Trefil Quarry Annual Monitoring Report - 2011

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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 on-going data collection and presentation in annual monitoring reports.

ESI Ltd. (2011) presents the 2010 annual monitoring report with data to February 2011. This annual report presents the data collected to December 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.

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1.4 Monitoring regime

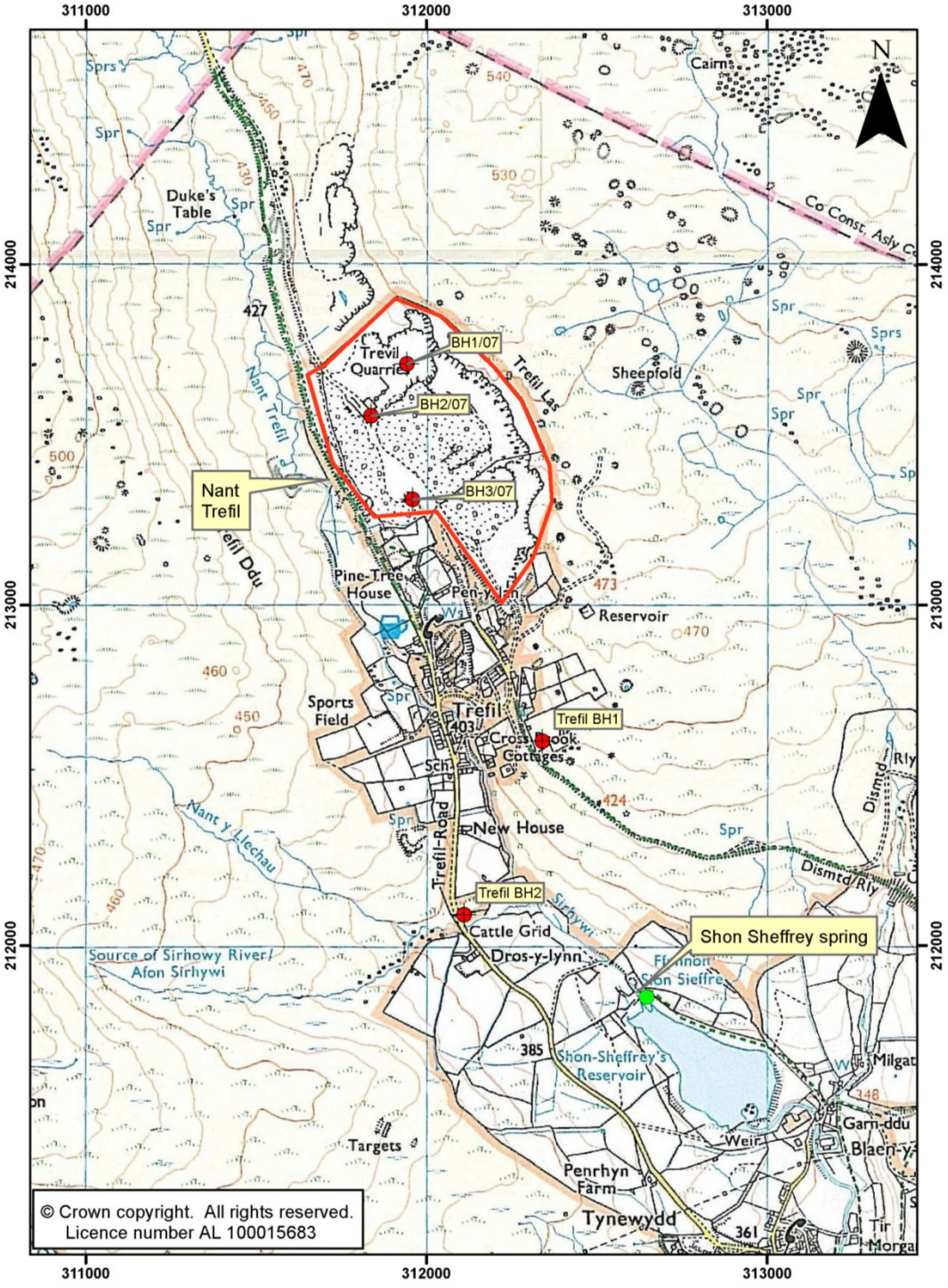
In order to quantify the level of impact at key sites and to make sure that the system is continuing to behave as predicted on the basis of the current conceptual model, a monitoring system is implemented.

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 my 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.

Figure 1.1 Monitoring borehole locations



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 and Figure 2.2 respectively. 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 December 2011 is summarised 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	234	234	234	18	22
Maximum (mAOD)	436.95	445.78	436.31	378.48	372.70
Minimum (mAOD)	431.68	436.51	432.61	374.93	367.86
Average (mAOD)	434.74	439.08	433.94	376.09	369.09
range	5.27	9.28	3.70	4.55	4.84

Figure 2.1 Groundwater level hydrographs (on site)

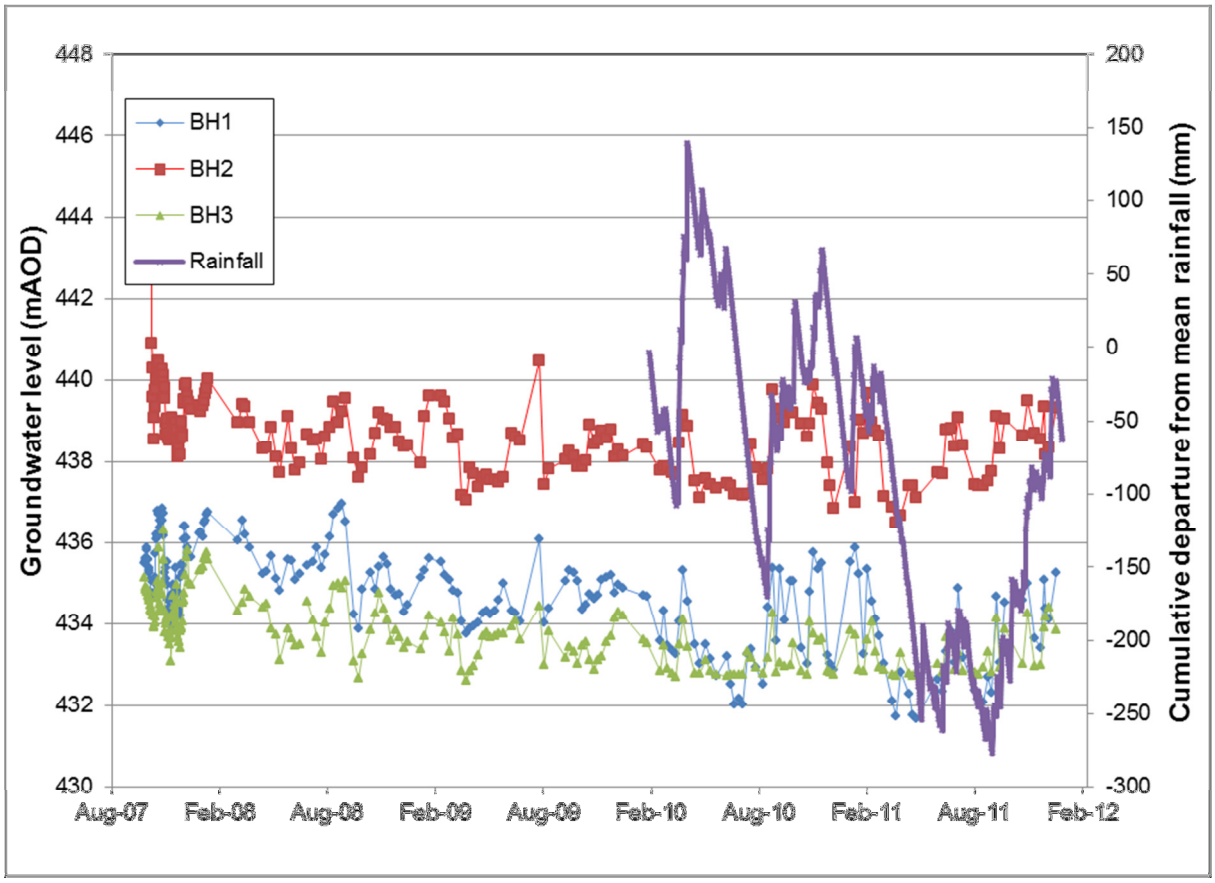
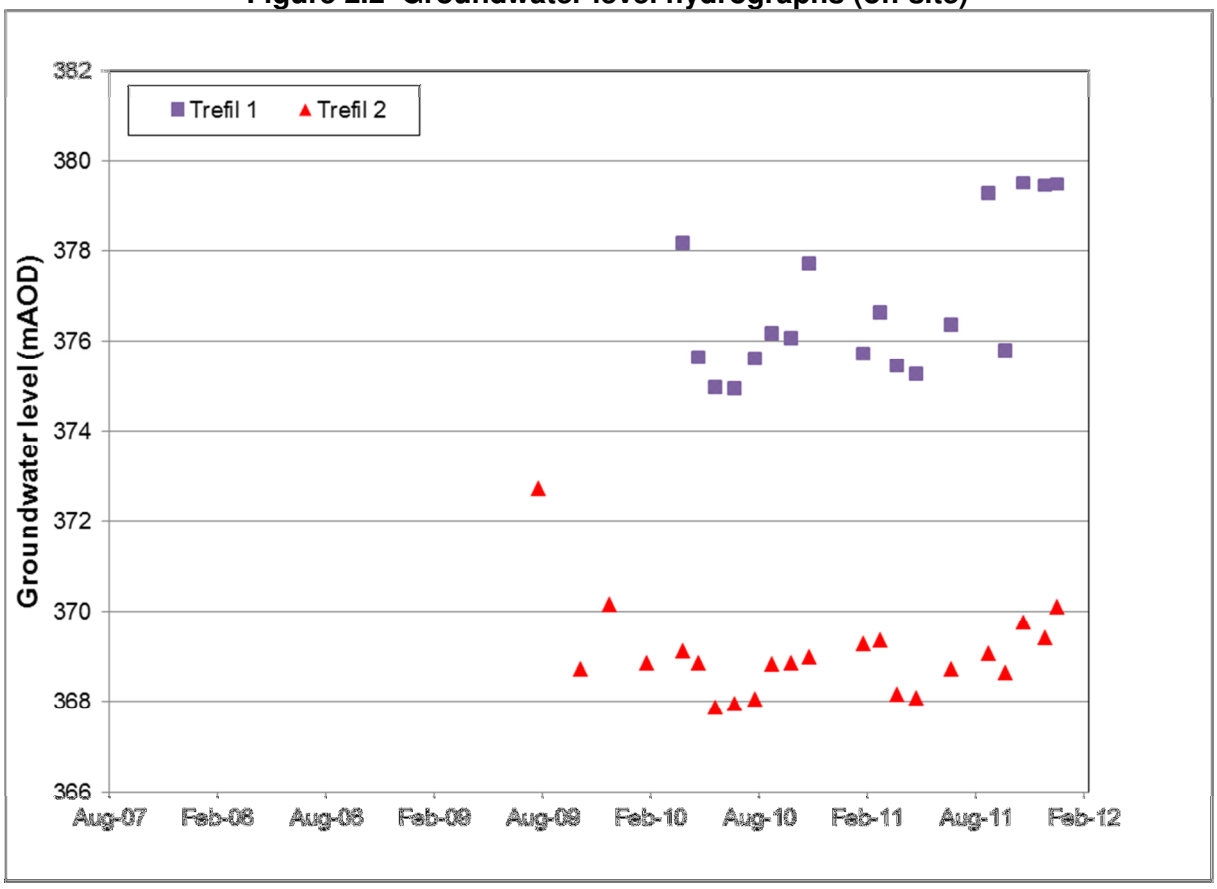


Figure 2.2 Groundwater level hydrographs (off site)



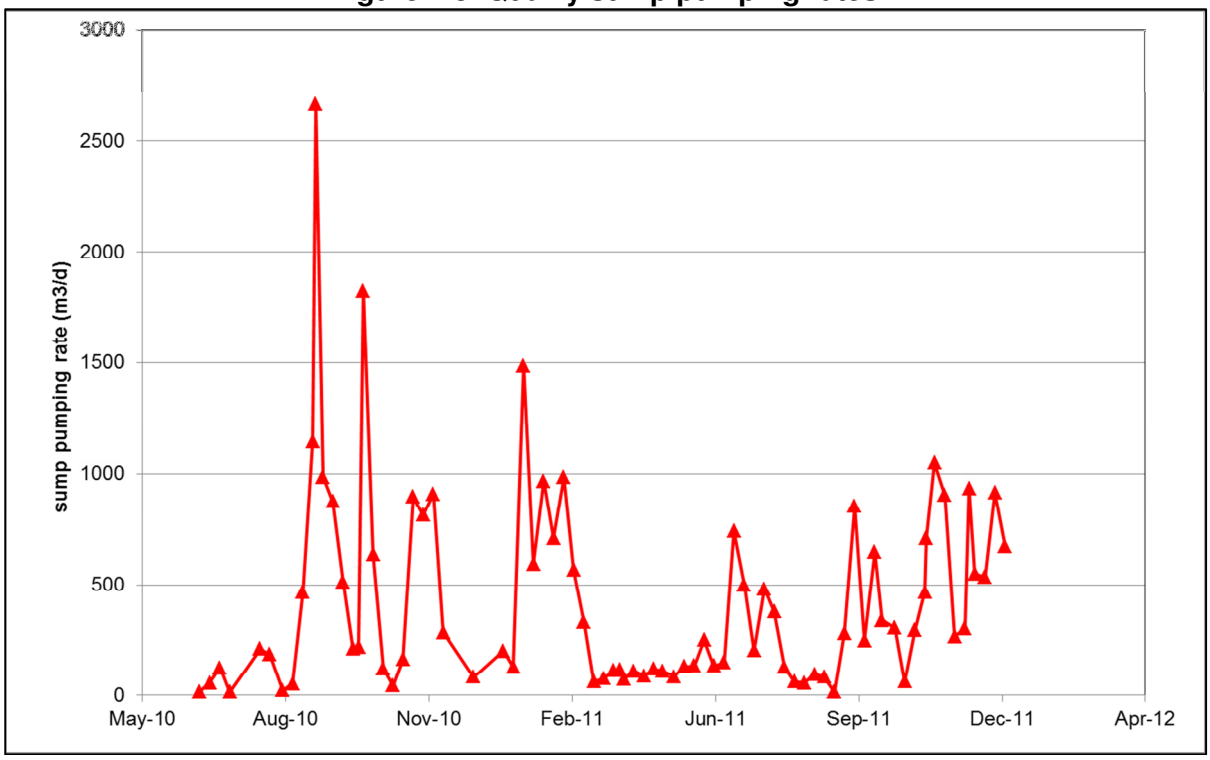
2.2 Quarry pumping

The rate of quarry pumping from the sump is monitored at weekly intervals by means of an in-line flow meter. The pump is operated 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 December 2011 with monthly totals given in Table 2.2 and raw data given in Appendix B. A time series plot is given in Figure 2.3. The average pumping rate is 344 m^3/d over the 2010 data period and 375 m^3/d for 2011.

Table 2.2 Monthly pumping totals

Date	Pumped volume (m^3)	
	2010	2011
Jan		19,680
Feb		22,590
Mar		4,540
Apr		3,140
May	430	4,300
Jun	1,460	10,670
Jul	5,830	8,760
Aug	17,180	1,750
Sep	17,000	15,900
Oct	12,220	9,240
Nov	20,330	19,400
Dec	1,750	17,040

Figure 2.3 Quarry sump pumping rates



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 32 results to 21 December given in Table 2.3. Suspended solids have 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	16.3	Suspended solids calculated based on correlation with turbidity reading
06-Sep-10	Wet	5.24	13.9	
23-Sep-10	Heavy rain	41.80	29.3	
06-Oct-10	Dry following overnight rain	103.50	55.3	
03-Nov-10	Overcast & drizzle	271.00	125.8	
18-Nov-10	Wet & misty	206.66	98.7	
06-Jan-11	Overcast	75.10	43.3	
20-Jan-11	Dry	38.70	28.0	
25-Jan-11	Wet	19.52	19.9	
03-Feb-11	Dry & bright	208.00	99.3	lab analysis of suspended solids
10-Feb-11	Wet & misty	36.40	27.0	
15-Feb-11	Wet & misty	159.00	67.0	
04-Mar-11	Clear & dry	116.00	73.0	
16-Jun-11	Showers	34.78	26.3	Suspended solids calculated based on correlation with turbidity reading
24-Jun-11	Dry to start heavy rain later	87.3	48.5	
07-Jul-11	Showers	198	95.1	
18-Jul-11	Showers	97.3	52.7	
07-Sep-11	Showers	33.67	25.9	
20-Sep-11	Heavy rain	179	87.1	
05-Oct-11	Heavy rain	23.73	21.7	
18-Oct-11	Dry & cold	189.6	91.5	
27-Oct-11	Wet	181.3	88.0	
02-Nov-11	Overcast & damp	41.26	29.1	
11-Nov-11	Heavy showers	199.8	95.8	
28-Nov-11	Overcast	178	86.7	
07-Dec-11	Dry and cold	168	82.4	
15-Dec-11	Showers	149.58	74.7	
21-Dec-11	Overcast with showers	142.68	71.8	

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 22 December 2011. In 2011, a total rainfall of 1453.5mm was recorded up to the end of the record period.

Table 2.4 Monthly rainfall data

Date	Rainfall (mm)	
	2010	**2011**
Jan		161
Feb	68	132.5
Mar	228	23
Apr	142.75	12
May	65.25	113.5
Jun	80.5	148.5
Jul	1.5	99
Aug	197.75	85
Sep	131.5	168
Oct	148.5	209.5
Nov	158	161.5
Dec	13	140*

**This is the total for 1 December 2011 to 22 December 2011*

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 22 December 2011 is presented in Appendix D.

During the 15 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 January and December 2011 has given an average discharge rate of 375 m^3/d. Total rainfall over the same period was 1453.5 mm

Welsh Water Authority (1980) suggest a mean summer flow of 65 to 75 l/s (5,616 m^3/d to 6,480 m^3/d) and a mean winter flow of 300 to 400 l/s (25,920 m^3/d to 34,560 m^3/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 total rainfall of 1453.5mm for 2011, this would give a quarry capture volume of 796 m^3/d. This is about two 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 375 m^3/d is equivalent to a capture zone area of 9.4 hectares assuming a rainfall of 1453.5 mm for the 2011 period. This is less than 1% of the catchment area of the spring which is estimated to be around 10 km^2 (ESI, 2008).

4 REFERENCES

ESI Ltd. (2008). Trefil Quarry: Hydrogeological Impact Assessment. Ref 6878R1rev1.

ESI Ltd. (2009). Water Management Plan - Trefil Quarry Deepening. Ref 6878TN1.

ESI Ltd. (2011). Trefil Quarry Annual Monitoring Report – 2010. Ref 6878R2.

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

APPENDICES

APPENDIX A

Groundwater level data

APPENDIX B

Quarry pumping data

APPENDIX C

Rainfall data

APPENDIX D

Site drainage system inspection records