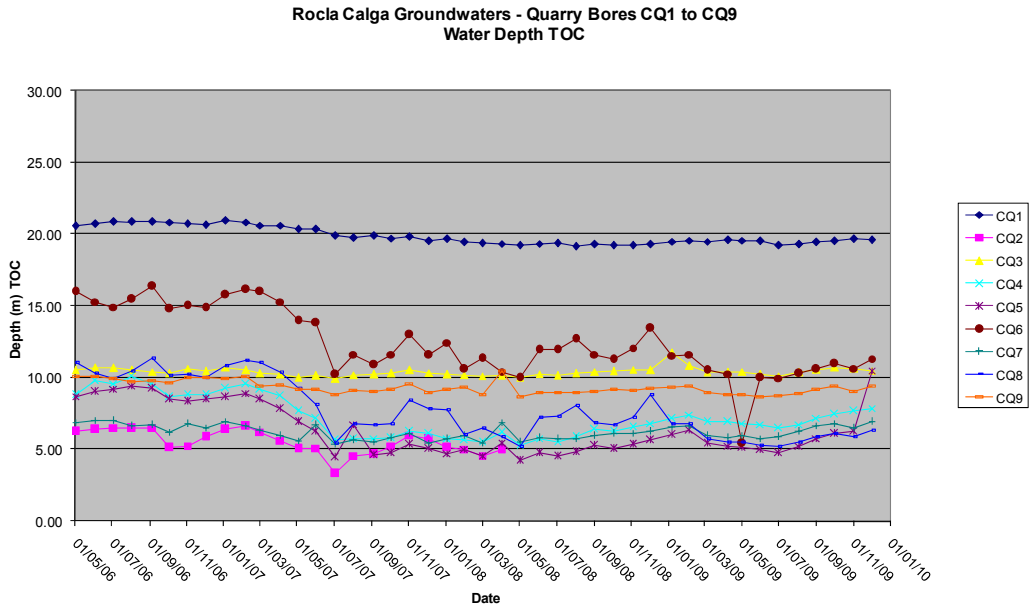
CP5 is broken and could not be dipped for depth.

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

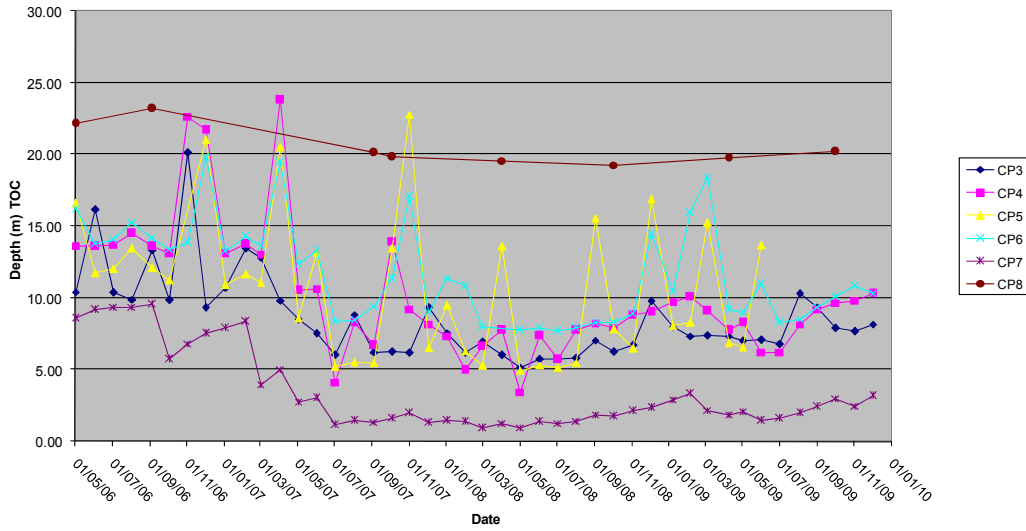
	Increase to ground water depth (water moved away from surface)
	Decrease to ground water depth (water moved towards surface)
	Stable water depth (+/- 0.01m)

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

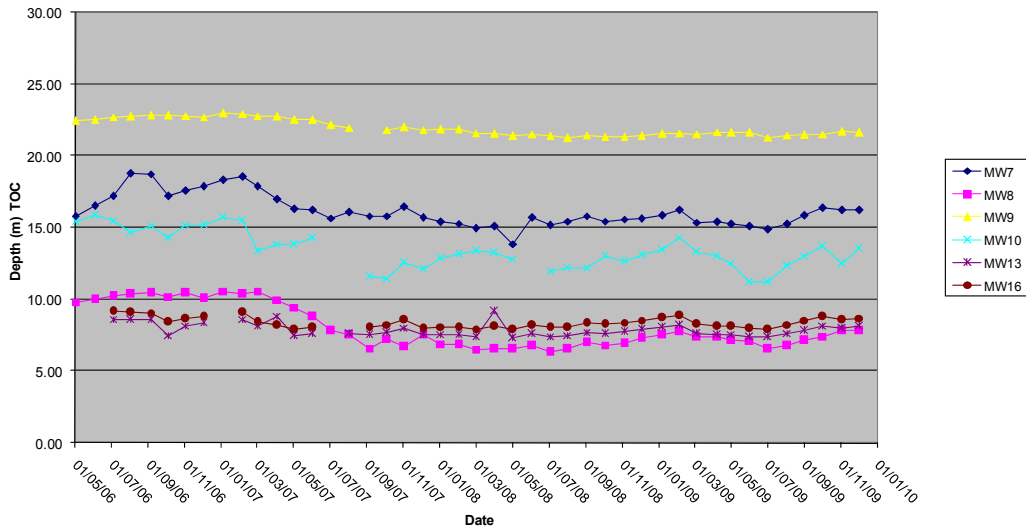
Figures 2 to 5: Groundwater Depth Charts.



Rocla Calga Groundwaters - Quarry Bores 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 November was approximately 100%. 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 November 2009 shows similar rainfall at the Rocla Calga Quarry station compared to the nearby Peats Ridge BOM station and Gosford BOM station. The rainfall comparison is provided below:

Rocla Calga Quarry	40.2mm
BOM Peats Ridge*	34.8mm
BOM Gosford*	39.8mm
BOM Peats Ridge Long term mean for November*	104.8mm

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

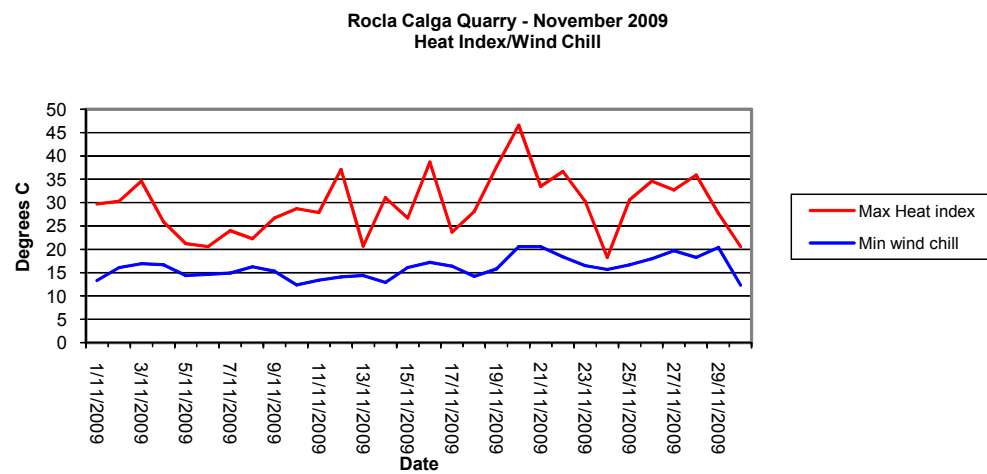
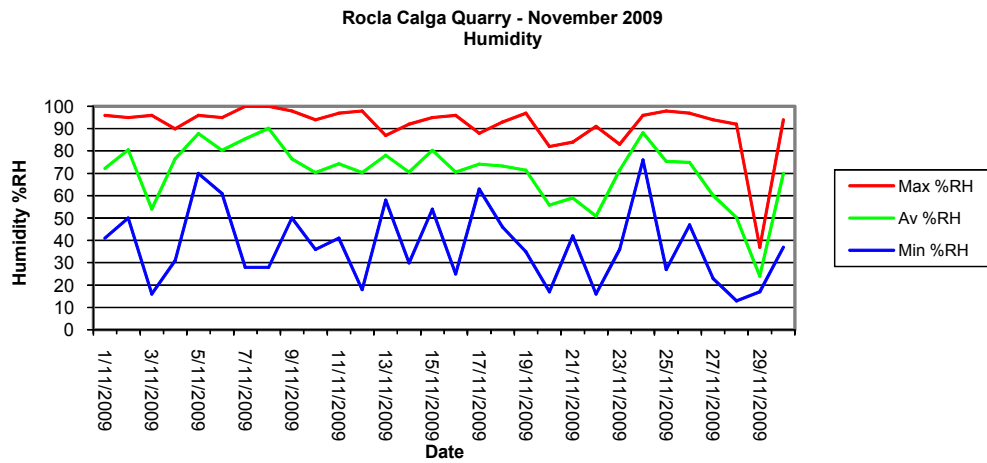
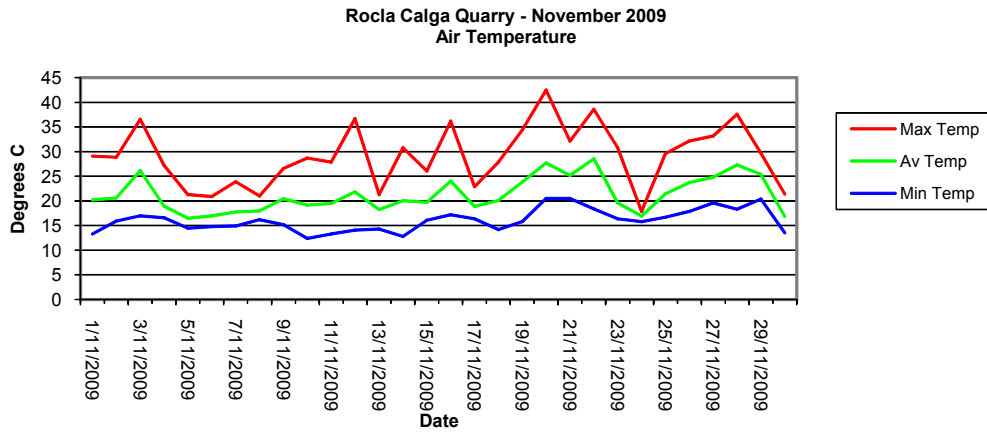
Results are displayed in the following table and figures.

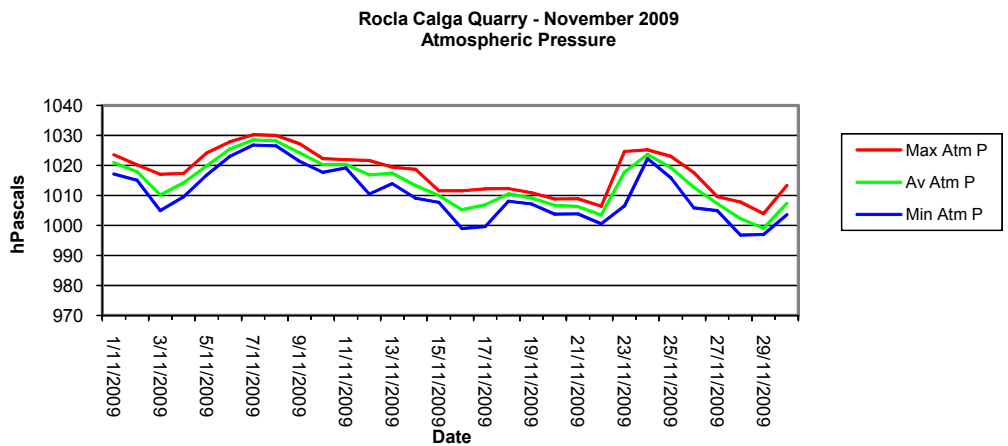
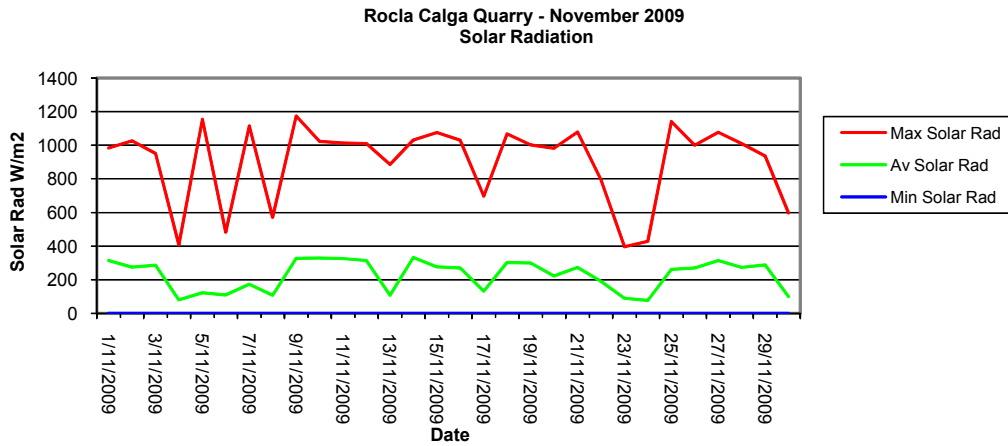
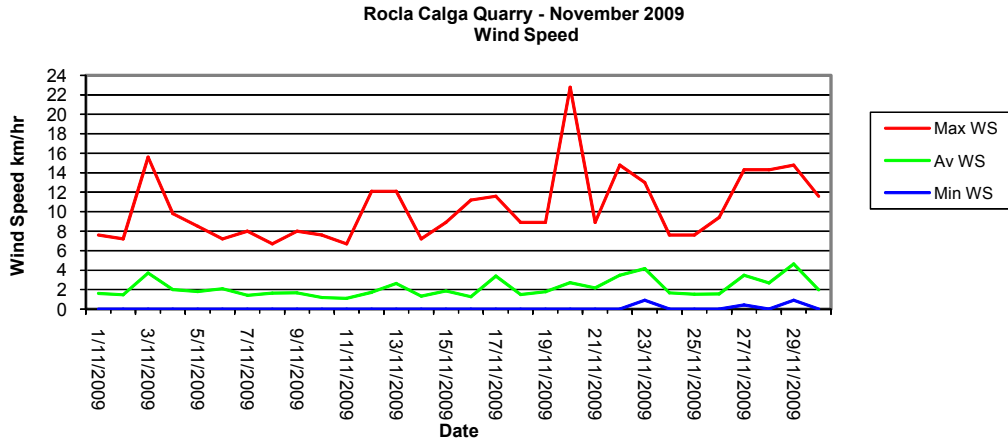
2.3.1 Monthly Meteorological Data Summary

Summary Nov-09 Rocla - Calga

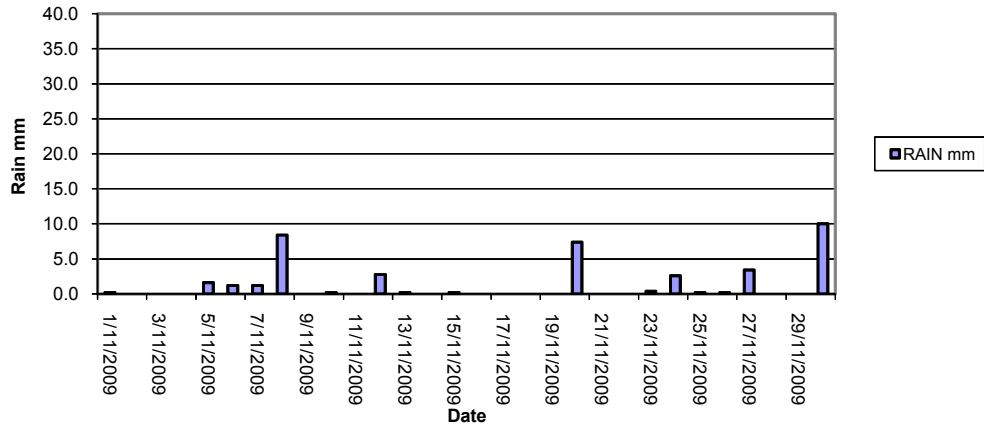
Date	Min Temp	Av Temp	Max Temp	Min %RH	Av %RH	Max %RH	RAIN mm	ET mm	Min WS	Av WS	Max WS	Min wind chill	Max Heat index	Min Atm P	Av Atm P	Max Atm P	Min Solar Rad	Av Solar Rad	Max Solar Rad	Min Data %	Av data %	Max Data %
1/11/2009	13.3	20.2	29.1	41	72	96	0.2	5.6	0	1.6	7.6	13.3	29.7	1017.2	1021.0	1023.6	0	312.9	984	89.8	98.6	100
2/11/2009	15.9	20.6	28.9	50	81	95	0.0	4.8	0	1.5	7.2	16.1	30.3	1015.1	1017.9	1020.2	0	273.8	1027	68.7	98.0	100
3/11/2009	17	26.2	36.6	16	54	96	0.0	8.2	0	3.7	15.6	16.9	34.6	1005	1010.2	1017.1	0	284.9	951	91.5	99.0	100
4/11/2009	16.6	18.9	27.2	31	77	90	0.0	2.0	0	2.0	9.8	16.7	25.9	1009.6	1014.2	1017.4	0	78.6	408	86.3	97.5	100
5/11/2009	14.5	16.5	21.3	70	88	96	1.6	2.0	0	1.8	8.5	14.4	21.2	1016.8	1019.8	1024.1	0	121.8	1155	93.9	99.7	100
6/11/2009	14.8	17.0	20.9	61	80	95	1.2	2.1	0	2.1	7.2	14.6	20.6	1023	1025.5	1027.9	0	108.1	482	88.6	98.7	100
7/11/2009	14.9	17.8	23.9	28	85	100	1.2	2.9	0	1.4	8	14.9	24	1026.8	1028.6	1030.3	0	172.0	1115	69.6	97.2	100
8/11/2009	16.2	18.0	21	28	90	100	8.4	1.8	0	1.6	6.7	16.3	22.3	1026.5	1028.2	1030	0	107.3	571	94.2	99.5	100
9/11/2009	15.2	20.4	26.6	50	76	98	0.0	5.6	0	1.7	8	15.3	26.7	1021.4	1024.2	1027.3	0	326.3	1174	94.2	99.7	100
10/11/2009	12.4	19.2	28.7	36	70	94	0.2	5.7	0	1.2	7.6	12.4	28.7	1017.7	1020.3	1022.3	0	328.2	1024	71.1	93.9	100
11/11/2009	13.3	19.5	27.9	41	74	97	0.0	5.6	0	1.1	6.7	13.4	27.9	1019.2	1020.4	1021.9	0	324.3	1014	75.7	97.5	100
12/11/2009	14.1	21.9	36.7	18	70	98	2.8	6.0	0	1.7	12.1	14.1	37.1	1010.5	1016.9	1021.7	0	314.2	1011	83.6	97.7	100
13/11/2009	14.3	18.3	21.3	58	78	87	0.2	2.5	0	2.6	12.1	14.4	20.7	1014	1017.5	1019.5	0	106.3	885	73.7	92.7	100
14/11/2009	12.8	20.1	30.8	30	71	92	0.0	5.8	0	1.3	7.2	12.9	31.1	1009.1	1013.3	1018.7	0	331.5	1032	59.9	84.3	100
15/11/2009	16.1	19.7	26.1	54	80	95	0.2	4.7	0	1.9	8.9	16.1	26.7	1007.7	1010.0	1011.6	0	275.2	1075	53.2	78.3	95.9
16/11/2009	17.2	24.0	36.2	25	71	96	0.0	5.0	0	1.3	11.2	17.2	38.7	999	1005.3	1011.6	0	268.6	1030	52.3	88.6	100
17/11/2009	16.4	18.9	22.9	63	74	88	0.0	3.1	0	3.4	11.6	16.4	23.7	999.7	1006.9	1012.2	0	131.4	698	87.1	95.9	99.4
18/11/2009	14.2	20.1	27.9	46	73	93	0.0	5.3	0	1.5	8.9	14.2	28.1	1008.1	1010.6	1012.3	0	302.5	1068	85.1	97.4	100
19/11/2009	15.8	23.8	34.4	35	71	97	0.0	5.8	0	1.8	8.9	15.8	37.7	1007.2	1009.2	1010.9	0	298.3	1002	90.4	99.4	100
20/11/2009	20.5	27.7	42.5	17	56	82	7.4	6.1	0	2.7	22.8	20.6	46.6	1003.8	1006.7	1008.8	0	222.4	982	92.1	99.5	100
21/11/2009	20.5	25.2	32.2	42	59	84	0.0	6.0	0	2.2	8.9	20.6	33.5	1003.9	1006.3	1008.9	0	272.3	1079	98.8	100.0	100
22/11/2009	18.4	28.6	38.6	16	51	91	0.0	7.2	0	3.5	14.8	18.4	36.7	1000.6	1003.5	1006.4	0	190.1	796	98.5	99.9	100
23/11/2009	16.4	19.6	30.8	36	71	83	0.4	2.9	0.9	4.1	13	16.5	30.3	1006.5	1017.8	1024.7	0	88.3	396	92.4	98.7	100
24/11/2009	15.8	16.9	17.9	76	88	96	2.6	1.3	0	1.6	7.6	15.7	18.3	1022.3	1023.7	1025.2	0	75.6	428	92.7	99.1	100
25/11/2009	16.7	21.5	29.6	27	75	98	0.2	4.9	0	1.5	7.6	16.7	30.6	1015.9	1019.3	1023	0	260.7	1141	96.5	99.7	100
26/11/2009	17.9	23.7	32.2	47	75	97	0.2	5.1	0	1.5	9.4	18	34.6	1005.9	1012.6	1017.6	0	268.6	1000	90.9	99.0	100
27/11/2009	19.6	24.8	33.2	23	60	94	3.4	7.2	0.4	3.5	14.3	19.7	32.7	1005	1007.4	1009.7	0	313.5	1077	88.9	99.1	100
28/11/2009	18.3	27.3	37.6	13	50	92	0.0	7.5	0	2.7	14.3	18.3	35.9	996.8	1002.4	1007.8	0	272.4	1011	96.5	99.7	100
29/11/2009	20.4	25.4	29.7	17	24	37	0.0	9.5	0.9	4.6	14.8	20.4	27.7	997	999.1	1004	0	287.1	936	98	99.8	100
30/11/2009	13.5	16.9	21.4	37	70	94	10.0	2.5	0	2.0	11.6	12.3	20.6	1003.6	1007.4	1013.3	0	99.2	597	91.8	99.7	100
Monthly	12.4	21.3	42.5	13	71	100	40.2	144.5	0	2.2	22.8	12.3	46.6	996.8	1014.2	1030.3	0	227.2	1174	52.3	96.9	100

2.3.2 Monthly weather charts

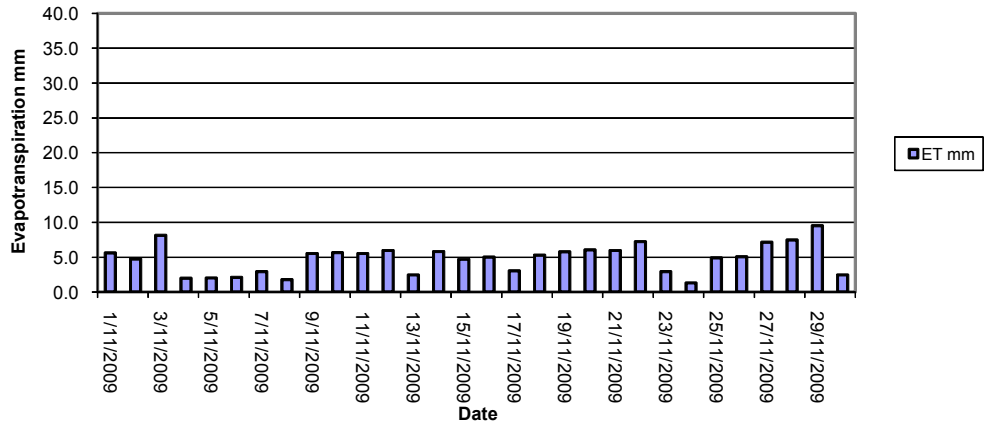




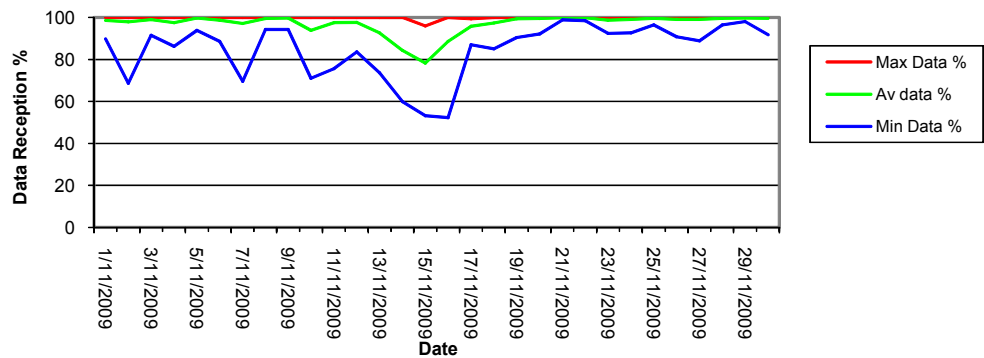
Rocla Calga Quarry - November 2009
Rainfall



Rocla Calga Quarry - November 2009
Evapotranspiration



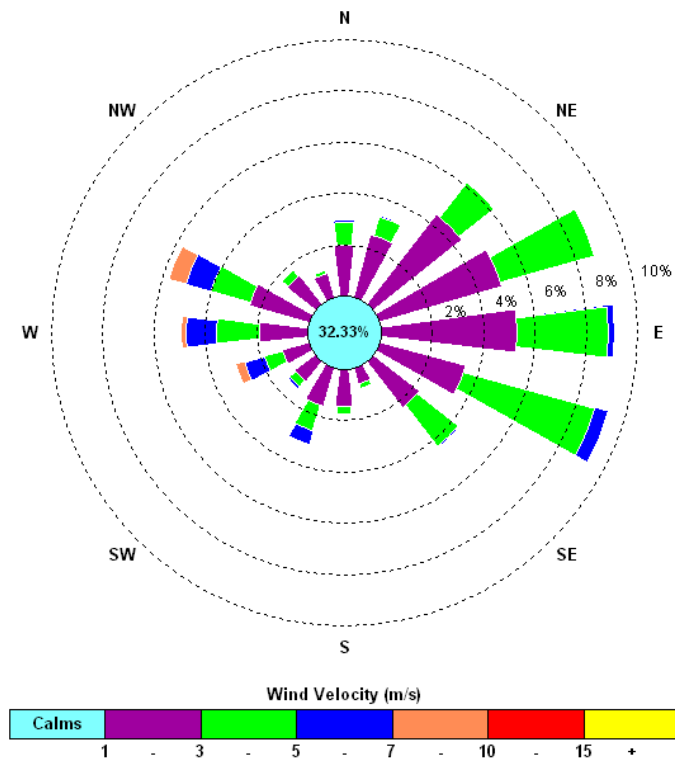
Rocla Calga Quarry - November 2009
Data Reception



2.3.3 Windrose plot

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

00:00, 1 November 2009 – 23:45, 30 November 2009



The predominant winds were split from the W-WNW and NE-ESE, with strongest winds from the WNW. The maximum wind speed was 22.8 m/s from the SSW.

APPENDIX 1
LABORATORY CERTIFICATES

APPENDIX 2

ADDITIONAL BUREAU OF METEOROLOGY DATA FROM PEATS RIDGE AND GOSFORD MONITORING STATIONS

