Trefil Quarry Annual Monitoring Report - 2020

08 March 2022

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Trefil Quarry Annual Monitoring Report - 2020

Prepared for

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Final Report

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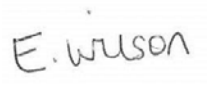
	Name	Signature
Author	Elizabeth Wilson	
Checked by	Robert Gordon	
Reviewed by	Robert Gordon	

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Issue	Date	Status	Comment	Author	Checker	Reviewer
1	01/02/2022	Draft	Draft for client feedback	EMW	RAG	RAG
2	08/03/2022	Final		EMW	RAG	RAG

Contents

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

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

- Monitoring
- Mitigation measures
- 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.

Previous annual monitoring reports have been produced by ESI Ltd (now Stantec UK Ltd) for the years 2010 to 2019. This annual report presents the monitoring data collected between January 2020 and December 2020 as well as an annual water balance. The annual report should be read in conjunction with the HIA (Stantec, 2008) which provides a description of the prevailing hydrogeological conceptual model.

The 2020 monitoring data is available in electronic format upon request.

1.2 The quarry development

Gryphonn Quarries Ltd is permitted to work to approximately 412 mAOD (the base of the Dowlais (Carboniferous) Limestone), with the lowest point in the quarry base currently at c. 413 mAOD. Prior to the current permission, the consented level was 439 mAOD. The most recent quarry topographic survey (taken August 2020) is included in Appendix A.

Dewatering is required to facilitate the dry excavation of the mineral. Maximum dewatering depths of 27 m will be required when the quarry is at its permitted depth. The estimated rate of dewatering required to facilitate dry working is discussed in Stantec (2008).

1.3 Potential receptors

The main receptors identified in the HIA (Stantec, 2008) are:

- Shon Sheffrey spring
- The Nant Trefil

- Groundwater in the Carboniferous Limestone

The location of the Site, Shon Sheffrey spring and Nant Trefil are shown on Figure 1.1.

The HIA (Stantec, 2008) concluded that proposed dewatering activities will not have any significant impact on flows in the Nant Trefil or at the Shon Sheffrey spring due to the recirculation of water discharged to the Nant Trefil.

The development poses risks from two main hazards with respect to groundwater and surface water quality:

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

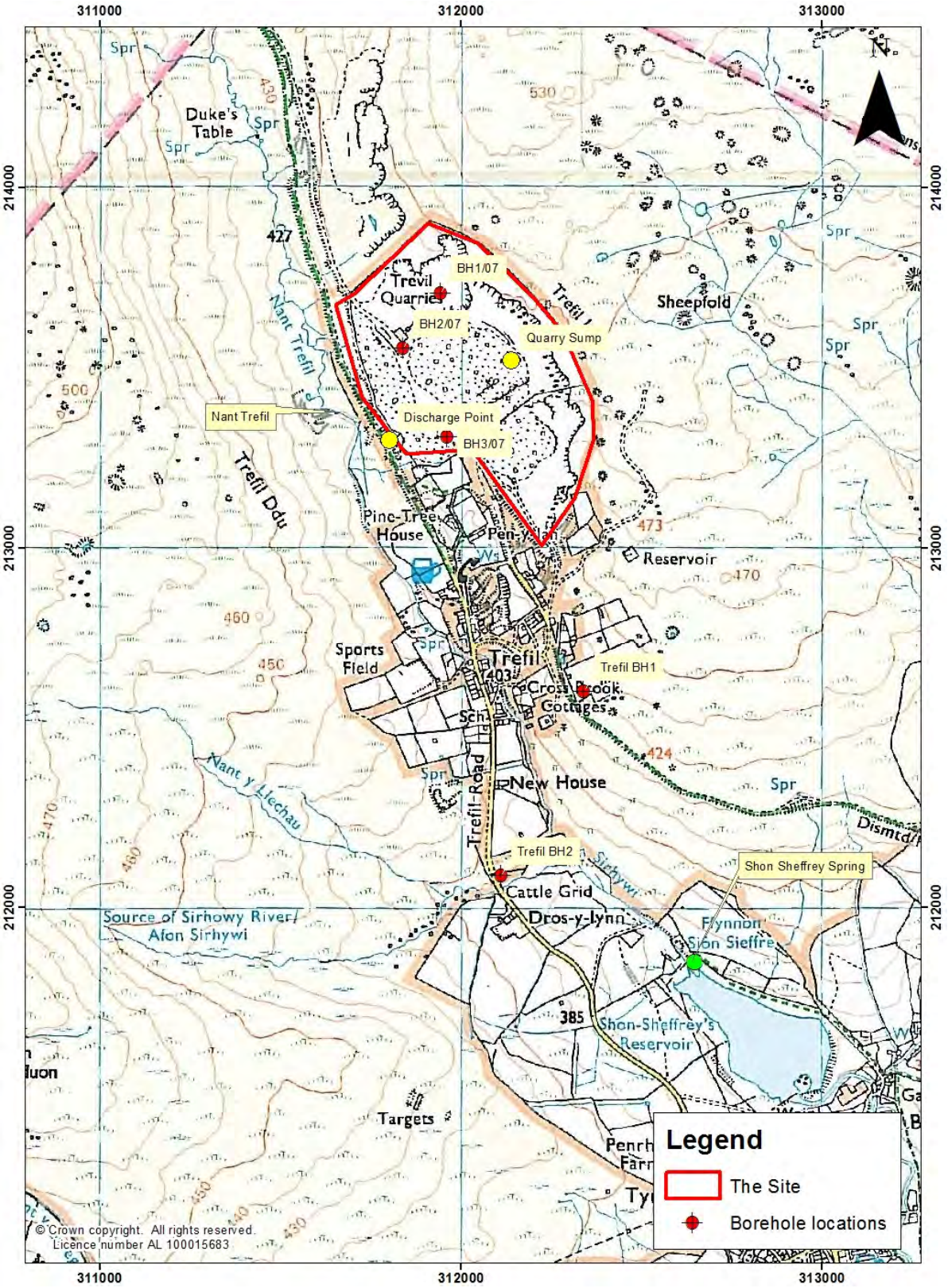
1.4 Monitoring regime

In order to quantify the level of impact at key receptors and to ensure that the hydrogeological system is continuing to behave as predicted on the basis of the current conceptual model, a monitoring system has been implemented. The following monitoring regime is in place:

- Groundwater levels in the three on-site boreholes (BH1/07, BH2/07 and BH3/07) are measured at weekly intervals (see Figure 1.1).
- Groundwater levels in Trefil BH1 and Trefil BH2 are monitored at monthly intervals (see Figure 1.1).
- The rate of pumping from the quarry 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 an on-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 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 location plan



Report Reference: 330201714R1

Report Status: Final Report

2 Monitoring Data

2.1 Rainfall

Daily readings of rainfall have been recorded from a rain gauge at the site since 1st February 2010. Data for the Trefil gauge is shown in Table 2.1 and presented in Figure 2.1. In 2020, a total rainfall of 1,214 mm was recorded at Trefil quarry. June and October saw above average rainfall whilst September was drier than average. Months with high recorded rainfall often correspond with months showing elevated recorded pumping data – as shown in Section 2.3.

It is noted that there have been exceptional issues during 2020 which mean that the annual rainfall total is likely to be an underestimate. Due to COVID-19 no rainfall data was collected between 25th March and 11th June; hence these data are missing from the monthly and annual totals shown. Rainfall data was also recorded as missing on a number of days between January and March (this was before a new gauge was fitted). It is known from site records that a number of high rainfall events occurred on some of these days so this rainfall will also be missing from the totals.

Furthermore, it known that the recorded annual rainfall total at the site is an underestimate given the nature of the gauge which means that any rainfall depth in exceedance of 50 mm is not recorded; it is noted that rainfall events of this magnitude are, however, rare.

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 (Stantec, 2008). Average long-term rainfall data over that period was 1,625 mm/a.

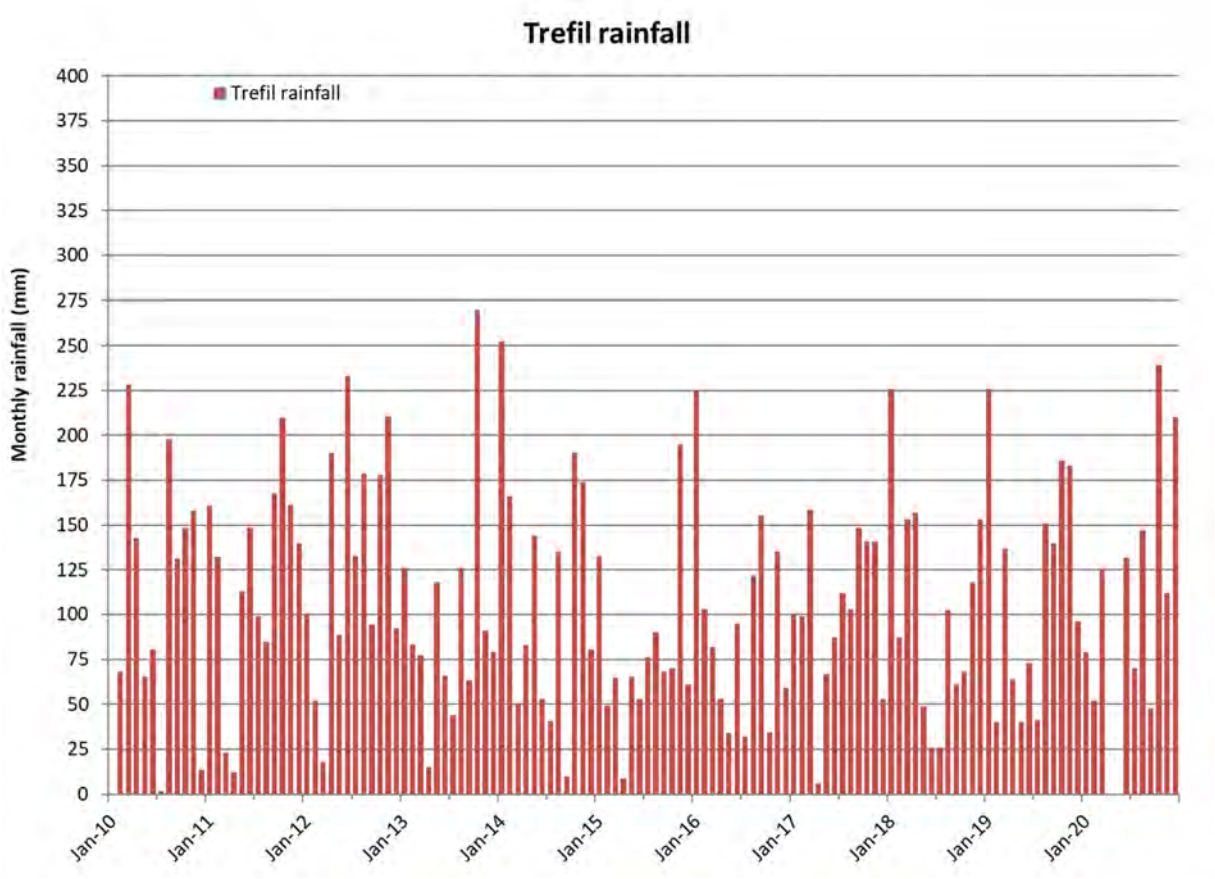
Table 2.1 Monthly rainfall data at Trefil quarry

	Rainfall (mm)									
Month	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Jan	161	100	126	253	133	225	100	226	33	79[f]
Feb	133	52	84	166	49	103	99	87	40	52[f]
Mar	23	18	77	50	65	82	159	153	137	125[f]
Apr	12	190	15	83	9	53	6	157	64	-[g]
May	114	89	118	144	65.5	34	67	48.5	40	-[g]
Jun	149	233	66	53	53	95	87	26	73	132
Jul	99	133	44	41	76.5	32	112	26	41	70
Aug	85	179	126	135	90	122	103	102.5	151	147
Sep	168	95	64	10	68	156	148.5	61	140	48
Oct	210	178	270	190	70	35	141	68	186	239

	Rainfall (mm)									
Month	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Nov	162	211	91	174	195	135	141	118	183	112
Dec	140[a]	93	79[b]	81[c]	61[d]	59	53	153	96[e]	210[h]
Total	**1,456**	**1,571**	**1,160**	**1,379**	**935**	**1,130**	**1,216**	**1,226**	**1,184**	**1,214**

[a] *This is the total for 1 December 2011 to 22 December 2011.*
[b] *This is the total for 1 December 2013 to 25 December 2013.*
[c] *This is the total for 1 December 2014 to 23 December 2014.*
[d] *This is the total from 1 December 2015 to 9 December 2015.*
[e] *This is the total from 1 December 2019 to 20 December 2019*
[f] *Rain gauge missing data*
[g] *No monitoring due to COVID-19*
[h] *This is the total for 1 December 2020 to 23 December 2020.*

Figure 2.1 Monthly rainfall – site data



2.2 Groundwater levels

The monitoring regime (as set out in the WMP and summarised in Section 1.4) states that weekly monitoring of on-site boreholes (BH1/07, BH2/07 and BH3/07) and monthly monitoring of off-site

boreholes (Trefil BH1 and Trefil BH2) is required. In 2020, groundwater levels were recorded at the on-site on 14 occasions and off-site boreholes on 11 occasions.

Groundwater level data for all five boreholes are summarised in Table 2.2 and shown in Figure 2.2 and Figure 2.3.

Groundwater levels in BH1/07 saw a gradual decline (with an overall fall in level of c. 4 m) between December 2014 and August 2015 which is relating to dewatering and was during which time the base of the quarry was deepened. Since this time the BH1/07 groundwater levels appear to have been stable (at around 429 - 430 mAOD). No such water level impacts have been evident in other borehole datasets suggesting that the dewatering effects at BH1/07 are fairly localised. As such, groundwater levels in BH2/07 and BH3/07 have remained relatively stable across the monitoring record[1]. It is noted that the decline in groundwater levels at BH1/07 appears to correlate with a reduction in the cumulative departure from mean (CDM) rainfall that has occurred since January 2015 (Figure 2.2), although this trend is not evident in the other groundwater data sets. The variability of groundwater levels at BH3/07 appears to have reduced over time although the minimum levels recorded have remained approximately the same throughout the monitoring record. However, 2020 recorded a larger variation due to a slight increase in levels in October and November.

Data collected at the off-site boreholes (see Figure 2.3) shows no evident long-term trends since data collection began. However, since 2018, peaks in readings during the winter (by around 4 m compared to summer levels) have become more apparent in both boreholes therefore showing slight seasonal variation.

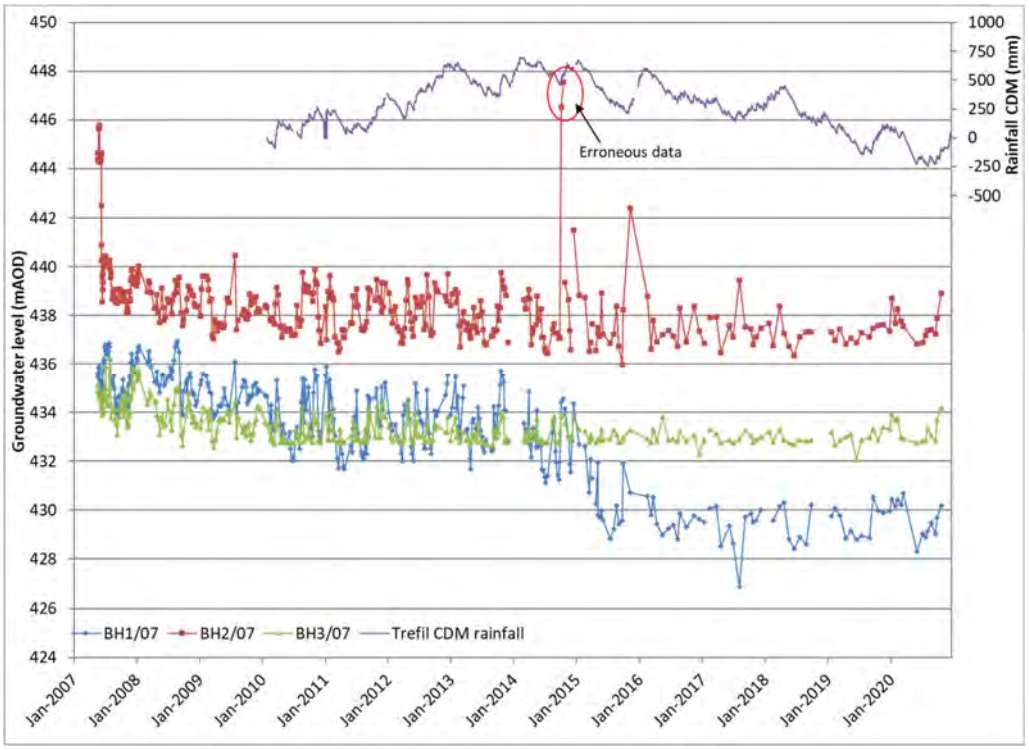
Table 2.2 Groundwater level statistics

Borehole Name	Frequency	Datum (mAOD)	Data period	Statistics (mAOD)			Range (m)
				Min	Arithmetic Mean	Max	
BH1/07	Weekly	442.691	Full record (2007-2020)	426.90	433.48	436.95	10.05
			2020	428.32	429.68	430.68	2.36
BH2/07	Weekly	452.753	Full record (2007-2020)	435.99	438.48	447.57	11.58
			2020	436.83	437.65	438.91	2.08
BH3/07	Weekly	453.499	Full record (2007-2020)	432.08	433.50	436.31	4.23

[1] The only exception are selected groundwater level data obtained for BH2 in October 2014 which are likely to be erroneous.

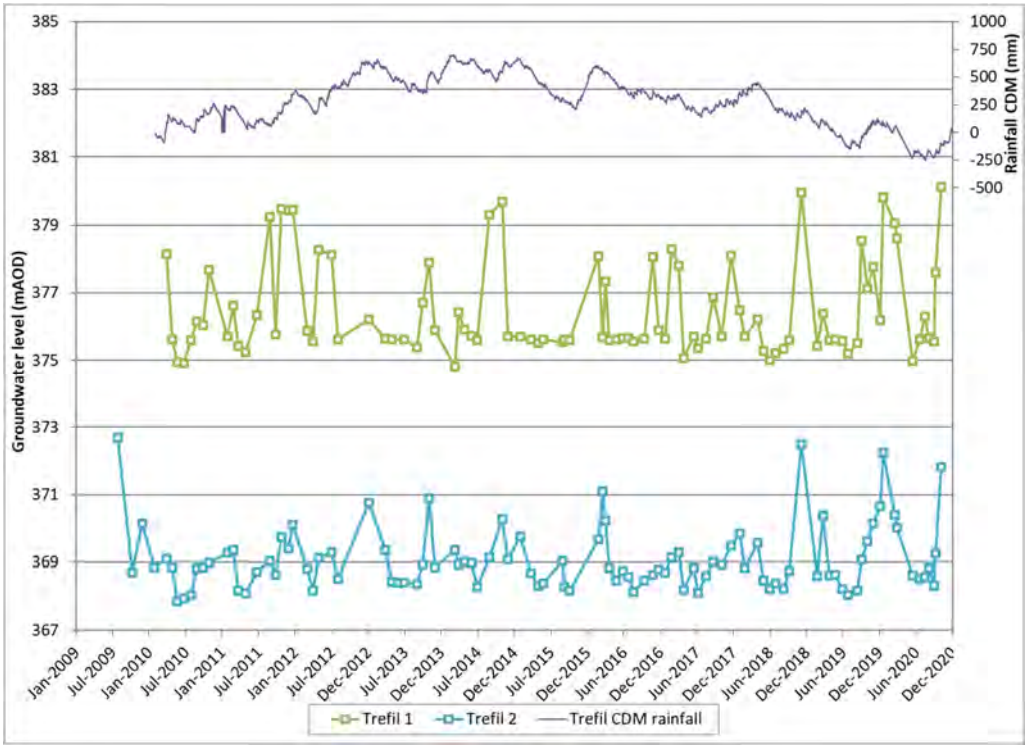
Borehole Name	Frequency	Datum (mAOD)	Data period	Statistics (mAOD)			Range (m)
				Min	Arithmetic Mean	Max	
			2020	432.74	433.30	434.19	1.45
Trefil BH1	Monthly	427.06	Full record (2007-2020)	374.81	376.46	380.11	5.30
			2020	374.99	377.23	380.11	5.12
Trefil BH2	Monthly	393.31	Full record (2007-2020)	367.86	369.09	372.70	4.84
			2020	368.33	369.75	372.24	3.91

Figure 2.2 Groundwater level hydrographs (on-site)



Note: Measurement for BH3/07 on 11/03/2020 was manually adjusted from 423.74 to 432.74 m AOD due to suspected transcription error

Figure 2.3 Groundwater level hydrographs (off-site)



2.3 Quarry pumping

The rate of pumping water from the quarry sump is recorded at weekly intervals by means of an in-line flow meter. The pump is operated when water levels in the base of the quarry are required to be lowered to carry out mineral extraction. Pumping records are available between 31 May 2010 and 31 December 2020, with monthly totals given in Table 2.3. A time series plot is shown in Figure 2.4 (note that for 2020 only weekly pumping totals are available). Broadly speaking, pumping volumes during 2020 were higher than those previously observed, particularly during March and July and October, which may be expected given the slightly higher rainfall rate in 2020.

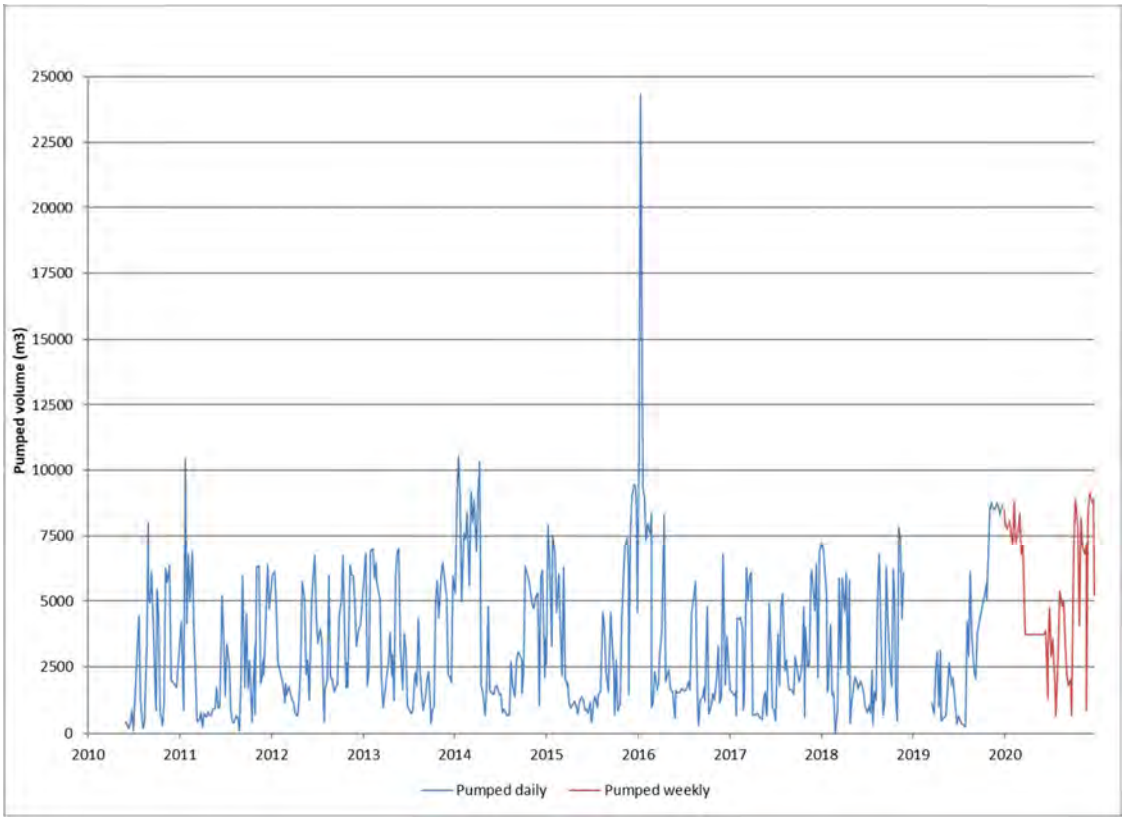
Table 2.3 Monthly pumping totals

Date	Pumped volume (m^3)									
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Jan	19,680	19,610	23,860	38,580	27,970	57,810	6,910	27,010	[1]	40,060
Feb	22,590	6,860	25,020	23,360	22,210	32,210	17,830	9,650	[1]	30,640
Mar	4,540	7,220	8,150	38,570	14,240	9,780	24,770	15,160	1,920	25,951[2]
Apr	3,140	5,340	13,820	24,160	4,420	13,970	2,890	19,030	10,040	14,924[2]
May	4,300	17,820	24,210	10,470	5,670	7,070	4,830	8,690	5,490	18,655[2]
Jun	10,670	23,320	9,690	6,560	3,750	8,140	10,770	6,400	5,640	15,840[2]
Jul	8,760	12,830	6,740	4,700	5,950	6,920	10,830	5,340	1,570	13,620
Aug	1,750	13,790	10,970	6,620	12,400	18,160	14,010	18,850	17,110	18,150
Sep	15,900	9,600	6,900	13,040	12,400	5,940	8,500	12,420	12,440	10,120
Oct	9,240	20,080	17,520	26,020	9,690	8,040	12,330	16,430	10,680	30,860
Nov	19,400	20,070	18,370	20,010	26,390	7,880	21,260	26,040	34,360	30,120
Dec	17,040	21,060	17,300	18,860	44,920	13,720	20,010	[1]	34,300	40,360
Average m^3	**11,418**	**14,800**	**15,213**	**19,246**	**15,834**	**15,803**	**12,912**	**15,002**	**13,355**	**24,108**
m^3/d	**375**	**485**	**500**	**633**	**521**	**518**	**424**	**494**	**441**	**790**

[1] = water meter failed at the end of November 2018 due to wear and hence no readings from December 2018 to 22 March 2019

[2] = Due to COVID-19 no records were kept between 22 March and 14 June 2020 so the total pumped for this period has been averaged out across this 12-week period

Figure 2.4 Quarry sump pumping time series data (daily / weekly totals)



Note: Due to COVID-19 no records were kept between 22 March and 14 June 2020 so the total pumped for this period has been averaged out across this 12-week period

2.4 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.

As part of the WMP, turbidity of the quarry discharge is required to be measured by the quarry operator at weekly intervals together with a note of the weather conditions at the time. This data is then used to calculate the equivalent suspended solids concentration where no suspended solids data are available. Turbidity monitoring has been carried out since April 2010 with 30 records collected in 2020; the 2020 data are presented in Table 2.4.

In 2020 there were no readings above the 100 mg/l threshold with the maximum derived suspended solid reading being 98.34 mg/l.

Table 2.4 Discharge turbidity and suspended solids results

Date	Weather Conditions	Sample Ref	Turbidity Reading (NTU)	Equivalent Suspended Solids Reading *(consented limit: 100 mg/l)*
09.01.20	Wet and misty	90120	176.53	88.81
14.01.20	Heavy rain	140120	187.31	93.76
16.01.20	Heavy rain	160120	197.28	98.34
23.01.20	Wet and misty	230120	191.79	95.82
05.02.20	Dry, cold and bright	50220	169.43	85.54
10.02.20	Storms with gales	100220	191.21	95.55
13.02.20	Wet	130220	185.31	92.84
18.02.20	Heavy rain	180220	173.98	87.63
24.02.20	Heavy rain with high winds	240220	192.06	95.94
11.3.20	Wet and windy	110320	139.07	71.60
18.03.20	Wet and misty	180320	153.78	78.35
19.06.20	Showers	190620	144.64	74.16
01.07.20	Raining	10720	133.275	68.93
15.07.20	Showers	150720	137.89	71.05
14.08.20	Raining	141820	127.88	66.46
21.08.20	Heavy rain	210820	159.99	81.21
28.08.20	Bright following heavy rain	280820	184.12	92.29
04.09.20	Heavy showers	4092	165.21	83.60
25.09.20	Wet and windy	250920	155.62	79.20
02.10.20	Heavy rain	21020	175.06	88.13
07.10.20	Heavy rain	71020	194.45	97.04

Date	Weather Conditions	Sample Ref	Turbidity Reading (NTU)	Equivalent Suspended Solids Reading *(consented limit: 100 mg/l)*
14.10.20	Bright and cold	141020	156.89	79.78
21.10.20	Raining	211020	148.22	75.80
28.10.20	Raining	281020	161.05	81.69
02.11.20	Heavy rain	21120	197.03	98.22
12.11.20	Wet and dull	121120	148.03	75.71
17.11.20	Heavy rain	171120	195.37	97.46
24.11.20	Dry	241120	155.78	79.27
04.12.20	Bright but very cold	41220	142.88	73.35
11.12.20	Heavy rain and misty	111220	194.33	96.98

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 on a weekly basis for the presence of voids (which might indicate the presence of fast pathways from the quarry to local receptors). No significant voids or drainage issues were identified during 2020.

During the 24 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 watercourses. 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

The average quarry pumping rate for 2020 was 790 m^3/d. The total rainfall recorded at the site in 2020 was 1,214 mm (see Section 2.1). However, it is acknowledged that these values will not be entirely representative for the year as there were periods during the year when data collection was not undertaken or records are incomplete because of COVID-19.

No potential evapotranspiration (PE) data were available for the Trefil site but having undertaken similar work for other sites in the region (Penderyn Quarry), it's estimated that the total annual PE for the site is around 595 mm (based upon the estimated regional long term average value).

The quarry catchment area is estimated to be about 20 hectares (equivalent to 2% of the Shon Sheffrey spring catchment area of around 10 km^2).

With a total annual rainfall for 2020 of 1,214 mm and an estimated annual potential evapotranspiration of 595 mm, this would result in a recharge rate of 338 m^3/d across the quarry catchment. Taking rainfall minus PE to approximate recharge may be considered a simplistic approach but is thought to be sufficient for this assessment.

The average pumping rate of c. 790 m^3/d in 2020 is much larger than the estimated recharge over the quarry catchment area suggesting that the quarry is intercepting recharge over the quarry catchment as well as drawing in groundwater from a small area outside of the assumed catchment (i.e. from a total of c. 24 ha).

The impact assessment (Stantec, 2008) concluded that 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. There is no new evidence to suggest that this has changed.

REFERENCES

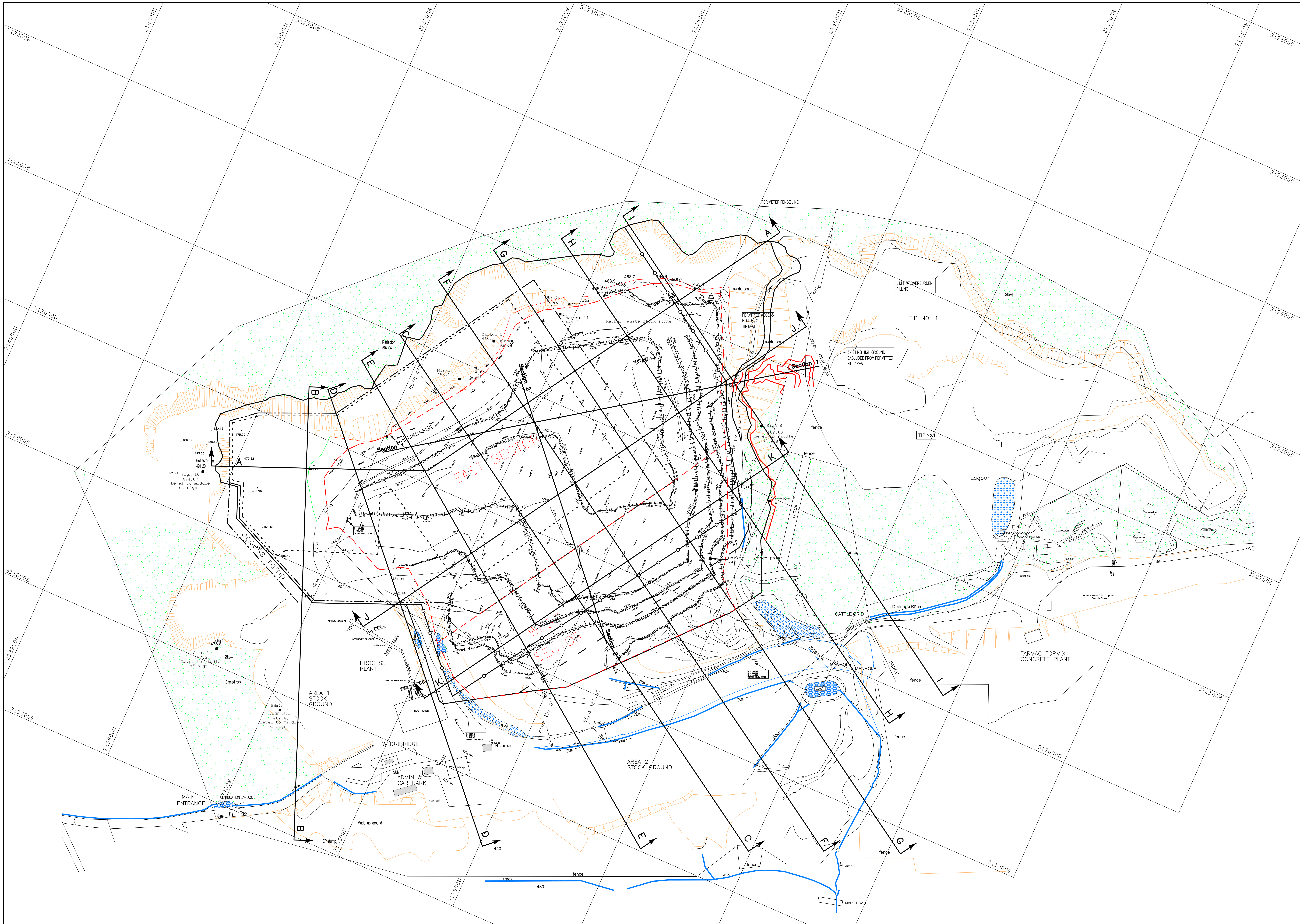
Stantec Ltd. (2008). Trefil Quarry: Hydrogeological Impact Assessment. Ref 6878R1rev1.

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

APPENDICES

Appendix A

Site survey



Reference marker coordinates
Sign 1 – 311788.030E 213688.858N 462.48
Sign 2 – 311812.544E 213754.539N 477.32

Sign 8 – 312149.108E 213428.118N 487.64
Sign 10 – 311937.256E 213821.264N 494.07
Coordinates are to the centre of the square yellow sign.

Paint mark 4 – 312086.931E 213663.457N 453.15
Paint mark 5 – 312125.322E 213650.563N 460.51
Paint mark 9 – 312096.635E 213398.298N 472.62
Paint mark 11 – 312166.360E 213610.652N 440.24
White block stone – 312170.268E 213573.164N 437.41
Orange paint mark – 312036.060E 213423.144N 442.54

KEY TO LINES

5 YEAR LINE
10 YEAR LINE
15 YEAR LINE
20 YEAR LINE
25 YEAR LINE

TREFIL QUARRY

GENERAL ARRANGEMENT & CLIFF FACE SURVEY

SCALE:	1:1000 at A0
JOB No.	5611K
Drg. No.	5611J/1000A0/1.1
DRAWN:	MJH/AC
CHECKED:	MJH/AC
APPROVED:	
DATE	Aug 2020

SHEET DIAGRAM

One Sheet Only

NOTES
1. OS grid & datum derived from GPS, April 2018
2. North arrow indicates approximate North.
3. Scale factor 1.00000
4. Refeference signs added June 2014
5. Boreholes 3 & 4 added on common April 2015.
6. Cliff faces re surveyed 26th Aug 2020
7. Ramp survey 2017
8. Converted to OS grid, April 2018

LINE TYPES

Buildings
Kerbs, Walls
Fences
Top of banks
Bottom of banks
Hedges
Overhead Wires
Surface Change

CLIENT

Gryphonn Quarries Ltd.

ABBREVIATIONS

IC – Inspection Cover
CL – Cover Level
IL – Invert Level
UTL – Unable To Lift
ø – Pipe Diameter(m)

C/B – Close Boarded
C/I – Corrugated Iron
I/R – Iron Railings
P/R – Post & Rail
P/W – Post & Wire
B/W – Barbed Wire

EL – Eaves Level
RL – Ridge Level
BL – Basement Level
SL – Step Level
FFL – Finished Floor Level
T.O.W. – Top Of Wall
AV – Air Valve
B – Bollard
BB – Belisha Beacon
BH – Bore Hole
BT – British Telecom
CATV – Cable T.V.
CB – Tel. Call Box
LB – Letter Box
LP – Lamp Post
Mkr – Utility Marker
MP – Mile Post
P – Post
RE – Rodding Eye
RS – Road Sign
SC – Stop Cock

DP – Down Pipe
DK – Drop Kerb
EP – Electricity Pole
ER – Earthing Rod
FH – Fire Hydrant
FL – Flood Light
FS – Flag Staff
G – Gulley
G 1.2 – Girth of Tree (m)
GV – Gas Valve
JB – Junction Box
KO – Kerb Outlet
SP – Sign Post
SV – Stop Valve
TH – Trial Hole
TP – Telegraph Pole
TS – Traffic Signal
VP – Vent Pipe
WM – Water Meter

CONTRACT SURVEYS (WALES) LIMITED

CONTRACT SURVEYS
LAND AND ENGINEERING SURVEYORS
SETTING OUT ENGINEERS
A QUALITY ASSURED ORGANIZATION