



Trefil Quarry Annual Monitoring Report - 2010

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Prepared for

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1 INTRODUCTION

1.1 Background

Gryphonn Quarries Limited was granted planning permission for the deepening of Trefil Quarry in February 2009. Planning Condition 20 of this permission states that *A Water Management Plan will be submitted for the approval of the Planning Authority prior to commencement of the deepening operations at the site.*

The Environmental Impact Assessment (EIA) that supported the application for the revised planning permission at the quarry included a series of recommendations for monitoring and mitigation that would form the basis of the Water Management Plan (WMP) for the site (ESI, 2008).

The WMP for the site was presented by ESI (2009) which specified requirements for three key activities:

1. Monitoring
2. Mitigation measures
3. Annual review

It was intended that the WMP would be subject to regular review and modification as necessary in the light of ongoing data collection and presentation in annual monitoring reports.

This annual report presents the data collected to February 2011 as well as a water balance.

1.2 The quarry development

Gryphonn Quarries Ltd are permitted to work to approximately 412 mAOD (the base of the Dowlais Limestone), with the quarry base currently at 430 mAOD. Prior to this permission the consented level was 439 mAOD. Dewatering is required to facilitate the dry excavation of the mineral. Maximum dewatering depths of 27 m will be required when the quarry reaches its permitted depth. The estimated rate of dewatering required to facilitate dry working is discussed in ESI (2008).

1.3 Potential Receptors

The main receptors identified in the hydrogeological impact assessment (ESI, 2008) are

- Shon Sheffrey Spring;
- The Nant Trefil; and
- Groundwater in the Carboniferous Limestone.

The impact assessment concluded that proposed dewatering activities will not have any significant effect on flows in the Nant Trefil or Shon Sheffrey spring due to the re-circulation of water discharged to the Nant Trefil.

The development involves two main hazards with respect to groundwater and surface water quality:

- Spills from plant operating on site.
- Discharge of sediment-laden water to surface water features including the Nant Trefil.

1.4 Monitoring regime

In order to quantify the level of impact at key sites and to make sure that the system is continuing to behave as predicted on the basis of the current conceptual model, a monitoring system is implemented.

The following monitoring regime is in place:

- Groundwater levels in the three boreholes on site (BH1/07, 2/07 and 3/07) are measured at weekly intervals (see Figure 1.1).
- Groundwater levels in Trefil Boreholes 1 and 2 are monitored at monthly intervals (see Figure 1.1).
- The rate of quarry pumping from the sump is monitored at weekly intervals by means of an in-line flow meter.
- The suspended solids/turbidity of the quarry discharge is measured by the quarry operator at weekly intervals together with a note of the weather conditions at the time.
- Daily rainfall data is monitored by means of a site rain gauge.
- The site drainage system is inspected on a daily basis to ensure that the oil booms are in place and that there is no visible oil downstream of the booms.

It will be necessary to continue monitoring until water levels in the quarries have recovered to their equilibrium position. It is anticipated that this will be one or two years after quarry dewatering ceases.

2 MONITORING DATA

2.1 Groundwater levels

Groundwater level data monitored at both on site and off site observation boreholes are shown in Figure 2.1. Groundwater level data recorded at on-site boreholes (BH1/07, BH2/07, BH3/07) have been monitored weekly since 30 September 2007 with off-site boreholes (Trefil 1 and Trefil 2) monitored monthly since 30 July 2009. The full dataset to 28 January 2011 is presented in Table 2.1 with the raw data given in Appendix A.

Table 2.1 Groundwater levels statistics

Statistic	BH1	BH2	BH3	Trefil 1	Trefil 2
No. of readings	200	200	200	9	13
max	436.95	445.78	436.31	378.14	372.70
min	432.03	436.86	432.61	374.93	367.86
mean	434.96	439.08	433.94	376.09	369.09
range	4.92	8.92	3.70	3.21	4.84

2.2 Quarry pumping

The rate of quarry pumping from the sump is monitored at weekly intervals by means of an in-line flow meter. The pump is operating manually when water levels in the base of the quarry are required to be lowered to carry out stone extraction. Records are available between 31 May 2010 to 31 January 2011 with monthly totals given in Table 2.2 and raw data given in Appendix B. A time series plot is given in Figure 2.2. The average pumping rate is 389 m³/d over the 246 day data period.

Table 2.2 Monthly pumping totals

Date	Pumped volume (m ³)
May-10	430
Jun-10	1,460
Jul-10	5,830
Aug-10	17,180
Sep-10	17,000
Oct-10	12,220
Nov-10	20,330
Dec-10	1,750
Jan-11	19,680

2.3 Suspended solids/turbidity of the quarry discharge

A discharge consent (reference: AN0258201) is associated with Trefil Quarry for discharge of trade effluent to the Nant Trefil. It specifies that the total suspended solids shall not exceed 100 mg/l and the concentration of total oil and grease shall not exceed 10 mg/l.

Suspended solids data were provided by the Environment Agency for the quarry discharge for the period 2002 and 2007 as reported in ESI (2008). These showed periodic exceedence of the discharge limit. Only one suspended solids data point was available for Shon Sheffrey spring (22 March 2007), which gave a result below the analytical detection limit. However, Welsh Water Authority (1982) reports that sand derived from the Millstone Grit reaches Shon Sheffrey Spring after heavy rainfall.

The turbidity of the quarry discharge is measured by the quarry operator at weekly intervals together with a note of the weather conditions at the time. This has been carried out since 9

April 2010 with 16 results to 10 February given in Table 2.3. Suspended solids has been measured by a laboratory on 8 occasions and a relationship between turbidity and suspended solids has been established.

Table 2.3 Discharge turbidity and suspended solids results

Date	Weather Conditions	Turbidity Reading (NTU)	Suspended Solids Reading	Comment
09-Apr-10	Dry	82.00	50.0	lab analysis of suspended solids
22-Jul-10	Wet	76.60	42.0	
17-Aug-10	Wet becoming dry	85.50	52.0	
24-Aug-10	Showers	17.13	12.0	
31-Aug-10	Dry	11.00	12.8	Suspended solids calculated based on correlation with turbidity reading
06-Sep-10	Wet	5.24	10.1	
23-Sep-10	Heavy rain	41.80	26.9	
06-Oct-10	Dry following overnight rain	103.50	55.3	
03-Nov-10	Overcast & drizzle	271.00	132.2	
18-Nov-10	Wet & misty	206.66	102.6	
06-Jan-11	Overcast	75.10	42.2	
20-Jan-11	Dry	38.70	25.5	
25-Jan-11	Wet	19.52	16.7	
03-Feb-11	Dry & bright	208.00	103.0	
10-Feb-11	Wet & misty	36.40	21.0	lab analysis of suspended solids
15-Feb-11	Wet & misty	159.00	67.0	
04-Mar-11	Clear & dry	116.00	73.0	

2.4 Rainfall

Monthly rainfall data were provided by the Environment Agency for a rain gauge located at Rhymney about 3 km to the south west of the Site from 1971 to 2003 (ESI, 2008). Average long term monthly mean rainfall data in this period is 1655 mm/a.

Daily readings of rainfall have been recorded from a rain gauge at the site (Appendix C) between 1 February 2010 to 31 January 2011. Over this period an annual total rainfall of 1396 mm was recorded. However, this is underestimated as no data is available between 29 June 2011 and 23 July 2011 as the rain gauge was stolen.

Table 2.4 Monthly rainfall data

Date	Rainfall (mm)
Feb-10	68
Mar-10	228
Apr-10	142.75
May-10	65.25
Jun-10	80.5
Jul-10	1.5
Aug-10	197.75
Sep-10	131.5
Oct-10	148.5
Nov-10	158
Dec-10	13
Jan-11	161

2.5 Site drainage system inspections

The site drainage system is inspected on a daily basis to ensure that the oil booms are in place and that there is no visible oil downstream of the booms.

Additionally, the quarry is inspected for the presence of voids (which might indicate the presence of fast pathways from the quarry to local receptors) on a weekly basis. These records have been kept since 1 July 2009 with no significant voids or drainage issues identified. The data to 31 January 2011 is presented in Appendix D.

During the 14 years that the quarry has been operated by its current owners there have been no reports of any contamination from hydrocarbons in any of the local water courses. This suggests that the current precautionary measures are effective at protecting the local water environment from accidental spillages from operating heavy plant in the area.

3 WATER BALANCE

Quarry pumping between May 2010 and January 2011 has given an average discharge rate of 389 m³/d. Total rainfall over the same period was 892 mm, although much of the July data was missing as the rain gauge was stolen. Assuming a long term average July rainfall of 80 mm (ESI, 2008), this would give a rainfall of 972 mm for the period.

Welsh Water Authority (1980) suggest a mean summer flow of 65 to 75 l/s (5,616 m³/d to 6,480 m³/d) and a mean winter flow of 300 to 400 l/s (25,920 m³/d to 34,560 m³/d) at the Shon Sheffrey spring. The low value was attributed to low flow conditions via the saturated limestone with the higher value having a significant component of flow via swallet water, some of which is likely to be via the unsaturated zone.

The quarry catchment area is estimated to be about 20 hectares. Assuming a rainfall of 972 mm between May 2010 and January 2011, this would give a quarry capture volume of 790 m³/d. This is 2 times higher than the average pumping rate suggesting a proportion of rainfall infiltration to ground. The quarry sump pumping represents only a small percentage of the water balance for the catchment. The average pumping rate of 389 m³/d is equivalent to a capture zone area of 9.8 hectares assuming a rainfall of 972 mm for the period between May 2010 and January 2011. The catchment area of the spring is estimated to be around 10 km² (1,000 hectares) (ESI, 2008).

4 REFERENCES

ESI Ltd. (2008). Trefil Quarry: Hydrogeological Impact Assessment

ESI Ltd. (2009). Water Management Plan - Trefil Quarry Deepening

Welsh Water Authority (1980). South East Wales Groundwater Study – Reconnaissance Report (by Howard Humphreys and Partners)

FIGURES

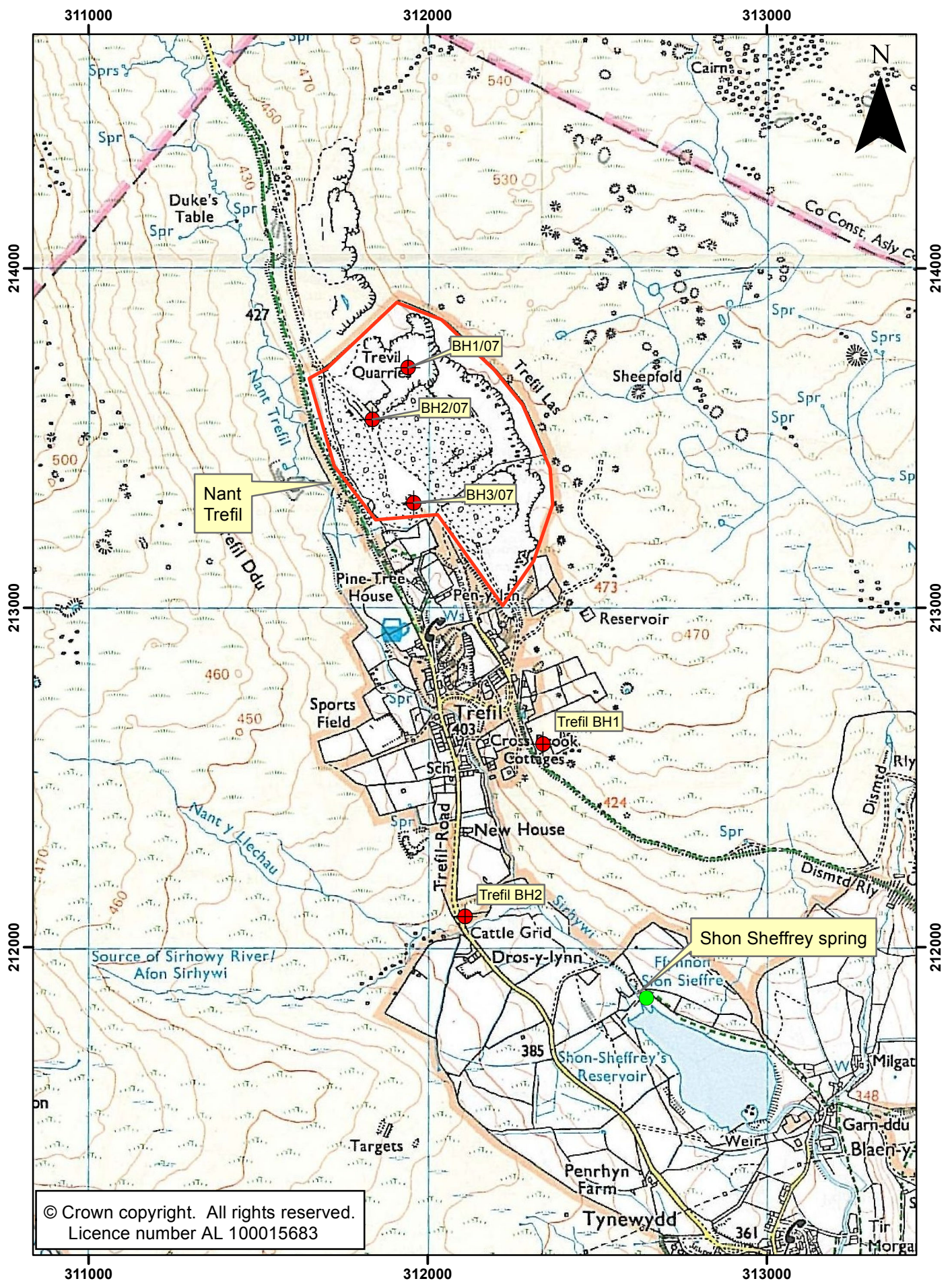


Figure 1.1
Monitoring borehole locations

Date	May 2011	Drawn	AWT
Scale	1:15,000	Checked	MJS
Original	A4	Revision	2
File Reference	O:\6878 Trefil Quarry\reports\R2\Figures		



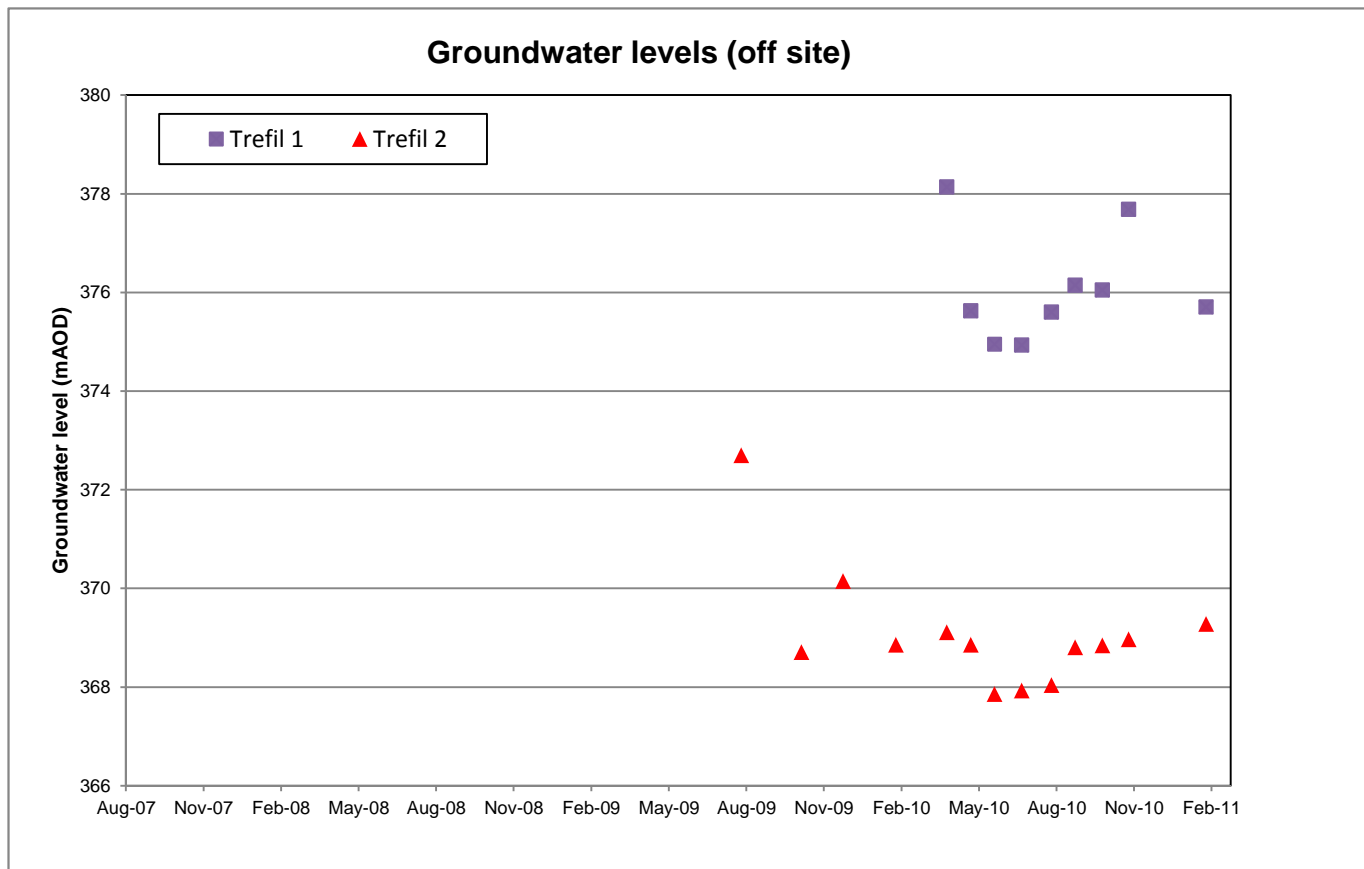
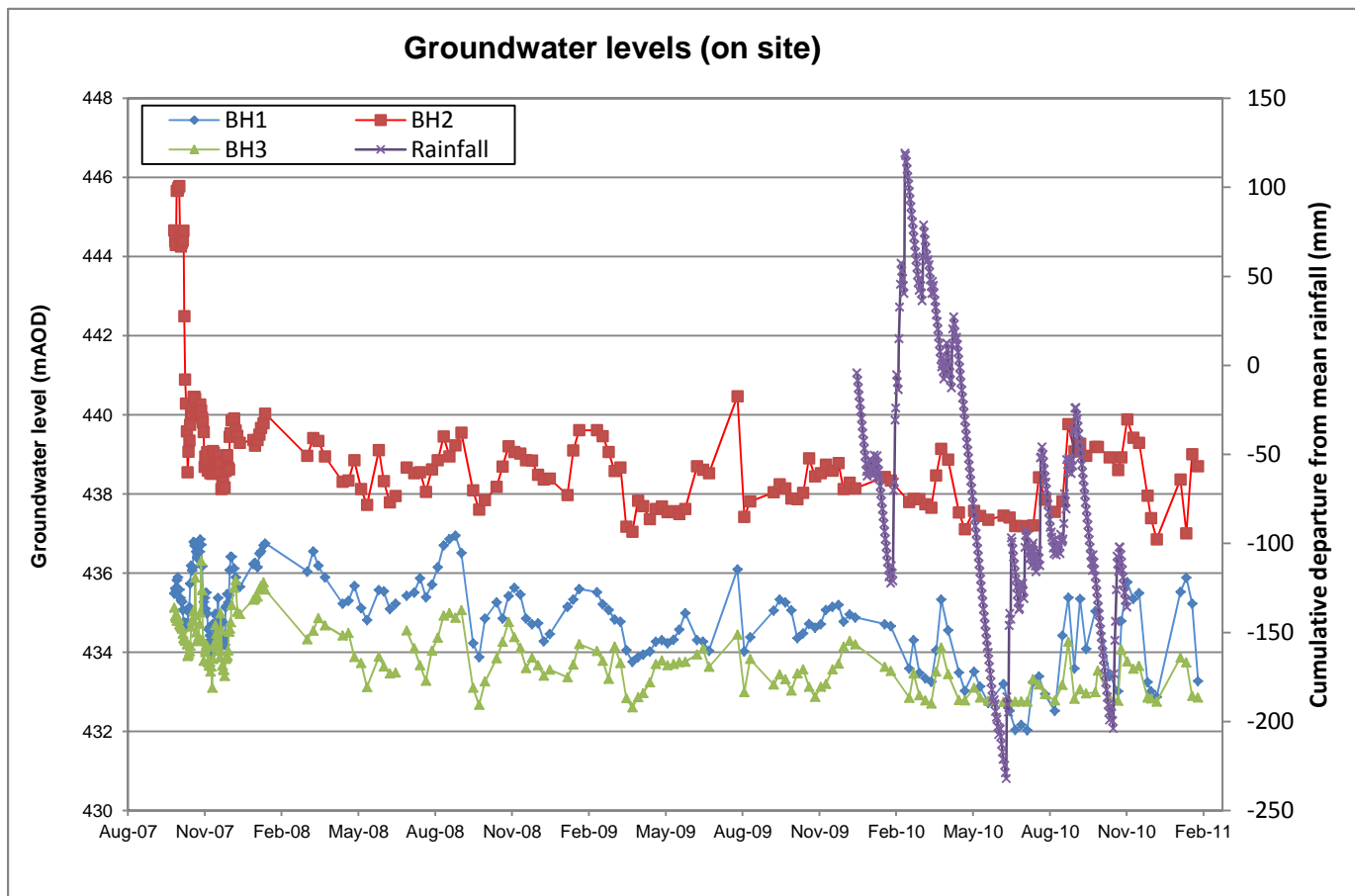


Figure 2.1
Groundwater level hydrographs
(on and off site boreholes)

Date	May 11	Drawn	AWT
Scale	dns	Checked	MJS
Original	A4	Revision	1
File Reference			
O:\6878\Reports\R2\Figures			



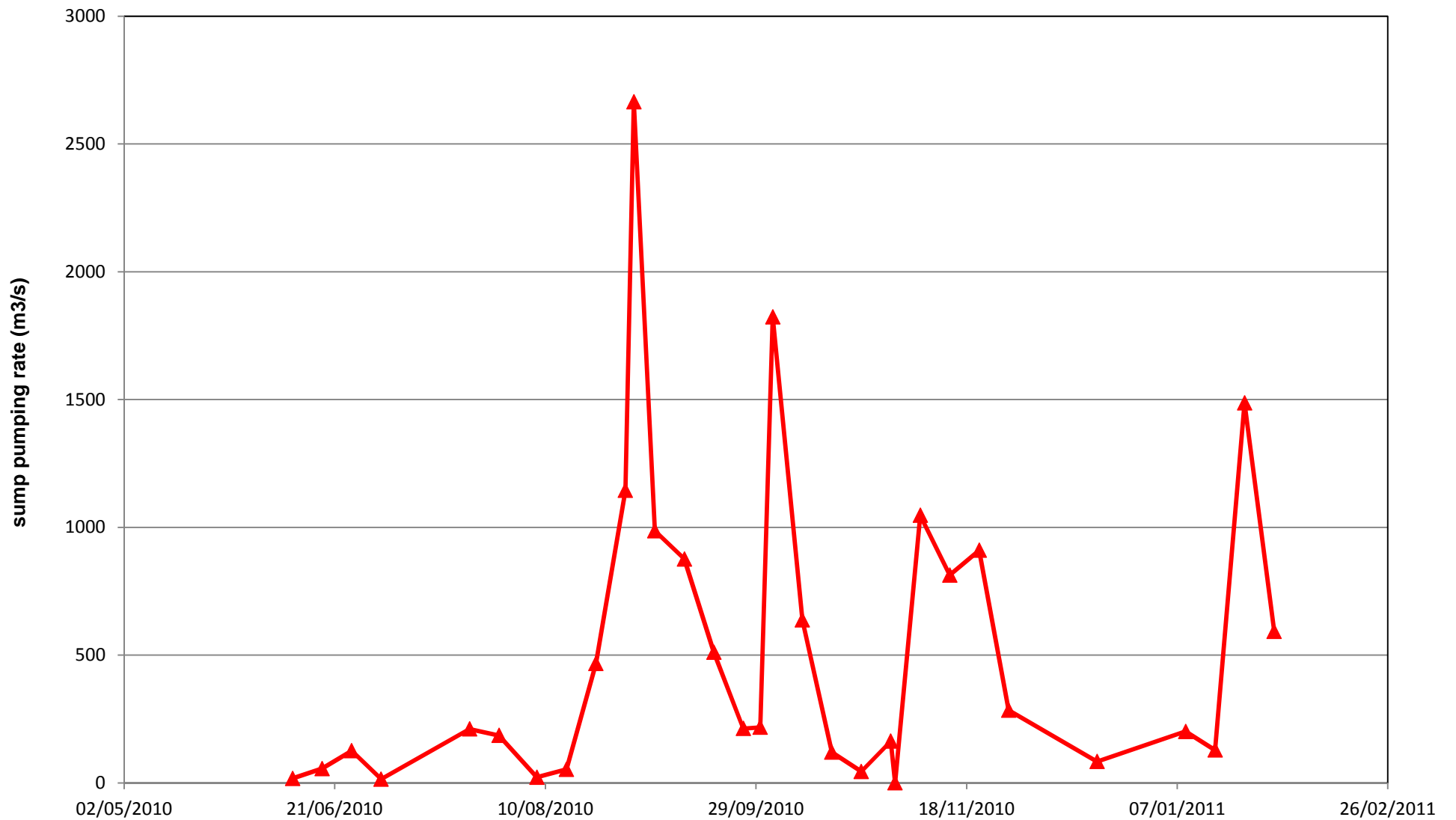


Figure 2.2
Quarry sump pumping rates

Date	May 11	Drawn	AWT
Scale	dns	Checked	PJD
Original	A4	Revision	1
File Reference			
O:\6878\Reports\R2\Figures			



APPENDICES

APPENDIX A

Groundwater level data

Groundwater levels (m b top of casing)

	BH1	BH2	BH3	BH1 off	BH2 off
Top of casing	442.691	452.753	453.499	427.060	393.310
23/05/2007	7.202	8.090	18.370		
24/05/2007	7.080	8.360	18.580		
25/05/2007	7.150	8.460	18.640		
29/05/2007	6.870	7.090	18.710		
30/05/2007	6.800	7.080	18.610		
31/05/2007	7.100	7.010	18.655		
01/06/2007	7.110	6.970	18.800		
04/06/2007	7.320	8.270	18.820		
05/06/2007	7.380	8.500	18.850		
07/06/2007	7.420	8.400	18.900		
08/06/2007	7.620	8.350	19.030		
11/06/2007	7.950	8.100	19.150		
12/06/2007	7.930	10.260	19.170		
13/06/2007	7.970	11.860	19.210		
14/06/2007	7.980	12.470	19.200		
15/06/2007	8.010	13.170	19.300		
18/06/2007	7.940	14.200	19.600		
19/06/2007	7.670	13.680	19.550		
20/06/2007	7.550	13.400	19.480		
22/06/2007	6.960	13.000	19.330		
26/06/2007	6.500	12.750	18.850		
27/06/2007	6.620	12.700	18.720		
29/06/2007	6.550	12.550	18.680		
02/07/2007	5.90	12.30	18.45		
04/07/2007	6.00	12.30	18.56		
06/07/2007	5.95	12.35	17.61		
09/07/2007	6.15	12.65	19.00		
16/07/2007	6.30	12.69	19.19		
18/07/2007	5.99	12.58	19.22		
20/07/2007	6.00	12.60	19.10		
24/07/2007	6.15	12.54	18.78		
27/07/2007	5.84	12.49	18.49		
30/07/2007	5.97	12.64	17.19		
02/08/2007	6.52	12.83	17.93		
06/08/2007	7.18	12.94	19.19		
08/08/2007	7.42	13.19	19.72		
15/08/2007	7.32	14.07	19.42		
17/08/2007	7.59	13.80	19.49		
22/08/2007	7.18	13.90	19.32		
28/08/2007	7.71	13.69	19.35		
31/08/2007	8.10	14.16	19.75		
03/09/2007	8.10	14.05	19.84		
05/09/2007	8.27	14.14	19.74		
07/09/2007	8.39	14.23	19.99		
10/09/2007	8.56	14.18	19.86		
12/09/2007	8.74	14.24	20.40		
26/09/2007	7.97	13.67	19.67		
28/09/2007	7.99	13.71	19.34		
01/10/2007	8.08	13.81	19.25		
10/10/2007	7.72	14.12	18.81		
12/10/2007	7.77	13.99	19.03		
15/10/2007	7.93	14.17	19.19		
17/10/2007	7.32	13.81	19.33		
19/10/2007	8.44	13.79	19.46		
22/10/2007	8.55	13.97	19.63		
05/11/2007	7.84	14.2	18.52		
07/11/2007	7.89	14.63	18.95		
09/11/2007	7.93	14.44	19.83		
12/11/2007	8.33	14.45	19.94		
14/11/2007	8.39	14.59	19.95		
16/11/2007	8.5	14.59	20.1		
19/11/2007	7.56	14.17	19.67		
21/11/2007	7.52	13.77	19.63		
23/11/2007	7.22	13.78	19.59		
26/11/2007	7.44	14.08	19.45		
28/11/2007	7.25	14.13	18.98		
03/12/2007	6.61	13.31	18.9		
05/12/2007	6.28	13.22	18.74		
07-Dec-07	6.28	12.89	18.31		
10-Dec-07	6.57	12.84	17.87		
12-Dec-07	6.8	13.15	17.68		
14-Dec-07	6.98	13.28	18.48		
17-Dec-07	7.04	13.46	18.53		
02-Jan-08	6.46	13.39	18.17		
04-Jan-08	6.43	13.53	18.14		
07-Jan-08	6.54	13.39	18.09		
09-Jan-08	6.2	13.25	17.9		
11-Jan-08	6.14	13.08	17.82		
14-Jan-08	5.99	12.96	17.73		

Groundwater levels (m AOD)

Date	BH1	BH2	BH3	Trefil 1	Trefil 2
	442.691	452.753	453.499	427.060	393.31
23/05/2007	435.489	444.663	435.129		
24/05/2007	435.611	444.393	434.919		
25/05/2007	435.541	444.293	434.859		
29/05/2007	435.821	445.663	434.789		
30/05/2007	435.891	445.673	434.889		
31/05/2007	435.591	445.743	434.844		
01/06/2007	435.581	445.783	434.699		
04/06/2007	435.371	444.483	434.679		
05/06/2007	435.311	444.253	434.649		
07/06/2007	435.271	444.353	434.599		
08/06/2007	435.071	444.403	434.469		
11/06/2007	434.741	444.653	434.349		
12/06/2007	434.761	442.493	434.329		
13/06/2007	434.721	440.893	434.289		
14/06/2007	434.711	440.283	434.299		
15/06/2007	434.681	439.583	434.199		
18/06/2007	434.751	438.553	433.899		
19/06/2007	435.021	439.073	433.949		
20/06/2007	435.141	439.353	434.019		
22/06/2007	435.731	439.753	434.169		
26/06/2007	436.191	440.003	434.649		
27/06/2007	436.071	440.053	434.779		
29/06/2007	436.141	440.203	434.819		
02/07/2007	436.791	440.453	435.049		
04/07/2007	436.691	440.453	434.939		
06/07/2007	436.741	440.403	435.889		
09/07/2007	436.541	440.103	434.499		
16/07/2007	436.391	440.063	434.309		
18/07/2007	436.701	440.173	434.279		
20/07/2007	436.691	440.153	434.399		
24/07/2007	436.541	440.213	434.719		
27/07/2007	436.851	440.263	435.009		
30/07/2007	436.721	440.113	436.309		
02/08/2007	436.171	439.923	435.569		
06/08/2007	435.511	439.813	434.309		
08/08/2007	435.271	439.563	433.779		
15/08/2007	435.371	438.683	434.079		
17/08/2007	435.101	438.953	434.009		
22/08/2007	435.511	438.853	434.179		
28/08/2007	434.981	439.063	434.149		
31/08/2007	434.591	438.593	433.749		
03/09/2007	434.591	438.703	433.659		
05/09/2007	434.421	438.613	433.759		
07/09/2007	434.301	438.523	433.509		
10/09/2007	434.136	438.573	433.639		
12/09/2007	433.951	438.513	433.099		
26/09/2007	434.721	439.083	433.829		
28/09/2007	434.701	439.043	434.159		
01/10/2007	434.611	438.943	434.249		
10/10/2007	434.971	438.633	434.689		
12/10/2007	434.921	438.763	434.469		
15/10/2007	434.761	438.583	434.309		
17/10/2007	435.371	438.943	434.169		
19/10/2007	434.251	438.963	434.039		
22/10/2007	434.141	438.783	433.869		
05/11/2007	434.851	438.553	434.979		
07/11/2007	434.801	438.123	434.549		
09/11/2007	434.761	438.313	433.669		
12/11/2007	434.361	438.303	433.559		
14/11/2007	434.301	438.163	433.549		
16/11/2007	434.191	438.163	433.399		
19/11/2007	435.131	438.583	433.829		
21/11/2007	435.171	438.983	433.869		
23/11/2007	435.471	438.973	433.909		
26/11/2007	435.251	438.673	434.049		
28/11/2007	435.441	438.623	434.519		
03/12/2007	436.081	439.443	434.599		
05/12/2007	436.411	439.533	434.759		
07-Dec-07	436.411	439.863	435.189		
10-Dec-07	436.121	439.913	435.629		
12-Dec-07	435.891	439.603	435.819		
14-Dec-07	435.711	439.473	435.019		
17-Dec-07	435.651	439.293	434.969		
02-Jan-08	436.231	439.363	435.329		
04-Jan-08	436.261	439.223	435.359		
07-Jan-08	436.151	439.363	435.409		
09-Jan-08	436.491	439.503	435.599		
11-Jan-08	436.551	439.673	435.679		
14-Jan-08	436.701	439.793	435.769		

Groundwater levels (m b top of casing)

	BH1	BH2	BH3	BH1 off	BH2 off
Top of casing	442.691	452.753	453.499	427.060	393.310
16-Jan-08	5.94	12.72	17.92		
06-Mar-08	6.65	13.79	19.17		
13-Mar-08	6.14	13.34	18.96		
19-Mar-08	6.5	13.41	18.64		
27-Mar-08	6.8	13.8	18.82		
17-Apr-08	7.46	14.44	19.08		
24-Apr-08	7.39	14.41	19.01		
01-May-08	7.01	13.9	19.62		
09-May-08	7.57	14.63	19.77		
16-May-08	7.88	15.03	20.38		
30-May-08	7.12	13.64	19.61		
05-Jun-08	7.15	14.43	19.86		
12-Jun-08	7.6	14.96	20.04		
19-Jun-08	7.46	14.8	20.01		
02-Jul-08	7.26	14.08	18.95		
11-Jul-08	7.18	14.23	19.4		
18-Jul-08	6.82	14.2	19.83		
25-Jul-08	7.3	14.7	20.22		
01-Aug-08	6.98	14.13	19.46		
08-Aug-08	6.54	13.9	19.13		
15-Aug-08	5.99	13.3	18.57		
22-Aug-08	5.83	13.8	18.51		
29-Aug-08	5.74	13.52	18.63		
05-Sep-08	6.18	13.2	18.44		
19-Sep-08	8.46	14.66	20.4		
26-Sep-08	8.81	15.15	20.83		
03-Oct-08	7.84	14.91	20.24		
17-Oct-08	7.43	14.57	19.65		
24-Oct-08	7.84	14.06	19.24		
31-Oct-08	7.27	13.55	18.73		
07-Nov-08	7.06	13.69	19.12		
14-Nov-08	7.23	13.73	19.39		
21-Nov-08	7.84	13.9	19.9		
28-Nov-08	7.98	13.91	19.64		
05-Dec-08	7.96	14.27	19.83		
12-Dec-08	8.41	14.39	20.09		
19-Dec-08	8.23	14.36	19.94		
09-Jan-09	7.54	14.78	20.13		
16-Jan-09	7.36	13.65	19.81		
23-Jan-09	7.09	13.14	19.29		
13-Feb-09	7.17	13.14	19.47		
20-Feb-09	7.48	13.29	19.72		
27-Feb-09	7.62	13.69	20.17		
06-Mar-09	7.86	14.17	19.36		
13-Mar-09	7.92	14.08	19.77		
20-Mar-09	8.64	15.58	20.66		
27-Mar-09	8.93	15.71	20.89		
03-Apr-09	8.81	14.92	20.64		
09-Apr-09	8.75	15.06	20.53		
17-Apr-09	8.67	15.39	20.26		
24-Apr-09	8.42	15.13	19.8		
01-May-09	8.38	15.07	19.71		
08-May-09	8.46	15.21	19.83		
15-May-09	8.37	15.19	19.8		
22-May-09	8.12	15.26	19.75		
29-May-09	7.7	15.13	19.74		
12-Jun-09	8.38	14.05	19.56		
19-Jun-09	8.42	14.14	19.41		
26-Jun-09	8.65	14.23	19.87		
30-Jul-09	6.595	12.28	19.05	>60	20.61
07-Aug-09	8.67	15.33	20.51		
14-Aug-09	8.31	14.94	19.67		
11-Sep-09	7.64	14.71	20.32		
18-Sep-09	7.36	14.51	20.06		
25-Sep-09	7.43	14.61	20.18		
02-Oct-09	7.63	14.87	20.47		
09-Oct-09	8.33	14.88	20.04		24.6
16-Oct-09	8.21	14.72	19.93		
23-Oct-09	7.97	13.85	20.37		
30-Oct-09	8.07	14.31	20.63		
06-Nov-09	7.98	14.23	20.37		
12-Nov-09	7.62	14.01	20.3		
20-Nov-09	7.54	14.16	19.93		
27-Nov-09	7.49	13.97	19.79	Cant get reliable reading from dip-meter (intermittant alarm)?	23.16

Groundwater levels (m AOD)

Date	BH1	BH2	BH3	Trefil 1	Trefil 2
	442.691	452.753	453.499	427.060	393.31
16-Jan-08	436.751	440.033	435.579		
06-Mar-08	436.041	438.963	434.329		
13-Mar-08	436.551	439.413	434.539		
19-Mar-08	436.191	439.343	434.859		
27-Mar-08	435.891	438.953	434.679		
17-Apr-08	435.231	438.313	434.419		
24-Apr-08	435.301	438.343	434.489		
01-May-08	435.681	438.853	433.879		
09-May-08	435.121	438.123	433.729		
16-May-08	434.811	437.723	433.119		
30-May-08	435.571	439.113	433.889		
05-Jun-08	435.541	438.323	433.639		
12-Jun-08	435.091	437.793	433.459		
19-Jun-08	435.231	437.953	433.489		
27/06/2008					
02/07/2008	435.431	438.673	434.549		
11/07/2008	435.511	438.523	434.099		
18/07/2008	435.871	438.553	433.669		
25/07/2008	435.391	438.053	433.279		
01/08/2008	435.711	438.623	434.039		
08/08/2008	436.151	438.853	434.369		
15/08/2008	436.701	439.453	434.929		
22/08/2008	436.861	438.953	434.989		
29/08/2008	436.951	439.233	434.869		
05/09/2008	436.511	439.553	435.059		
19/09/2008	434.231	438.093	433.099		
26/09/2008	433.881	437.603	432.669		
03/10/2008	434.851	437.843	433.259		
17/10/2008	435.261	438.183	433.849		
24/10/2008	434.851	438.693	434.259		
31/10/2008	435.421	439.203	434.769		
07/11/2008	435.631	439.063	434.379		
14/11/2008	435.461	439.023	434.109		
21/11/2008	434.851	438.853	433.599		
28/11/2008	434.711	438.843	433.859		
05/12/2008	434.731	438.483	433.669		
12/12/2008	434.281	438.363	433.409		
19/12/2008	434.461	438.393	433.559		
09/01/2009	435.151	437.973	433.369		
16/01/2009	435.331	439.103	433.689		
23/01/2009	435.601	439.613	434.209		
13/02/2009	435.521	439.613	434.029		
20/02/2009	435.211	439.463	433.779		
27/02/2009	435.071	439.063	433.329		
06/03/2009	434.831	438.583	434.139		
13/03/2009	434.771	438.673	433.729		
20/03/2009	434.051	437.173	432.839		
27/03/2009	433.761	437.043	432.609		
03/04/2009	433.881	437.833	432.859		
09/04/2009	433.941	437.693	432.969		
17/04/2009	434.021	437.363	433.239		
24/04/2009	434.271	437.623	433.699		
01/05/2009	434.311	437.683	433.789		
08/05/2009	434.231	437.543	433.669		
15/05/2009	434.321	437.563	433.699		
22/05/2009	434.571	437.493	433.749		
29/05/2009	434.991	437.623	433.759		
12/06/2009	434.311	438.703	433.939		
19/06/2009	434.271	438.613	434.089		
26/06/2009	434.041	438.523	433.629		
30/07/2009	436.096	440.473	434.449		372.70
07/08/2009	434.021	437.423	432.989		
14/08/2009	434.381	437.813	433.829		
11/09/2009	435.051	438.043	433.179		
18/09/2009	435.331	438.243	433.439		
25/09/2009	435.261	438.143	433.319		
02/10/2009	435.061	437.883	433.029		
09/10/2009	434.361	437.873	433.459		368.71
16/10/2009	434.481	438.033	433.569		
23/10/2009	434.721	438.903	433.129		
30/10/2009	434.621	438.443	432.869		
06/11/2009	434.711	438.523	433.129		
12/11/2009	435.071	438.743	433.199		
20/11/2009	435.151	438.593	433.569		
27/11/2009	435.201	438.783	433.709		370.15

Groundwater levels (m b top of casing)

	BH1	BH2	BH3	BH1 off	BH2 off
Top of casing	442.691	452.753	453.499	427.060	393.310
03-Dec-09	7.92	14.63	19.36		
10-Dec-09	7.73	14.47	19.21		
17-Dec-09	7.81	14.61	19.3		
21-Jan-10	7.98	14.32	19.87		
28-Jan-10	8.03	14.41	19.97	Cant get reliable reading from dip-meter (intermittant alarm)?	24.45
19-Feb-10	9.1	14.958	20.65		
24-Feb-10	8.38	14.875	20.035	Cant get reliable reading from dip-meter (intermittant alarm)?	
03-Mar-10	9.215	14.88	20.59		
10-Mar-10	9.345	15.01	20.715		
17-Mar-10	9.435	15.095	20.795		
23-Mar-10	8.64	14.285	19.99		
29-Mar-10	7.36	13.61	19.38	48.92	24.2
06-Apr-10	8.13	13.88	20.05		
19-Apr-10	9.205	15.22	20.71		
26-Apr-10	9.665	15.64	20.715	51.43	24.45
07-May-10	9.18	15.18	20.395		
14-May-10	9.56	15.31	20.645		
24-May-10	9.97	15.4	20.725	52.11	25.45
11-Jun-10	9.49	15.3	20.76		
18-Jun-10	10.17	15.35	20.73		
25-Jun-10	10.65	15.56	20.745	52.13	25.375
02-Jul-10	10.525	15.56	20.74		
09-Jul-10	10.663	15.569	20.745		
16-Jul-10	9.441	15.546	20.182		
23-Jul-10	9.304	14.33	20.32		
30-Jul-10	9.75	14.896	20.56	51.46	25.265
11-Aug-10	10.17	15.2	20.72		
20-Aug-10	8.27	14.94	20.325		
27-Aug-10	7.306	12.985	19.234	50.915	24.5
03-Sep-10	9.1	13.676	20.677		
10-Sep-10	7.34	13.48	20.435		
17-Sep-10	8.602	13.785	20.537		
28-Sep-10	7.65	13.56	20.51	51.01	24.465
01-Oct-10	7.65	13.56	19.963		
15-Oct-10	9.29	13.83	20.65		
25-Oct-10	9.675	14.15	20.727		
29-Oct-10	7.9	13.823	19.43	49.373	24.338
05-Nov-10	6.92	12.87	19.733		
12-Nov-10	7.338	13.332	19.92		
19-Nov-10	7.195	13.458	19.846		
29-Nov-10	9.446	14.794	20.644		
03-Dec-10	9.677	15.359	20.665		
10-Dec-10	9.82	15.895	20.748		
07-Jan-11	7.166	14.387	19.635		
14-Jan-11	6.801	15.747	19.76		
21-Jan-11	7.463	13.746	20.607		
28-Jan-11	9.42	14.048	20.641	51.353	24.03

Groundwater levels (m AOD)

Date	BH1	BH2	BH3	Trefil 1	Trefil 2
	442.691	452.753	453.499	427.060	393.31
03/12/2009	434.771	438.123	434.139		
10/12/2009	434.961	438.283	434.289		
17/12/2009	434.881	438.143	434.199		
21/01/2010	434.711	438.433	433.629		
28/01/2010	434.661	438.343	433.529		368.86
19/02/2010	433.591	437.795	432.849		
24/02/2010	434.311	437.878	433.464		
03/03/2010	433.476	437.873	432.909		
10/03/2010	433.346	437.743	432.784		
17/03/2010	433.256	437.658	432.704		
23/03/2010	434.051	438.468	433.509		
29/03/2010	435.331	439.143	434.119	378.140	369.11
06/04/2010	434.561	438.873	433.449		
19/04/2010	433.486	437.533	432.789		
26/04/2010	433.026	437.113	432.784	375.630	368.86
07/05/2010	433.511	437.573	433.104		
14/05/2010	433.131	437.443	432.854		
24/05/2010	432.721	437.353	432.774	374.950	367.86
11/06/2010	433.201	437.453	432.739		
18/06/2010	432.521	437.403	432.769		
25/06/2010	432.041	437.193	432.754	374.930	367.94
02/07/2010	432.166	437.193	432.759		
09/07/2010	432.028	437.184	432.754		
16/07/2010	433.250	437.207	433.317		
23/07/2010	433.387	438.423	433.179		
30/07/2010	432.941	437.857	432.939	375.600	368.05
11/08/2010	432.521	437.553	432.779		
20/08/2010	434.421	437.813	433.174		
27/08/2010	435.385	439.768	434.265	376.145	368.81
03/09/2010	433.591	439.077	432.822		
10/09/2010	435.351	439.273	433.064		
17/09/2010	434.089	438.968	432.962		
28/09/2010	435.041	439.193	432.989	376.050	368.85
01/10/2010	435.041	439.193	433.536		
15/10/2010	433.401	438.923	432.849		
25/10/2010	433.016	438.603	432.772		
29/10/2010	434.791	438.930	434.069	377.687	368.97
05/11/2010	435.771	439.883	433.766		
12/11/2010	435.353	439.421	433.579		
19/11/2010	435.496	439.295	433.653		
29/11/2010	433.245	437.959	432.855		
03/12/2010	433.014	437.394	432.834		
10/12/2010	432.871	436.858	432.751		
07/01/2011	435.525	438.366	433.864		
14/01/2011	435.890	437.006	433.739		
21/01/2011	435.228	439.007	432.892		
28/01/2011	433.271	438.705	432.858	375.707	369.28

APPENDIX B

Quarry pumping data

Date	Day	Month	Year	Pumped since last measurment (m3)
31/05/2010	31	5	2010	430
01/06/2010	1	6	2010	
02/06/2010	2	6	2010	
03/06/2010	3	6	2010	
04/06/2010	4	6	2010	
05/06/2010	5	6	2010	
06/06/2010	6	6	2010	
07/06/2010	7	6	2010	
08/06/2010	8	6	2010	
09/06/2010	9	6	2010	
10/06/2010	10	6	2010	
11/06/2010	11	6	2010	190
12/06/2010	12	6	2010	
13/06/2010	13	6	2010	
14/06/2010	14	6	2010	
15/06/2010	15	6	2010	
16/06/2010	16	6	2010	
17/06/2010	17	6	2010	
18/06/2010	18	6	2010	390
19/06/2010	19	6	2010	
20/06/2010	20	6	2010	
21/06/2010	21	6	2010	
22/06/2010	22	6	2010	
23/06/2010	23	6	2010	
24/06/2010	24	6	2010	
25/06/2010	25	6	2010	880
26/06/2010	26	6	2010	
27/06/2010	27	6	2010	
28/06/2010	28	6	2010	
29/06/2010	29	6	2010	
30/06/2010	30	6	2010	
01/07/2010	1	7	2010	
02/07/2010	2	7	2010	100
03/07/2010	3	7	2010	
04/07/2010	4	7	2010	
05/07/2010	5	7	2010	
06/07/2010	6	7	2010	
07/07/2010	7	7	2010	
08/07/2010	8	7	2010	
09/07/2010	9	7	2010	
10/07/2010	10	7	2010	
11/07/2010	11	7	2010	
12/07/2010	12	7	2010	
13/07/2010	13	7	2010	
14/07/2010	14	7	2010	
15/07/2010	15	7	2010	
16/07/2010	16	7	2010	
17/07/2010	17	7	2010	
18/07/2010	18	7	2010	
19/07/2010	19	7	2010	
20/07/2010	20	7	2010	
21/07/2010	21	7	2010	
22/07/2010	22	7	2010	
23/07/2010	23	7	2010	4430
24/07/2010	24	7	2010	
25/07/2010	25	7	2010	
26/07/2010	26	7	2010	
27/07/2010	27	7	2010	
28/07/2010	28	7	2010	
29/07/2010	29	7	2010	
30/07/2010	30	7	2010	1300
31/07/2010	31	7	2010	
01/08/2010	1	8	2010	
02/08/2010	2	8	2010	
03/08/2010	3	8	2010	
04/08/2010	4	8	2010	
05/08/2010	5	8	2010	
06/08/2010	6	8	2010	
07/08/2010	7	8	2010	
08/08/2010	8	8	2010	200
09/08/2010	9	8	2010	
10/08/2010	10	8	2010	
11/08/2010	11	8	2010	
12/08/2010	12	8	2010	
13/08/2010	13	8	2010	
14/08/2010	14	8	2010	
15/08/2010	15	8	2010	370
16/08/2010	16	8	2010	
17/08/2010	17	8	2010	
18/08/2010	18	8	2010	
19/08/2010	19	8	2010	
20/08/2010	20	8	2010	
21/08/2010	21	8	2010	
22/08/2010	22	8	2010	3270

Date	Day	Month	Year	Pumped since last measurment (m3)
23/08/2010	23	8	2010	
24/08/2010	24	8	2010	
25/08/2010	25	8	2010	
26/08/2010	26	8	2010	
27/08/2010	27	8	2010	
28/08/2010	28	8	2010	
29/08/2010	29	8	2010	8010
30/08/2010	30	8	2010	
31/08/2010	31	8	2010	5330
01/09/2010	1	9	2010	
02/09/2010	2	9	2010	
03/09/2010	3	9	2010	
04/09/2010	4	9	2010	
05/09/2010	5	9	2010	4930
06/09/2010	6	9	2010	
07/09/2010	7	9	2010	
08/09/2010	8	9	2010	
09/09/2010	9	9	2010	
10/09/2010	10	9	2010	
11/09/2010	11	9	2010	
12/09/2010	12	9	2010	6130
13/09/2010	13	9	2010	
14/09/2010	14	9	2010	
15/09/2010	15	9	2010	
16/09/2010	16	9	2010	
17/09/2010	17	9	2010	
18/09/2010	18	9	2010	
19/09/2010	19	9	2010	3580
20/09/2010	20	9	2010	
21/09/2010	21	9	2010	
22/09/2010	22	9	2010	
23/09/2010	23	9	2010	
24/09/2010	24	9	2010	
25/09/2010	25	9	2010	
26/09/2010	26	9	2010	1490
27/09/2010	27	9	2010	
28/09/2010	28	9	2010	
29/09/2010	29	9	2010	
30/09/2010	30	9	2010	870
01/10/2010	1	10	2010	
02/10/2010	2	10	2010	
03/10/2010	3	10	2010	5470
04/10/2010	4	10	2010	
05/10/2010	5	10	2010	
06/10/2010	6	10	2010	
07/10/2010	7	10	2010	
08/10/2010	8	10	2010	
09/10/2010	9	10	2010	
10/10/2010	10	10	2010	4460
11/10/2010	11	10	2010	
12/10/2010	12	10	2010	
13/10/2010	13	10	2010	
14/10/2010	14	10	2010	
15/10/2010	15	10	2010	
16/10/2010	16	10	2010	
17/10/2010	17	10	2010	840
18/10/2010	18	10	2010	
19/10/2010	19	10	2010	
20/10/2010	20	10	2010	
21/10/2010	21	10	2010	
22/10/2010	22	10	2010	
23/10/2010	23	10	2010	
24/10/2010	24	10	2010	310
25/10/2010	25	10	2010	
26/10/2010	26	10	2010	
27/10/2010	27	10	2010	
28/10/2010	28	10	2010	
29/10/2010	29	10	2010	
30/10/2010	30	10	2010	
31/10/2010	31	10	2010	1140
01/11/2010	1	11	2010	
02/11/2010	2	11	2010	
03/11/2010	3	11	2010	
04/11/2010	4	11	2010	
05/11/2010	5	11	2010	
06/11/2010	6	11	2010	
07/11/2010	7	11	2010	6280
08/11/2010	8	11	2010	
09/11/2010	9	11	2010	
10/11/2010	10	11	2010	
11/11/2010	11	11	2010	
12/11/2010	12	11	2010	
13/11/2010	13	11	2010	
14/11/2010	14	11	2010	5690

Date	Day	Month	Year	Pumped since last measurment (m3)
15/11/2010	15	11	2010	
16/11/2010	16	11	2010	
17/11/2010	17	11	2010	
18/11/2010	18	11	2010	
19/11/2010	19	11	2010	
20/11/2010	20	11	2010	
21/11/2010	21	11	2010	6370
22/11/2010	22	11	2010	
23/11/2010	23	11	2010	
24/11/2010	24	11	2010	
25/11/2010	25	11	2010	
26/11/2010	26	11	2010	
27/11/2010	27	11	2010	
28/11/2010	28	11	2010	1990
29/11/2010	29	11	2010	
30/11/2010	30	11	2010	
01/12/2010	1	12	2010	
02/12/2010	2	12	2010	
03/12/2010	3	12	2010	
04/12/2010	4	12	2010	
05/12/2010	5	12	2010	
06/12/2010	6	12	2010	
07/12/2010	7	12	2010	
08/12/2010	8	12	2010	
09/12/2010	9	12	2010	
10/12/2010	10	12	2010	
11/12/2010	11	12	2010	
12/12/2010	12	12	2010	
13/12/2010	13	12	2010	
14/12/2010	14	12	2010	
15/12/2010	15	12	2010	
16/12/2010	16	12	2010	
17/12/2010	17	12	2010	
18/12/2010	18	12	2010	
19/12/2010	19	12	2010	1750
20/12/2010	20	12	2010	
21/12/2010	21	12	2010	
22/12/2010	22	12	2010	
23/12/2010	23	12	2010	
24/12/2010	24	12	2010	
25/12/2010	25	12	2010	
26/12/2010	26	12	2010	
27/12/2010	27	12	2010	
28/12/2010	28	12	2010	
29/12/2010	29	12	2010	
30/12/2010	30	12	2010	
31/12/2010	31	12	2010	
01/01/2011	1	1	2011	
02/01/2011	2	1	2011	
03/01/2011	3	1	2011	
04/01/2011	4	1	2011	
05/01/2011	5	1	2011	
06/01/2011	6	1	2011	
07/01/2011	7	1	2011	
08/01/2011	8	1	2011	
09/01/2011	9	1	2011	4220
10/01/2011	10	1	2011	
11/01/2011	11	1	2011	
12/01/2011	12	1	2011	
13/01/2011	13	1	2011	
14/01/2011	14	1	2011	
15/01/2011	15	1	2011	
16/01/2011	16	1	2011	900
17/01/2011	17	1	2011	
18/01/2011	18	1	2011	
19/01/2011	19	1	2011	
20/01/2011	20	1	2011	
21/01/2011	21	1	2011	
22/01/2011	22	1	2011	
23/01/2011	23	1	2011	10410
24/01/2011	24	1	2011	
25/01/2011	25	1	2011	
26/01/2011	26	1	2011	
27/01/2011	27	1	2011	
28/01/2011	28	1	2011	
29/01/2011	29	1	2011	
30/01/2011	30	1	2011	4150
31/01/2011	31	1	2011	

APPENDIX C

Rainfall data

Date	Rain (mm)	Comment
01/02/2010	0	Dry
02/02/2010	0	Wet
03/02/2010	0	Wet
04/02/2010	0	Wet
05/02/2010	0	Dry
06/02/2010	0	Dry
07/02/2010	0	Wet
08/02/2010	0	Dry & cold
09/02/2010	0	Dry & cold
10/02/2010	0	Dry & cold
11/02/2010	0	Dry & cold
12/02/2010	0	Dry & cold
13/02/2010	0	Dry
14/02/2010	0	Wet
15/02/2010	1.5	Wet
16/02/2010	11	Dry
17/02/2010	0	Snowing
18/02/2010	3.5	Snowing
19/02/2010	12	Dry & cold, snow on ground
20/02/2010	0	Dry
21/02/2010	0	Snowing
22/02/2010	8	Snowing
23/02/2010	0	Snowing
24/02/2010	15.5	Misty, snow turning to slush.
25/02/2010	0	Dry
26/02/2010	0	Dry
27/02/2010	0	
28/02/2010	16.5	
01/03/2010	0	Dry
02/03/2010	0	Dry
03/03/2010	0	Dry
04/03/2010	0	Dry
05/03/2010	0	Dry
06/03/2010	0	Dry
07/03/2010	0	Dry
08/03/2010	0	Dry
09/03/2010	0	Dry
10/03/2010	0	Dry
11/03/2010	0	Dry
12/03/2010	0	Dry
13/03/2010	0	Dry
14/03/2010	0	Dry
15/03/2010	0	Dry
16/03/2010	0	Dry
17/03/2010	5	Wet & misty
18/03/2010	0	Dry & overcast
19/03/2010	14	Dry & overcast
20/03/2010	0	Wet
21/03/2010	0	Dry
22/03/2010	55	Wet
23/03/2010	9	Wet & misty
24/03/2010	39	Wet & misty
25/03/2010	11	Overcast & dry
26/03/2010	23	Wet
27/03/2010	0	Dry
28/03/2010	0	Dry
29/03/2010	33	Wet
30/03/2010	22	Wet
31/03/2010	17	Snow
01/04/2010	16	Snow
02/04/2010	0	Wet
03/04/2010	0	Wet
04/04/2010	0	Dry
05/04/2010	0	Showers
06/04/2010	83	Overcast
07/04/2010	3	Showers
08/04/2010	0.75	Dry
09/04/2010	0	Dry
10/04/2010	0	Dry
11/04/2010	0	Dry
12/04/2010	0	Dry
13/04/2010	0	Dry
14/04/2010	0	Dry
15/04/2010	0	Dry
16/04/2010	0	Dry
17/04/2010	0	Dry
18/04/2010	0	Dry
19/04/2010	0	Dry
20/04/2010	0	Dry
21/04/2010	0	Dry
22/04/2010	0	Dry
23/04/2010	0	Dry
24/04/2010	0	Dry
25/04/2010	0	Wet
26/04/2010	11	Overcast
27/04/2010	0	Dry
28/04/2010	0	Dry
29/04/2010	0	Wet
30/04/2010	29	Wet
01/05/2010	22	Wet
02/05/2010	0	Dry
03/05/2010	0	Dry
04/05/2010	0	Dry
05/05/2010	0	Dry
06/05/2010	1	Wet
07/05/2010	5	Rain then snow
08/05/2010	1.5	Showers

Date	Rain (mm)	Comment
09/05/2010	0	Dry
10/05/2010	0	Overcast
11/05/2010	0.75	Wet
12/05/2010	0	Showers
13/05/2010	11	Dry
14/05/2010	2	Wet
15/05/2010	0	Dry
16/05/2010	0	Dry
17/05/2010	0.5	Dry
18/05/2010	0	Dry
19/05/2010	0.5	Dry
20/05/2010	0	Dry
21/05/2010	0	Dry
22/05/2010	0	Dry
23/05/2010	0	Dry
24/05/2010	0	Dry
25/05/2010	0	Dry
26/05/2010	6	Dry
27/05/2010	0	Dry
28/05/2010	0	Dry
29/05/2010	15	Wet
30/05/2010	0	Dry
31/05/2010		Dry
01/06/2010	22	Wet
02/06/2010	0.5	Dry
03/06/2010	0	Dry
04/06/2010	0	Dry
05/06/2010	0	Dry
06/06/2010	0	Dry
07/06/2010	0	Showers
08/06/2010	28.5	Showers
09/06/2010	13	Wet
10/06/2010	11	Showers
11/06/2010	0	Dry
12/06/2010	0	Dry
13/06/2010	0	Showers
14/06/2010	5.5	Showers
15/06/2010	0	Dry
16/06/2010	0	Dry
17/06/2010	0	Dry
18/06/2010	0	Dry
19/06/2010	0	Dry
20/06/2010	0	Dry
21/06/2010	0	Dry
22/06/2010	0	Dry
23/06/2010	0	Dry
24/06/2010	0	Dry
25/06/2010	0	Dry
26/06/2010	0	Dry
27/06/2010	0	Dry
28/06/2010	0	Dry
29/06/2010	in guage has be stole	Wet
30/06/2010	0	Dry
01/07/2010	0	Overcast
02/07/2010	No rain guage.	Overnight rain
03/07/2010	0	Dry
04/07/2010	No rain guage	Showers
05/07/2010	No rain guage.	Dry
06/07/2010	0	Dry
07/07/2010	No rain guage.	Wet
08/07/2010	No rain guage.	Wet
09/07/2010	0	Dry
10/07/2010	0	Dry
11/07/2010	0	Dry
12/07/2010	No rain guage.	Showers
13/07/2010	No rain guage.	Showers
14/07/2010	No rain guage.	Wet
15/07/2010	No rain guage.	Heavy showers
16/07/2010	0	Overcast
17/07/2010	No rain guage	Showers
18/07/2010	No rain guage	Showers
19/07/2010	0	Dry
20/07/2010	No rain guage.	Wet
21/07/2010	0	Dry
22/07/2010	No rain guage.	Wet
23/07/2010	placement guage in u	Wet
24/07/2010	0	Light showers
25/07/2010	0	Dry
26/07/2010	1.25	Dry
27/07/2010	0.25	Fine drizzle
28/07/2010	0	Dry
29/07/2010	0	Dry
30/07/2010	0	Overcast am wet pm
31/07/2010	0	Dry
01/08/2010	0	Showers
02/08/2010	2	Dry
03/08/2010	5	Showers
04/08/2010	2	Showers
05/08/2010	0	Dry
06/08/2010	1	Wet & misty
07/08/2010	3	Showers
08/08/2010	0	Dry
09/08/2010	0	Slight drizzle
10/08/2010	8	Wet
11/08/2010	3.5	Dry
12/08/2010	0	Dry
13/08/2010	0	Dry

Date	Rain (mm)	Comment
14/08/2010	0	Wet
15/08/2010	0	Dry
16/08/2010	4.25	Dry
17/08/2010	1	Wet first thing dry later
18/08/2010	0	Dry
19/08/2010	1	Wet
20/08/2010	50	Wet
21/08/2010	0	Wet
22/08/2010	0	Dry
23/08/2010	53	Wet
24/08/2010	11	Showers
25/08/2010	1	Overcast @ first then heavy rain later
26/08/2010	50	Rain & mist
27/08/2010	2	Overcast but dry
28/08/2010	0	Dry
29/08/2010	0	Dry
30/08/2010	0	Dry
31/08/2010	0	Dry
01/09/2010	0	Dry
02/09/2010	0	Dry
03/09/2010	0	Dry
04/09/2010	0	Dry
05/09/2010	0	Wet
06/09/2010	5	Wet
07/09/2010	17	Wet
08/09/2010	6	Dry
09/09/2010	1	Dry
10/09/2010	7	Wet
11/09/2010	0	Wet
12/09/2010	0	Light Showers
13/09/2010	33	Wet
14/09/2010	11	Wet
15/09/2010	7	Dry
16/09/2010	1	Dry
17/09/2010	0	Dry
18/09/2010	0	Dry
19/09/2010	0	Wet
20/09/2010	9	Wet
21/09/2010	0	Dry
22/09/2010	0	Dry
23/09/2010	15	Wet
24/09/2010	6	Overcast
25/09/2010	0	Dry
26/09/2010	0	Dry
27/09/2010	0	Overcast
28/09/2010	1	Showers
29/09/2010	11	Wet
30/09/2010	1.5	Showers
01/10/2010	12	Heavy rain
02/10/2010	0	Showers
03/10/2010	0	Heavy rain
04/10/2010	65	Dry
05/10/2010	4.5	Dry
06/10/2010	10	Dry following overnight rain
07/10/2010	0	Dry
08/10/2010	0	Dry
09/10/2010	0	Showers
10/10/2010	0	Dry
11/10/2010	1.5	Dry
12/10/2010	0	Dry
13/10/2010	0	Dry
14/10/2010	0	Dry and overcast
15/10/2010	0	Dry and overcast
16/10/2010	0	Dry
17/10/2010	0	Dry
18/10/2010	1.5	Light shower
19/10/2010	1.5	Light shower
20/10/2010	2.5	Showers
21/10/2010	0	Light shower
22/10/2010	1	Light shower
23/10/2010	12	Showers
24/10/2010	0	Dry
25/10/2010	0	Dry
26/10/2010	6.5	Wet
27/10/2010	8	Overcast
28/10/2010	5	Wet & misty
29/10/2010	2.5	Wet & misty
30/10/2010	0	Showers
31/10/2010	15	Showers
01/11/2010	0	Dry
02/11/2010	5	Wet
03/11/2010	5	Overcast
04/11/2010	13	Wet
05/11/2010	21	Wet
06/11/2010	0	Wet
07/11/2010	0	Wet
08/11/2010	32	Wet
09/11/2010	1.5	Showers
10/11/2010	0	Dry
11/11/2010	12	Heavy rain
12/11/2010	4	Wet
13/11/2010	0	Dry
14/11/2010	0	Dry
15/11/2010	12	Dry
16/11/2010	1	Dry
17/11/2010	23	Heavy rain
18/11/2010	6	Wet and misty

Date	Rain (mm)	Comment
19/11/2010	16	Wet and misty
20/11/2010	4.5	Wet & misty
21/11/2010	0	Dry
22/11/2010	2	Wet and misty
23/11/2010	0	Dry
24/11/2010	0	Dry
25/11/2010	0	Dry
26/11/2010	0	Snow & ice
27/11/2010	0	Dry & ice
28/11/2010	0	Dry & ice
29/11/2010	0	Dry & ice
30/11/2010	0	Snow & ice
01/12/2010	0	Snow & ice
02/12/2010	0	Light snow & ice
03/12/2010	0	Light snow & ice
04/12/2010	0	Icy
05/12/2010	0	Icy
06/12/2010	0	Icy
07/12/2010	0	Icy
08/12/2010	0	Icy
09/12/2010	0	D ry
10/12/2010	0	Dry
11/12/2010	0	Dry
12/12/2010	0	Dry
13/12/2010	13	Dry
14/12/2010	0	Dry
15/12/2010	0	Dry
16/12/2010	0.5	Wet
17/12/2010	0	Heavy snow - close quarry
18/12/2010	0	Snow & ice
19/12/2010	0	Snow & ice
20/12/2010	0	Heavy snow - close quarry early
21/12/2010	0	Snow & ice
22/12/2010	0	Snow & ice
23/12/2010	0	Snow & ice
24/12/2010	0	
25/12/2010	0	
26/12/2010	0	
27/12/2010	0	
28/12/2010	0	
29/12/2010	0	
30/12/2010	0	
31/12/2010	0	
01/01/2011		
02/01/2011		
03/01/2011		
04/01/2011		Misty & damp
05/01/2011	12	Rain & mist
06/01/2011	4.5	Overcast
07/01/2011		Snow overnight turning to rain
08/01/2011		
09/01/2011		
10/01/2011	35	Rain & misty
11/01/2011	23	Rain & wind
12/01/2011	15	Heavy rain
13/01/2011	22	Rain
14/01/2011	23	Rain
15/01/2011		Rain
16/01/2011		Rain
17/01/2011	18	Dry
18/01/2011	4	Dry following overnight rain
19/01/2011		Dry
20/01/2011		Dry
21/01/2011		Dry
22/01/2011		Dry
23/01/2011		Dry
24/01/2011		Dry
25/01/2011		Light rain
26/01/2011	4	Overcast, damp & misty
27/01/2011	0.5	Overcast & freezing
28/01/2011		Bright & freezing
29/01/2011		Dry & freezing
30/01/2011		Dry & freezing
31/01/2011		Dry & freezing
01/02/2011		Rain to start clear later
02/02/2011		Rain & mist
03/02/2011		Dry & sunny
04/02/2011		Wet & windy
05/02/2011		Wet & windy
06/02/2011		Wet & windy
07/02/2011		Rain
08/02/2011		Dry & sunny
09/02/2011		Rain & mist
10/02/2011		Rain & mist
11/02/2011		Rain & mist

APPENDIX D

Site drainage system inspection records

	Visual Inspection				Comment	
	Weekly		Daily...		Observation	Action
	OK = ✓	Fault = ✕	OK = ✓	Fault = ✕		
01/07/09			✓			
02/07/09			✓			
03/07/09	✓		✓			
04/07/09			✓			
05/07/09						
06/07/09			✓			
07/07/09			✓			
08/07/09			✓			
09/07/09			✓			
10/07/09	✓		✓			
11/07/09			✓			
12/07/09						
13/07/09			✓			
14/07/09			✓			
15/07/09			✓			
16/07/09			✓			
17/07/09	✓		✓			
18/07/09			✓			
19/07/09						
20/07/09			✓			
21/07/09			✓			
22/07/09				✕	Oil boom misplaced. No sightings of hydrocarbons	Reposition oil boom at final lagoon out-fall
23/07/09			✓			
24/07/09	✓		✓			
25/07/09			✓			
26/07/09						
27/07/09			✓			
28/07/09			✓			
29/07/09			✓			
30/07/09			✓			
31/07/09	✓		✓			
01/08/09						
02/08/09						
03/08/09			✓			
04/08/09			✓			
05/08/09			✓			
06/08/09			✓			Change oil booms
07/08/09	✓		✓			
08/08/09			✓			
09/08/09						
10/08/09			✓			
11/08/09			✓			
12/08/09			✓			
13/08/09			✓			
14/08/09	✓		✓			
15/08/09			✓			
16/08/09						
17/08/09			✓			
18/08/09			✓			
19/08/09			✓			
20/08/09			✓			
21/08/09	✓		✓			
22/08/09			✓			
23/08/09						
24/08/09			✓			
25/08/09			✓			
26/08/09			✓			
27/08/09			✓			
28/08/09	✓		✓			
29/08/09						
30/08/09						
31/08/09						
01/09/09			✓			
02/09/09			✓			
03/09/09			✓			
04/09/09	✓		✓			
05/09/09			✓			
06/09/09						
07/09/09			✓			
08/09/09			✓			
09/09/09			✓			
10/09/09			✓			
11/09/09	✓		✓			
12/09/09						
13/09/09						
14/09/09			✓			
15/09/09			✓			
16/09/09			✓			
17/09/09			✓			
18/09/09	✓		✓			
19/09/09						
20/09/09						
21/09/09			✓			
22/09/09			✓			
23/09/09			✓			
24/09/09			✓			
25/09/09	✓		✓			
26/09/09						
27/09/09						
28/09/09			✓			
29/09/09			✓			
30/09/09			✓			
01/10/09			✓			
02/10/09	✓		✓			
03/10/09						
04/10/09						
05/10/09			✓			
06/10/09			✓			
07/10/09			✓			

	Visual Inspection				Comment	
	Weekly		Daily...		Observation	Action
	OK = ✓	Fault = x	OK = ✓	Fault = x		
08/10/09			✓			
09/10/09	✓		✓			
10/10/09						
11/10/09						
12/10/09			✓			
13/10/09			✓			
14/10/09			✓			
15/10/09						
16/10/09						
17/10/09						
18/10/09						
19/10/09			✓			
20/10/09			✓			
21/10/09			✓			
22/10/09			✓			
23/10/09	✓		✓			
24/10/09						
25/10/09						
26/10/09			✓			
27/10/09			✓			
28/10/09			✓			
29/10/09			✓			
30/10/09	✓		✓			
31/10/09						
01/11/09						
02/11/09			✓			
03/11/09			✓			
04/11/09			✓			
05/11/09			✓			
06/11/09	✓		✓			
07/11/09						
08/11/09						
09/11/09			✓			
10/11/09			✓			
11/11/09			✓			
12/11/09			✓			
13/11/09	✓		✓			
14/11/09						
15/11/09						
16/11/09			✓			
17/11/09			✓			
18/11/09			✓			
19/11/09			✓			
20/11/09	✓		✓			
21/11/09						
22/11/09						
23/11/09			✓			
24/11/09			✓			
25/11/09			✓			
26/11/09			✓			
27/11/09	✓		✓			
28/11/09						
29/11/09						
30/11/09			✓		Oil booms should be changed in the near future.	
01/12/09			✓			
02/12/09			✓			
03/12/09			✓			
04/12/09	✓		✓			
05/12/09						
06/12/09						
07/12/09			✓			
08/12/09			✓			
09/12/09			✓			
10/12/09			✓			
11/12/09	✓		✓			
12/12/09						
13/12/09						
14/12/09			✓			
15/12/09			✓			
16/12/09			✓		18th Open culverts & settling ponds frozen, (the discharge from the final lagoons is restricted by ice and as a result water levels rose above the outflow - stop pumping)	
17/12/09			✓			
18/12/09	✓		✓			
19/12/09						
20/12/09						
21/12/09			✓			
22/12/09			✓			
23/12/09	✓		✓			
24/12/09						
25/12/09						
26/12/09						
27/12/09						
28/12/09						
29/12/09						
30/12/09						
31/12/09						
01/01/10						
02/01/10						
03/01/10						
04/01/10				x	No pumping/run-off. Freezing conditions	
05/01/10				x	No pumping/run-off. Freezing conditions	
06/01/10				x	Quarry closed. No pumping/run-off. Unable to inspect	
07/01/10				x	No pumping/run-off. Freezing conditions	
08/01/10		x		x	Quarry closed. No pumping/run-off. Unable to inspect	
09/01/10				x	Quarry closed. No pumping/run-off. Unable to inspect	
10/01/10				x	Quarry closed. No pumping/run-off. Unable to inspect	
11/01/10				x	No pumping/run-off. Freezing conditions	

	Visual Inspection				Comment	
	Weekly		Daily...		Observation	Action
	OK = ✓	Fault = x	OK = ✓	Fault = x		
12/01/10				x	No pumping/run-off. Freezing conditions	
13/01/10				x	No pumping/run-off. Freezing conditions	
14/01/10				x	No pumping/run-off. Freezing conditions	
15/01/10		x		x	Quarry open for sales only. No pumping/run-off	
16/01/10						
17/01/10						
18/01/10				✓		
19/01/10				✓		
20/01/10				✓		
21/01/10				✓		
22/01/10	✓			✓		
23/01/10						
24/01/10						
25/01/10				✓		
26/01/10				✓		
27/01/10				✓		
28/01/10				✓		
29/01/10	✓			✓		
30/01/10						
31/01/10						
01/02/10			✓			
02/02/10			✓			
03/02/10			✓			
04/02/10			✓			
05/02/10	✓		✓			
06/02/10						
07/02/10						
08/02/10			✓			
09/02/10			✓		BGCBC visit to quarry (Permit to Operate)	
10/02/10			✓			
11/02/10			✓			
12/02/10	✓		✓			
13/02/10						
14/02/10						
15/02/10			✓			
16/02/10			✓			
17/02/10			✓			
18/02/10			✓			
19/02/10	x		✓		Unable to carry out a adequate inspection because of overlaying snow.	
20/02/10						
21/02/10						
22/02/10			✓			
23/02/10			✓			
24/02/10			✓			
25/02/10			✓			
26/02/10	✓		✓			
27/02/10						
28/02/10						
01/03/2010			✓			
02/03/2010			✓			
03/03/2010			✓			
04/03/2010			✓			
05/03/2010	✓		✓			
06/03/2010						
07/03/2010						
08/03/2010			✓			
09/03/2010			✓			
10/03/2010			✓			
11/03/2010			✓			
12/03/2010	✓		✓			
13/03/2010						
14/03/2010						
15/03/2010			✓			
16/03/2010			✓			
17/03/2010			✓			
18/03/2010			✓			
19/03/2010	✓		✓			
20/03/2010						
21/03/2010			✓			
22/03/2010			✓			
23/03/2010			✓			
24/03/2010			✓			
25/03/2010			✓			
26/03/2010	✓		✓			
27/03/2010						
28/03/2010						
29/03/2010			✓			
30/03/2010			✓			
31/03/2010			✓			
01/04/2010	✓		✓			
02/04/2010					Easter Bank Holiday	
03/04/2010						
04/04/2010						
05/04/2010					Easter Bank Holiday	
06/04/2010			✓			
07/04/2010			✓			
08/04/2010			✓			
09/04/2010	✓		✓			
10/04/2010						
11/04/2010						
12/04/2010			✓			
13/04/2010			✓			
14/04/2010			✓			
15/04/2010			✓			
16/04/2010	✓		✓			
17/04/2010						
18/04/2010						
19/04/2010			✓			

	Visual Inspection				Comment	
	Weekly		Daily...		Observation	Action
	OK = ✓	Fault = x	OK = ✓	Fault = x		
20/04/2010			✓			
21/04/2010			✓			
22/04/2010			✓			
23/04/2010	✓		✓			
24/04/2010						
25/04/2010						
26/04/2010			✓			
27/04/2010			✓			
28/04/2010			✓			
29/04/2010			✓			
30/04/2010	✓		✓			
01/05/10						
02/05/10						
03/05/10						
04/05/2010			✓			
05/05/2010			✓			
06/05/2010			✓			
07/05/2010	✓		✓			
08/05/10						
09/05/10						
10/05/2010			✓			
11/05/2010			✓			
12/05/2010			✓			
13/05/2010			✓			
14/05/2010	✓		✓			
15/05/10						
16/05/10						
17/05/2010			✓			
18/05/2010			✓			
19/05/2010			✓			
20/05/2010			✓			
21/05/2010	✓		✓		Oil booms need changing	
22/05/10						
23/05/10						
24/05/2010			✓			
25/05/2010			✓			
26/05/2010			✓			Replaced oil booms.
27/05/2010			✓			
28/05/2010	✓		✓			
29/05/10						
30/05/10						
31/05/10						
01/06/2010			✓			
02/06/2010			✓			
03/06/2010			✓			
04/06/2010	✓		✓			
05/06/10						
06/06/10			✓			
07/06/2010			✓			
08/06/2010			✓			
09/06/2010			✓			
10/06/2010			✓			
11/06/2010	✓		✓			
12/06/10						
13/06/10						
14/06/2010			✓			
15/06/2010			✓		a.m. Roads dusty.	Tractor broke-down waiting for parts - running in the afternoon.
16/06/2010			✓			
17/06/2010			✓			
18/06/2010	✓		✓			
19/06/10						
20/06/10						
21/06/2010			✓		a.m. Roads dusty.	Move pump to reach receding water level. Running from 10.30 am.
22/06/2010			✓			
23/06/2010			✓			
24/06/2010			✓			Clean silt from pond No. 6
25/06/2010	✓		✓			Clean silt from pond No. 6
26/06/10						
27/06/10						
28/06/2010			✓			Clean silt from pond No.6
29/06/2010			✓			
30/06/2010			✓			
01/07/2010			✓			
02/07/10	P		✓			
03/07/10						
04/07/10						
05/07/2010			✓			
06/07/2010			✓			
07/07/2010			✓			
08/07/2010			✓			
09/07/2010	✓		✓			
10/07/10			✓			
11/07/10						
12/07/2010			✓			
13/07/2010			✓			
14/07/2010			✓			
15/07/2010			✓			
16/07/2010	✓		✓			
17/07/10						
18/07/10						
19/07/2010			✓			
20/07/2010			✓			
21/07/2010			✓			
22/07/2010			✓			
23/07/2010	✓		✓			
24/07/10						
25/07/10						
26/07/2010			✓			
27/07/2010			✓			

	Visual Inspection				Comment	
	Weekly		Daily...		Observation	Action
	OK = ✓	Fault = ✕	OK = ✓	Fault = ✕		
28/07/2010			✓			
29/07/2010			✓			
30/07/2010	✓		✓			
31/07/2010						
01/08/2010			✓			
02/08/2010			✓			
03/08/2010			✓			
04/08/2010			✓			
05/08/2010			✓			
06/08/2010	✓		✓			
07/08/2010						
08/08/2010						
09/08/2010			✓			
10/08/2010			✓			
11/08/2010			✓			
12/08/2010			✓			
13/08/2010	✓		✓			
14/08/2010						
15/08/2010						
16/08/2010			✓			
17/08/2010			✓			
18/08/2010			✓			
19/08/2010			✓			
20/08/2010	✓		✓			
21/08/2010						
22/08/2010						
23/08/2010			✓			
24/08/2010			✓			
25/08/2010			✓			
26/08/2010			✓			
27/08/2010	✓		✓			
28/08/2010						
29/08/2010						
30/08/2010					Bank Holiday Monday	
31/08/2010			✓			
01/09/2010			✓			
02/09/2010			✓			
03/09/2010	✓		✓			
04/09/2010						
05/09/2010						
06/09/2010			✓			
07/09/2010			✓			
08/09/2010			✓			
09/09/2010			✓			
10/09/2010	✓		✓			
11/09/2010						
12/09/2010						
13/09/2010			✓			
14/09/2010			✓			
15/09/2010			✓			
16/09/2010			✓			
17/09/2010	✓		✓			
18/09/2010						
19/09/2010					Excavating additional settlement pond (Western Bund Area).	
20/09/2010			✓		As above	
21/09/2010			✓		As above	
22/09/2010			✓		As above	
23/09/2010			✓		As above	
24/09/2010	✓		✓		As above	
25/09/2010						
26/09/2010						
27/09/2010			✓			
28/09/2010			✓			
29/09/2010			✓			
30/09/2010			✓			
01/10/2010	✓		✓			
02/10/2010						
03/10/2010						
04/10/2010			✓			
05/10/2010			✓			
06/10/2010			✓			
07/10/2010			✓			
08/10/2010	✓		✓			
09/10/2010						
10/10/2010						
11/10/2010			✓			
12/10/2010			✓			
13/10/2010			✓			
14/10/2010			✓			
15/10/2010	✓		✓			
16/10/2010						
17/10/2010						
18/10/2010			✓			
19/10/2010			✓			
20/10/2010			✓			
21/10/2010			✓			
22/10/2010	✓		✓			
23/10/2010						
24/10/2010						
25/10/2010			✓			
26/10/2010			✓			
27/10/2010			✓			
28/10/2010			✓			
29/10/2010	✓		✓			
30/10/2010						
31/10/2010			✓			
01/11/2010			✓			
02/11/2010			✓			
03/11/2010			✓			

	Visual Inspection				Comment	
	Weekly		Daily...		Observation	Action
	OK = ✓	Fault = ✕	OK = ✓	Fault = ✕		
04/11/2010			✓			
05/11/2010	✓		✓			
06/11/2010						
07/11/2010						
08/11/2010			✓			
09/11/2010			✓			
10/11/2010			✓			
11/11/2010			✓			
12/11/2010	✓		✓			
13/11/2010						
14/11/2010						
15/11/2010			✓			
16/11/2010			✓			
17/11/2010			✓			
18/11/2010			✓			
19/11/2010	✓		✓			
20/11/2010						
21/11/2010						
22/11/2010			✓			
23/11/2010			✓			
24/11/2010			✓			
25/11/2010			✓			
26/11/2010	✓		✓			
27/11/2010						
28/11/2010						
29/11/2010			✓			
30/11/2010			✓			
01/12/2010			✓			
02/12/2010			✓			
03/12/2010	✓		✓			
04/12/2010						
05/12/2010						
06/12/2010			✓			
07/12/2010			✓			
08/12/2010			✓			
09/12/2010			✓			
10/12/2010	✓		✓			
11/12/2010						
12/12/2010						
13/12/2010			✓			
14/12/2010			✓			
15/12/2010			✓			
16/12/2010			✓			
17/12/2010	✓		✓			
18/12/2010						
19/12/2010						
20/12/2010			✓			
21/12/2010			✓			
22/12/2010			✓			
23/12/2010			✓			
24/12/2010						
25/12/2010						
26/12/2010						
27/12/2010						
28/12/2010						
29/12/2010						
30/12/2010						
31/12/2010						
01/01/2011						
02/01/2011						
03/01/2011						
04/01/2011						
05/01/2011			✓			
06/01/2011			✓			
07/01/2011	✓		✓			
08/01/2011						
09/01/2011						
10/01/2011				✕	There is a slight hydraulic oil leak from the 6" pumps submersible head.	The oil used is synthetic & biodegradable (Hydra 46) however the pump has been stopped until replacement parts can be fitted.
11/01/2011			✓			
12/01/2011			✓			
13/01/2011			✓			
14/01/2011	✓		✓		Oil booms should be replaced.	Replacement submersible head has been fitted - pump ready to test & run.
15/01/2011						
16/01/2011						
17/01/2011			✓			5 Oil booms replaced (awaiting delivery of another 5).
18/01/2011			✓			
19/01/2011			✓			
20/01/2011			✓			
21/01/2011	✓		✓			
22/01/2011						
23/01/2011						
24/01/2011			✓			Balance of 5 oil booms replaced
25/01/2011			✓			
26/01/2011			✓			
27/01/2011			✓			
28/01/2011	✓		✓			
29/01/2011						
30/01/2011						
31/01/2011			✓			