Pump Test Report and Assessment

Greenway Poultry,

Brecon, LD3 7YA

On behalf of

Greenway Poultry Limited

Quality Management

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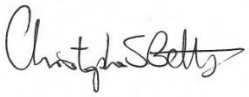
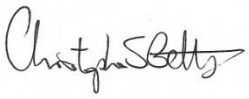
Authorised by:	Chris Betts BSC MSc FGS CGeol	
Calculations Approved by:	Chris Betts BSC MSc FGS CGeol	
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1 Introduction and Background

Hydrogeo have been commissioned by Agri Management Solutions Hereford to carry out a borehole pumping test on behalf of Greenway Poultry, Brecon, LD3 7YA.

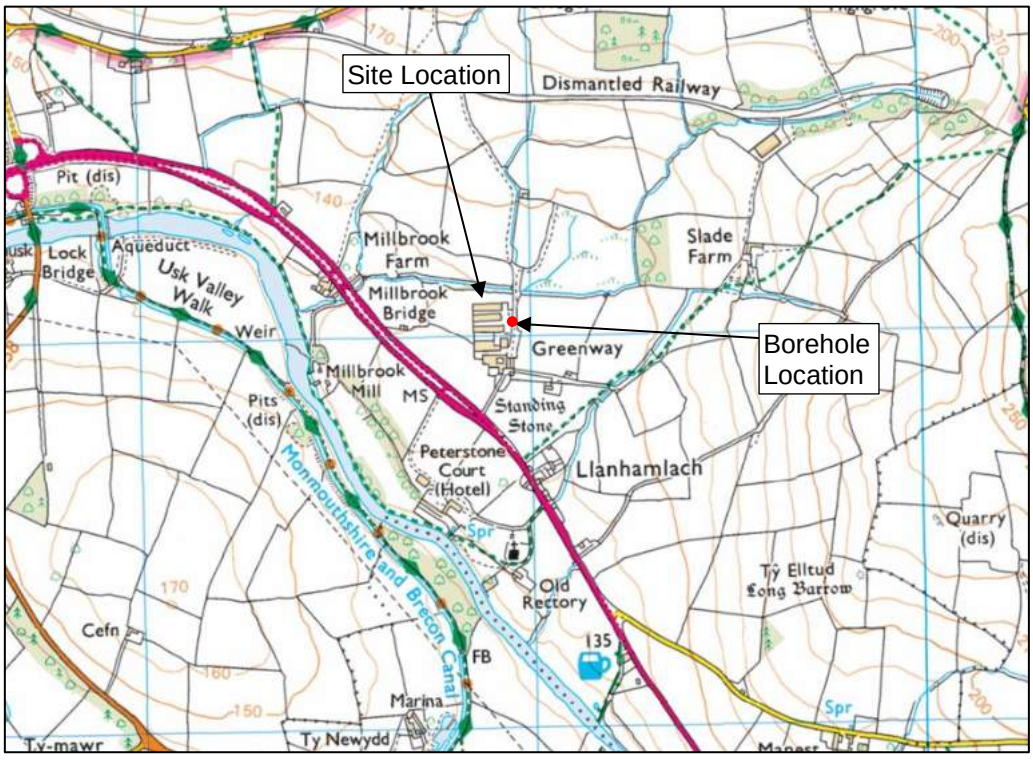
This report details the setup of the pumping test and presents the results of the testing. It also presents the analysis of the pumping test data, a groundwater conceptual model and a groundwater impact assessment which assesses the potential impact of the abstraction on nearby water features.

These works were carried out under a consent to investigate a groundwater source issued by Natural Resources Wales (ref. PPN-00320). The pumping test and groundwater impact assessment are a requirement prior to the submission of an application for a groundwater abstraction license for the abstraction borehole.

1.1 Site Location

Greenway Farm is in a rural area approximately 200m to the north-north west of the village of Llanhamiach in Powys. A site location plan is shown in Figure 1-1. The surrounding land is primarily used for arable farming although there are some meadows and wooded areas.

Figure 1-1 - Site Location Plan



Six poultry sheds are present on site. Water for the sheds is provided by an existing abstraction borehole, which is located at NGR 308952, 227051.

1.2 Topography

The abstraction borehole is located at approximately 142 meters above ordnance datum (mAOD).

Greenway Farm is located on a relatively level area of ground located to the north-east of the River Usk. The land rises to the north and east to heights of around 200 to 250mAOD. To the south and west, the land falls away to the River Usk which is located at approximately 120mAOD to 115mAOD.

1.3 Published Geology

The information on the geology of the Site is detailed across the British Geological Survey (BGS) solid and drift geological map sheet for Talgarth; Sheet 214 (2004), presented in Drawing 1.

Artificial Ground

No artificial deposits are shown to be present at the site or in the local area on BGS mapping.

Superficial Deposits

The abstraction borehole and much of the area surrounding Greenway Farm is covered by a mantle of Glacial Till. These deposits were laid down in the Devensian Glaciation and consist of a heterogeneous mixture of stiff clay with sand, gravel, cobbles and boulders.

Approximately 500m south-west of the site, adjacent to the River Usk, River Terrace deposits comprising sand and gravel are present, forming a bench on the eastern bank of the river.

On the higher ground to the north and east of the site, no superficial deposits are shown to be present.

Bedrock Geology

The bedrock geology within the local area comprises the St. Maughans Formation, which is part of the Old Red Sandstone Group. The St. Maughans Formation consists of interbedded purple, brown and green sandstones and siltstones with red mudstones and intraformational conglomerates containing calcrete clasts.

Bedrock Geology Structure

No dips indicating the inclination of the local geology are shown on BGS mapping. Geological memoirs indicate that regionally, the dip is gentle and towards the south.

The St Maughans Formation ranges from 300m to 350m in thickness in the region. Based upon the site's position in relation to the outcrop of the overlying and underlying formations, it is likely that at least 100m of the St. Maughans Formation is present beneath the site.

Several geological faults are present in the local area. A north to south trending fault is present 570m east of the abstraction borehole; the direction of throw is not indicated. Another fault is present 470m south-west of the site; this fault strikes north west to south east, closely flowing the base of the River Usk. The direction and distance of throw for these faults is not given in published sources.

1.4 Borehole Record

A borehole log is available for the site abstraction borehole. The log is appended as Appendix A.

The borehole was completed in June 1991, and was advanced to a depth of 77.1mbgl via rotary down the hole hammer. The borehole encountered:

- 0.0m to 1.8m: Soft red clay.
- 1.8m to 4.6m: Sands and gravels (water bearing).
- 4.6m to 8.5m: Soft red clay.
- 8.5m to 16.5m: Red sandstone, medium hard.
- 16.5m to 77.1m: Red marl, alternating soft and medium hard.

Water strikes are not provided on the log, but the superficial sands and gravels are marked as water bearing. It is likely that the section of the log marked as 'marl' from 16.5m to 77.1m also contained interbedded siltstone and sandstone; this is supported by the variation in hardness noted.

Full installation details are not provided on the log. It is indicated that the borehole is installed with a threaded PVC liner and well screen. It is also indicated that steel casing was used to case out the superficial deposits during borehole advancement.

A pumping test, carried out in October 1993 is detailed on the log. The borehole was subject to a constant rate test, and was pumped at a rate of 59.2m^3/day for 24 hours. The

rest water level was 0.94mbgl, and the pumped water level was 12.96mbgl. Calculated transmissivities ranging from 1m^2/day to 4m^2/day were derived from the test data. It was noted that equilibrium (static pumped water level) was not achieved following 24 hours of pumping.

1.5 Hydrogeology

Bedrock

The St. Maughans Formation is classified as a Secondary A Aquifer; these are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Sandstone units within the formation are able to store and transmit groundwater where the sandstones are open to recharge and fractured.

The presence of mudstone units interbedded with the sandstones means that the St. Maughans Formation is a multi-layered aquifer. Sandstone layers may behave as separate hydraulically isolated aquifer units.

Superficial

The superficial Glacial Till is classified as a Secondary Undifferentiated Aquifer. This designation indicates that the deposits haven previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

As a heterogeneous deposit, the Glacial Till will have a highly variable permeability. Predominantly clay layers will limit the flow and storage of groundwater, where more permeable sandy and gravelly horizons may be water bearing.

1.6 Hydrology

The NRW issued consent letter requires that the effect of the abstraction on nearby water features be considered. The site is located within 500m of the River Usk Special Area of Conservation (SAC). Consequentially, the watercourse located 60m to the north of the abstraction borehole which is a tributary of the River Usk was monitored throughout the test.

This water course issues from a disused railway tunnel located 1.25km north-east of the abstraction borehole (Drawing 3). The watercourse flows to the south-west across farmland before passing 60m to the north of the abstraction borehole. From this point the watercourse continues to flow to the west towards the Usk; the confluence is located 570m west of the abstraction borehole.

The disused tunnel, Talyllyn Tunnel, is approximately 600m in length and opened in 1816 as part of the Brecon to Hay tramway. The tramway was widened to take trains in the 1860s, and the tunnel remained operational until 1964. At the time of closure the tunnel was the oldest railway tunnel in regular use, and when constructed it was the longest tunnel in the United Kingdom.

Figure 1-2 Talyllyn Tunnel western portal

Figure 1-3 - Interior of Talyllyn Tunnel.

There are several points where other small watercourses and ditches join the monitored watercourse along its length. Field water quality measurements obtained from the watercourse indicate that it has a conductivity of around 540 µS/cm, indicating moderately mineralised water. It is likely that the watercourse is fed by both groundwater issuing from the disused railway tunnel, and surface water runoff from the local drainage network. Based upon the straightness of the watercourse as it flows from east to west to the north of the farm, it is likely that it has been modified as part of the local drainage network.

2 Pumping Test

2.1 Requisite Monitoring

In accordance with the NRW consent, water levels were monitored before, during and after the pump test in the pumped borehole. Additionally, level and flow measurements were recorded in a watercourse adjacent to the pumped borehole. The monitoring locations are shown in Drawing 2.

The abstraction borehole was monitored with an electronic pressure transducer set to record at 1 minute intervals, installed within a dip tube inserted into the borehole casing. The pressure transducer was installed at 40mbgl. The borehole data has been calibrated by a barometric logger and by manual water level dips.

The watercourse to the north of the abstraction borehole was monitored using an ISCO 2150 flow meter, an ultrasonic Doppler flow meter. The flow meter was mounted securely on a plate and installed in the base channel of the watercourse. The flow meter was set to record the watercourse level and flow at 15 minute intervals.

During the pump test abstracted groundwater was discharged through lay flat pipe to a watercourse downstream of the abstraction borehole and watercourse monitoring point. The discharge point is also shown on Drawing 2. The flow rate and volume of water abstracted from the borehole was recorded using an existing flow meter installed at the borehole headworks; this flow meter has a precision down to 0.001m^3 (1L).

2.2 Pre-Test Monitoring

On 09/09/2019 at 11:31, before the commencement of test pumping the borehole was installed with a pressure transducer inside a dip tube. The watercourse monitoring position was also installed at this time.

Prior to the test the borehole pumping rate was set to 57 m^3/day (0.66 L/s) using the installed flow meter and valve.

Water levels were recorded over the days preceding the pump test to establish a baseline groundwater level. Pumping was required for supplying poultry sheds on the farm until 14:48 on 09/09/2019. Pumping ceased at this time to allow recovery of the water level. The water level recovered to 2.63mbgl at 14:37 on 11/09/2019, at which point the pump test began.

2.3 Pumping Constant Rate Test

The Constant rate test ran from 14:48 on 11/09/2019 to 11:09 on 16/09/2019 over a period of five days.

The circuit breaker of the pump tripped at 20:06 on 12/09/2019, halting the pump overnight. The fault was discovered and corrected at 9:01 on 13/09/2019. At the time the pump tripped, the borehole had attained a drawdown of 27.36m (29.99mbgl). Following the restart of pumping, the drawdown of 27.36m was reached again at 21:40 on 13/09/2019.

The test then ran until 11:09 on 16/09/2019. At this point the water level had attained drawdown of 30.93 mbgl and had stabilised at this level. A few hours prior the water level had reached a maximum drawdown of 31.0mbgl at 04:25 on 16/09/2019.

In total the pump was running for a period of 6,206 minutes (103 hours), with a period of 775 minutes where the pump was off overnight.

Flow readings were taken at the start and end of the test using a cumulative flow meter. The meter read 5,284.406 m^3 at the beginning of the test and 5,528.616 m^3 at the end of the test; 244.210 m^3 of water was abstracted over the pumping period of 6,206 minutes, giving an average pumping rate of 56.66m^3/day.

Flow readings were also performed during the test and indicated that when pumping, the borehole was abstracting close to 57m^3/day.

2.4 Recovery Period

Following cessation of pumping, the water level in the borehole recovered from 30.90mbgl to 3.08mbgl at 11:32 on 18/09/2019, an elapsed time since pump shutoff of just over two days (2,903 minutes). A residual drawdown of 0.45m was present when the logger was withdrawn, as the water level had not fully recovered to the starting level of 2.63mbgl.

2.5 Test Summary

A summary of the test measurements is shown in Table 2-1. An excel data sheet containing all pumping test data is included as a digital Appendix to this report (Appendix B).

Table 2-1 - Summary of test measurements

Date and Time	Time elapsed since test start (minutes)	Comment	Groundwater Level (mbgl)	Drawdown (m)
11/09/2019 11:09	0	Pre-test level	2.63	0.00
12/09/2019 20:06	1,758	Pumping fault	29.99	27.36
13/09/2019 9:01	2,533	Pumping resumed	5.47	2.84
16/09/2019 04:25	6,577	Maximum recorded drawdown	33.63	31.00
16/09/2019 11:09	6,981	End of pumping	33.53	30.90
18/09/2019 11:32	9,884	End of recovery	3.08	0.45

Figure 2-1 shows the borehole water level throughout the test with annotations. Of particular interest is the increase in drawdown over time discernible just after midnight on 15/09/2019, where the hydrograph steepens.

There is a second break in the curve at around midday on 15/09/2019 where the graph levels out as drawdown over time decreases; at this point the borehole appears to have reached equilibrium.

There appear to be no changes in the drawdown or recovery curve at shallower drawdowns. This indicates that there appears to be no influence on the borehole drawdown test due to shallow groundwater containing superficial deposits being dewatered. There is therefore no indication of hydraulic continuity between the borehole and shallow groundwater in superficial deposits.

Watercourse Monitoring Point

Watercourse flow and level data from the watercourse located to the north of the borehole is presented in Figure 2-2.

Rainfall data from a rain gauge located 5.2km west of the site at approximate NGR 303746, 227640 has been collated and is presented with the watercourse level data in Figure 2-3.

When the watercourse flow meter was installed on 09/09/2019, it had been raining over the morning and the stream was at a relatively high level. The stream also responded to the rainfall event on the morning of 11/09/2019. There were no further records of rainfall over the monitoring period.

Watercourse level and borehole level data is presented in Figure 2-4, which demonstrates that there is no discernible relationship between the watercourse and pumping at the abstraction borehole. The flow and level in the stream appears to be largely dictated by rainfall.

Figure 2-1 - Hydrograph - abstraction borehole, annotated

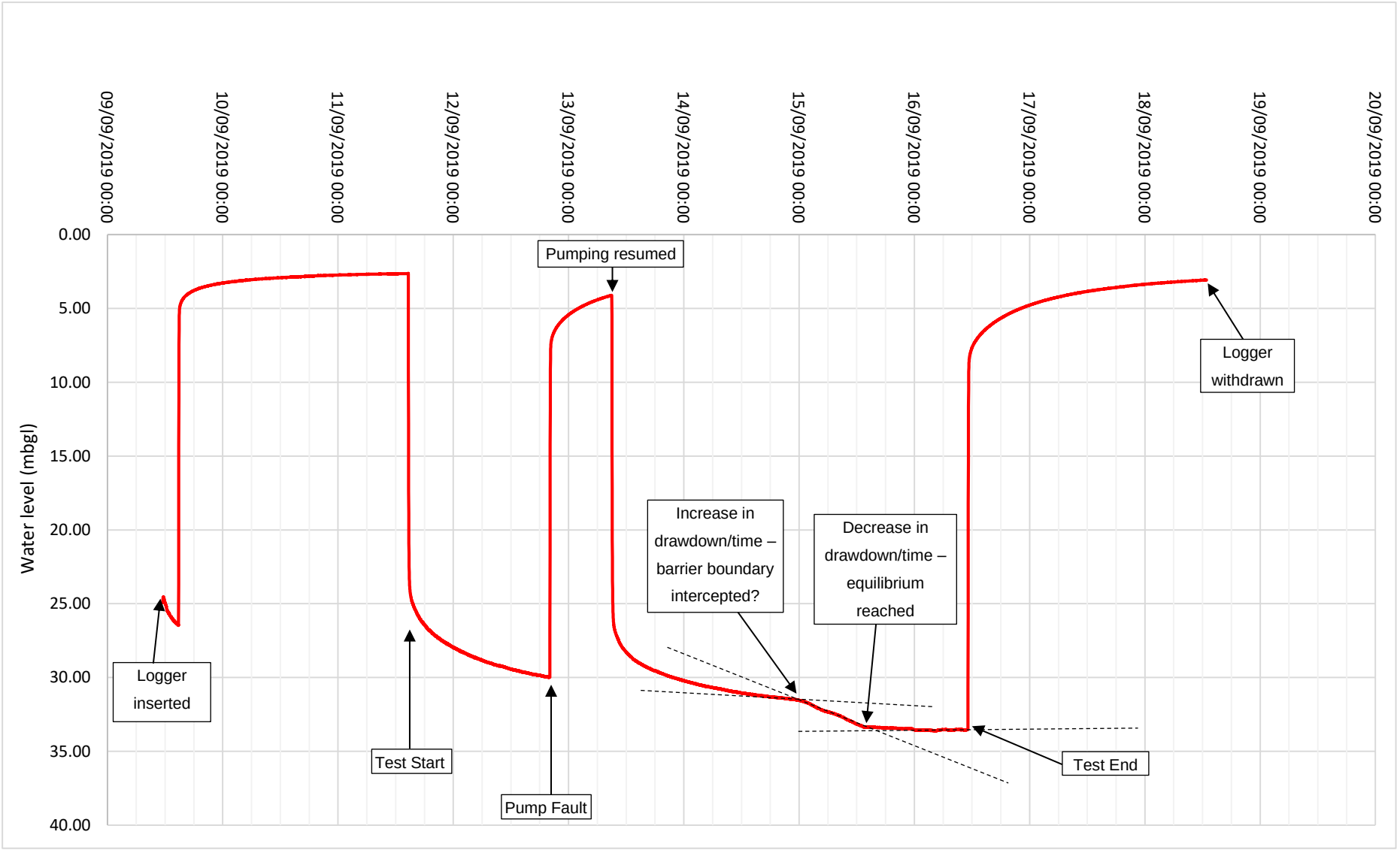


Figure 2-2 Hydrograph - watercourse level and flow

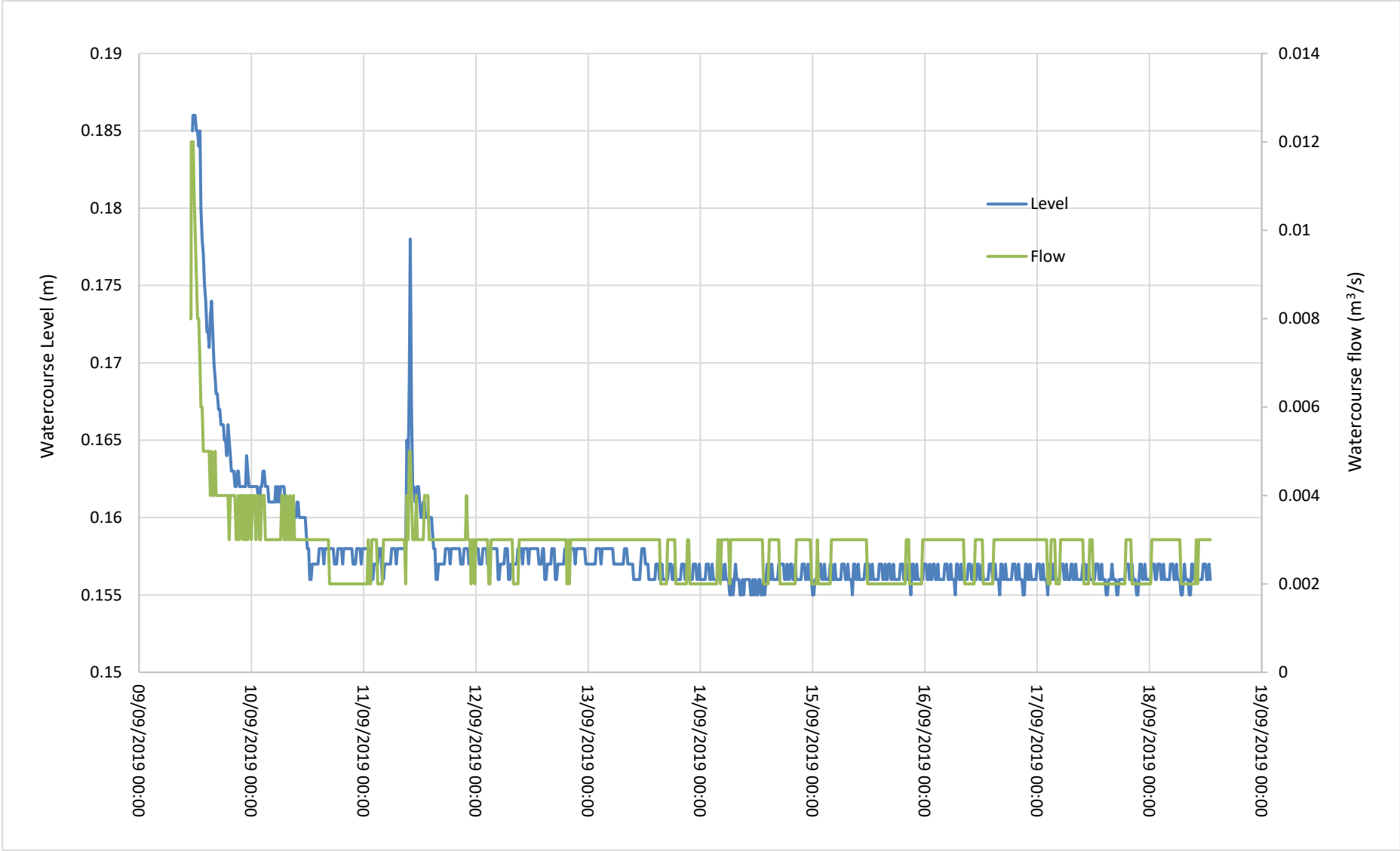


Figure 2-3 - Hydrograph - watercourse level and rainfall

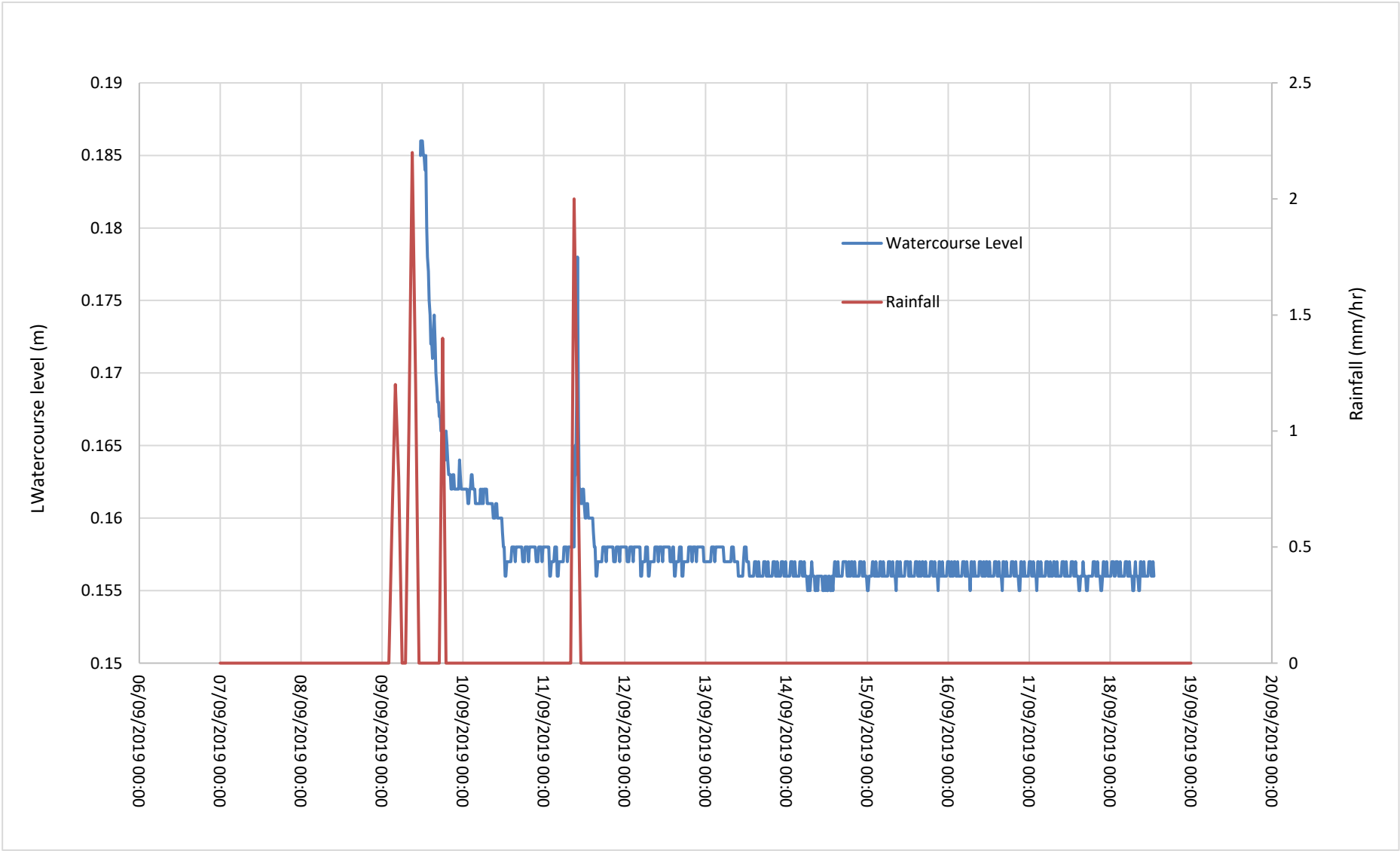
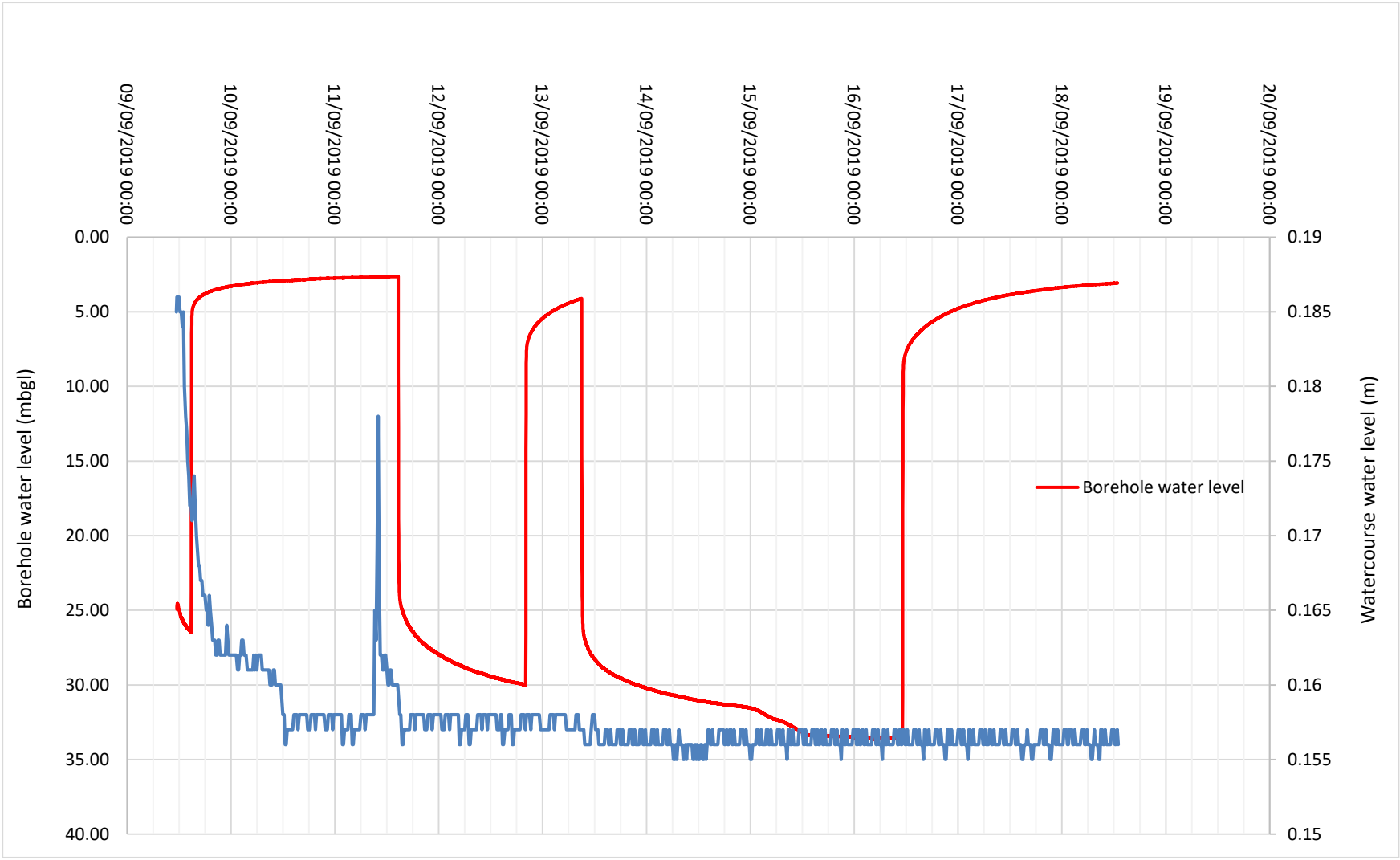


Figure 2-4 - Hydrograph - borehole and watercourse water level



3 Pumping Test Analysis

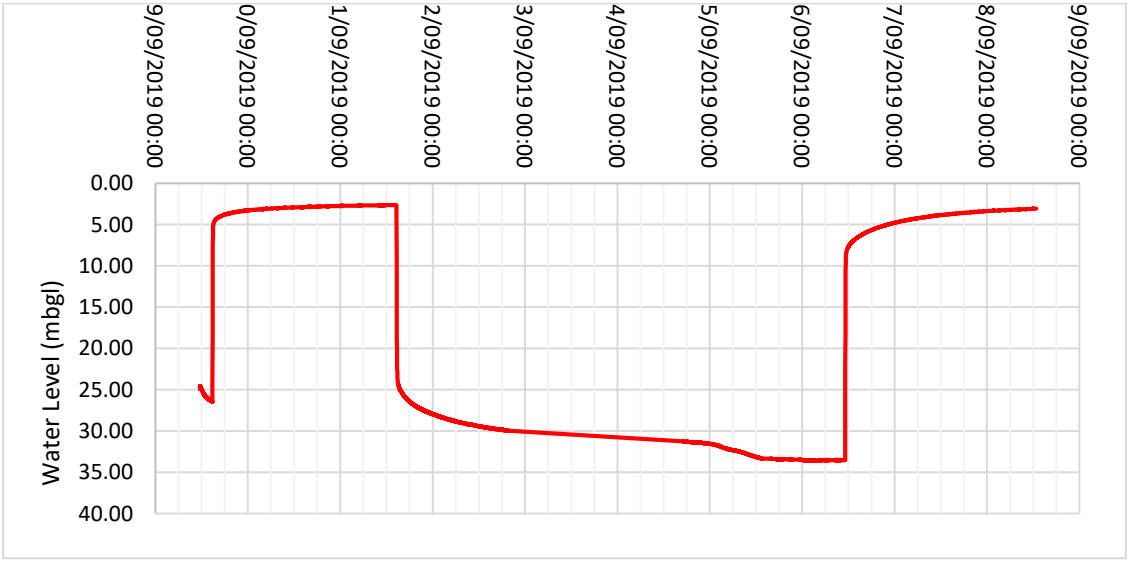
Using the data recorded during the pumping test, analysis has been undertaken to calculate the aquifer transmissivity and storage coefficient. The values have been calculated using the parameters shown in **Error! Reference source not found.**.

Table 3-1 - Parameters used for aquifer analysis

Parameter	Value
Borehole Depth	77.1m (Known)
Screened Section Length	67.1m (Assumed)
Top depth of screen	10m (Assumed)
Borehole Drilled Diameter	165mm (Known)
Borehole inner casing diameter	125mm (Assumed)
Pumping rate	56.66m^3/day (Known)

The intermittent nature of the pumping during the constant rate test complicates analysis of the data. To simplify the calculation of aquifer parameters, the period of the pumping test where the pump was off has been removed from the analysis, as shown in Figure 3-1.

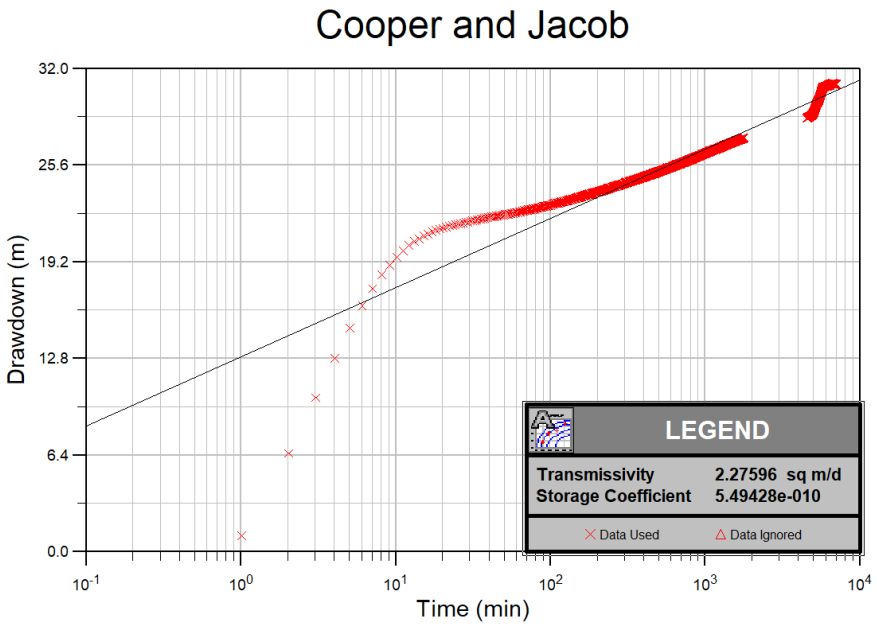
Figure 3-1 - borehole data used for aquifer analysis



Pumping phase

AquiferWin 32 was used to calculate the transmissivity and storage coefficient from the pumping phase of the test. The pumping phase was analysed using the Jacob – Cooper Straight Line Method.

Figure 3-2 - Pumping phase analysis

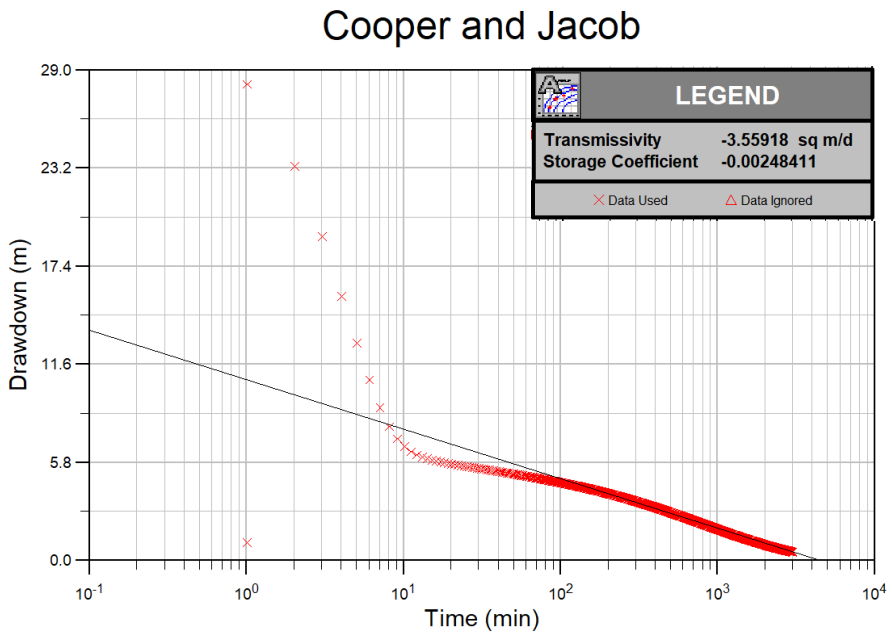


It is typically difficult to calculate accurate storage coefficient values from a single pumping well due to well losses caused by well screen inefficiencies; the storage coefficient should therefore be viewed with caution.

Recovery Phase

The recovery phase of the test was analysed in AquiferWin 32 using the Cooper Jacob recovery method, as shown in Figure 3-3.

Figure 3-3 - Recovery phase analysis



The calculated aquifer transmissivities are presented in the table below, alongside the results of the 1993 pumping test. Also included are values from 'The Physical Properties of Minor Aquifers in England and Wales' for the Devonian Old Red Sandstone Group, to allow comparison to published aquifer properties.

Table 3-2 - Comparison of aquifer properties

Source	Transmissivity (m^2/day)	Storage Coefficient
2019 Constant Rate – Cooper Jacob	2.28	-
2019 Recovery – Cooper Jacob	3.56	2.5×10^{-3}
1993 Constant Rate – Boulton, Late Data	1	-
1993 Constant Rate – Boulton, Early Data	4	-
1993 Recovery – Theis, Early Data	2	-
1993 Recovery – Theis, Late Data	1	-
Minor Aquifer Handbook	2 to 17*	1.9×10^{-4} to 5.0×10^{-2} **

* Brecon area, St. Maughans Formation, six records

**Three records, Old Red Sandstone

4 Groundwater Impact Assessment

4.1 Hydrogeological Conceptual Model

Using published geological and hydrogeological information, and the data derived from the pumping test, a hydrogeological conceptual model has been produced for the site and is presented in Drawing 3.

Field conductivity measurements made of the watercourse to the north of the abstraction borehole indicate that it is moderately mineralized. It is known that the watercourse is fed by groundwater issues from the disused Talyllyn Tunnel.

After issuing from the tunnel, the watercourse picks up other field drains and ditches as it flows towards the River Usk. For the first section of the watercourse, it flows across the bedrock of the St. Maughans Formation. It is likely that the aquifer is unconfined on the hillslopes to the north-west of the abstraction point.

As the watercourse approaches Greenway Farm, the topographic slope reduces and the watercourse flows over the superficial Glacial Till deposits. The borehole log indicates that at the abstraction borehole, the till is approximately 8m thick and comprises an upper layer of clay, a middle layer of sand and gravel, and a basal clay layer.

Clay layers within the Glacial Till and mudstone layers in the bedrock could limit hydraulic continuity of the watercourse, shallow groundwater in the superficial deposits and deeper groundwater in sandstone bands the bedrock St. Maughans Formation.

During the course of the pumping test there appeared to be no response in the watercourse to either the drawdown induced by the pumping, or the recovery following the cessation of pumping. Instead, the watercourse appears to respond only to rainfall events, rather than pumping in the vicinity of the poultry sheds.

On the basis of the conceptual model and the lack of response in the watercourse to pumping at the abstraction borehole, it is considered that the Glacial Till is preventing hydraulic continuity between shallow and deep groundwater. The pumping test indicates that the borehole is abstracting from confined water-bearing strata in the bedrock.

4.2 Conclusion

Continuous pumping from the abstraction borehole at 56.66m^3/day for nearly five days resulted in a maximum drawdown of 31.00m. Recovery from the drawdown is rapid.

Aquifer parameters derived from the pumping test data have been calculated and are in line with published literature values and values previously calculated at the site.

There appears to be no hydraulic continuity between the abstraction borehole and the adjacent watercourse, which instead is strongly influenced by rainfall.

The proposed abstraction is not expected to impact on nearby surface water features.

This groundwater impact assessment and the pumping test data will be issued to Natural Resources Wales to support the application for an abstraction licence.

Drawings

HYDROGEO
Groundwater and Environment

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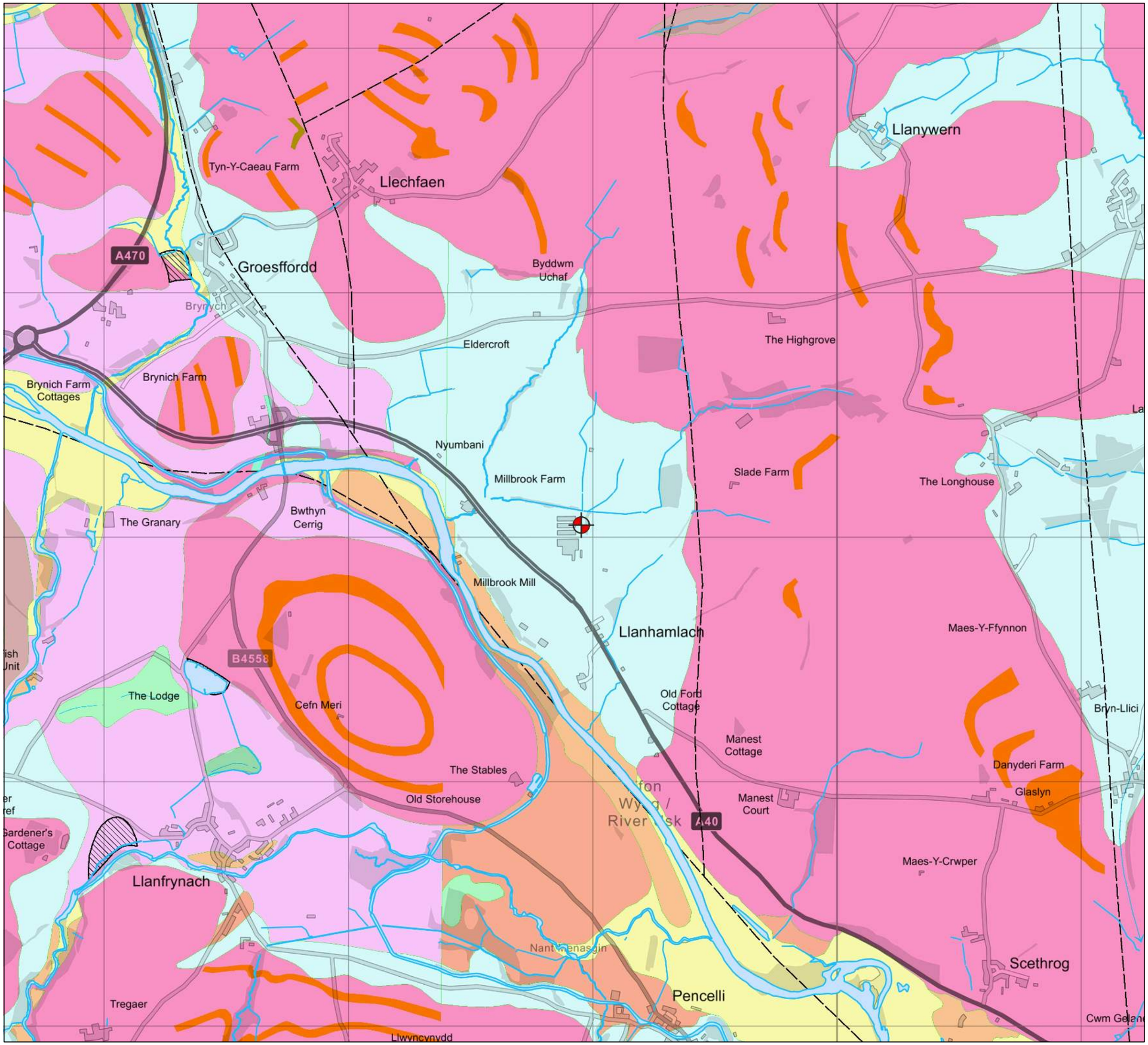
DRAWING 1
Bedrock and Superficial Geological Map



KEY

Water Features

- Abstraction Borehole
- Water Area
- Watercourse

Linear Features

- Geological Fault

Superficial Geology

- Glacial Till - stiff clay with sand, gravel and boulders
- Hummocky Glacial Deposits - sand and gravel
- Glaciofluvial Deposits - sand and gravel
- River Terrace Deposits - sand and gravel
- Alluvium - clay with sand, silt and peat

Bedrock Geology

- St. Maughans Formation - sandstone, siltstone and mudstone
- St. Maughans Formation - sandstone
- Bishops Frome Limestone Member - calcrete
- Raglan Mudstone Formation - mudstone with sandstone and calcrete

200 0 200 400 600 m

N

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Groundwater and Environment

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DRAWING 2
Plan of Pumping Test

KEY

- Abstraction Borehole
- Surface Water Monitoring Point
- Discharge Point

0 50 100 150 200 m

N

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Groundwater and Environment

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DRAWING 3
Conceptual Site Model

Increased incidence of drainage features - low permeability Glacial Till.

Discharge of groundwater from disused tunnel.

Dewatering of St. Maughans Formation by historic tunnel.

Flow of watercourse over unconfined aquifer.

Flow of watercourse over confined aquifer.

Tyn-Y-Caeau Farm
Llechfaen
Llanywern
A470
Groesffordd
Byddwm Uchaf
Brynrych
Eldercroft
The Highgrove
Brynich Farm Cottages
Brynich Farm
Nyumbani
Millbrook Farm
Slade Farm
The Longhouse
The Granary
Bwthyn Cerrig
Millbrook Mill
Llanhamlach
Maes-Y-Ffynnon
B4558
The Lodge
Cefn Meri
Bryn-Llici
Manest Cottage
The Stables
Danyderi Farm
Glaslyn
Old Storehouse
Manest Court
A40
Gardener's Cottage
Maes-Y-Crwper
Llanfrynach
Scethrog
Pencelli
Tregaer
Llwyncynydd
Cwm Gelan

KEY

Water Features

- Abstraction Borehole
- Water Area
- Watercourse

Linear Features

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- Hummocky Glacial Deposits - sand and gravel
- Glaciofluvial Deposits - sand and gravel
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Date	By	Paper	Scale	Rev
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Appendices

Appendix A

Borehole Log

Welsh L.S.
Welsh N.R.A.

WELL AND PUMP DATA

W. B. & A. D. MORGAN

Water Well Drilling,
Electrical Engineers and Pumping Specialists
The Old Vicarage, Lyonshall,
Kington, Herefordshire HR5 3LN
Telephone LYONSHALL (05448) 297/577

Property owner's name and address
MR. WILLIAMS
GREENWAY FARM
LLANHAMLACH
BRECON
POWYS.

SO 02/2

214

SO 02 NE/74

Remarks, Comments, etc.

NGDC ACCESSION NUMBER 21229

RECEIVED N.GD.C.
DATE: 29-6-95
SIG: S Roach

0900 2704

NGR SO ~~093 369~~. Licence No.

Well depth 353' 77.11m Datum point from which all measurements are taken SURFACE.

Method of Drilling
☑ Rotary hammer ☐ F.O.A. ☐ Direct rotary

Use
☐ Domestic ☐ Public supply ☐ Industrial
☐ Irrigation ☐ Commercial ☐ Monitoring
☐ Test Well ☐ Heating or cooling ☑ AGRI.

Temporary Casing
Hole Dia 8 in/cm Casing Size 8 in/cm Depth 98 ft/m
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m

Permanent Casing
☐ Steel ☑ PVC ☐ Other
☑ Threaded ☐ Welded ☐ Solvent
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m

Intake Portion of Well
Screen type VERTICAL or open hole from ____ ft/m to ____ ft/m
Manufacturer BOODE
Material PVC Dia. ____
Fittings THREADED Length ____
Set between ____ ft/m and ____ ft/m Slot ____
____ ft/m and ____ ft/m Slot ____
____ ft/m and ____ ft/m Slot ____

Filter Pack
Volume used ____ Depth to top of f.p. ____

Grout
Used? ☐ Yes ☐ No Volume used ____
☐ Neat Cement ☐ Bentonite ☐ ____
Method of installation
Depth: from ____ ft/m to ____ ft/m
from ____ ft/m to ____ ft/m

Development
Method ____ Duration ____
Dates ____ Sand content after ____ hrs. ____

Static Water Level
____ ft/m ☐ below ☐ above grade
Date measured ____

Pumping Water Level
____ ft/m ☐ below ☐ above grade Date ____
After ____ hrs. pumping at ____ gpm/lpm

Pump
Date installed ____ Type ____
Manufacturer ____ Model No. ____
H.P. ____ Volts ____ Capacity ____
Depth of pump intake setting ____ No. of stages ____
Material of drop pipe ____

Water Quality
Sample taken? ☐ Yes ☐ No
Where analyzed ____

Date started ____ completed 6 91

	Formation Log	Colour	Hardness	From	To
QUATERNARY	CLAY	RED	SOFT	0	6'
	SAND. GRAVEL (WATER BEARING).	RED	SOFT	6'	15'
	CLAYS	RED	SOFT	15'	98'
OLD RED SANDSTONE	SANDSTONE	RED	MED	98'	54'
	MARL	RED	SOFT/MED	54'	353'
				77.11m	

Water Made @ ____ ft/m

Drilling Crew PRICE, S ASHLEY Rig DANDO.

Welsh L.S.
Welsh N.R.A.

WELL AND PUMP DATA

W. B. & A. D. MORGAN

Water Well Drilling,
Electrical Engineers and Pumping Specialists
The Old Vicarage, Lyonshall,
Kington, Herefordshire HR5 3LN
Telephone LYONSHALL (05448) 297/577

Property owner's name and address
MR. WILLIAMS
GREENWAY FARM.
LLANHAMLACH
BRECON
POWYS.

SO 02/2

214 SO 02NE/74

Remarks, Comments, etc.

Well depth 253' 77.11m Datum point from which all measurements are taken SURFACE.

Method of Drilling
☑ Rotary hammer ☐ F.O.A. ☐ Direct rotary

Use
☐ Domestic ☐ Public supply ☐ Industrial
☐ Irrigation ☐ Commercial ☐ Monitoring
☐ Test Well ☐ Heating or cooling ☑ AGRI.

Temporary Casing
Hole Dia 8 in/cm Casing Size 8 in/cm Depth 28 ft/m
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m

Permanent Casing
☐ Steel ☑ PVC ☐ Other
☑ Threaded ☐ Welded ☐ Solvent
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m
Hole Dia ____ in/cm Casing Size ____ in/cm Depth ____ ft/m

Intake Portion of Well
Screen type VERTICAL or open hole from ____ ft/m to ____ ft/m
Manufacturer BOODE
Material PVC Dia. ____
Fittings THREADED. Length ____
Set between ____ ft/m and ____ ft/m Slot ____
____ ft/m and ____ ft/m Slot ____
____ ft/m and ____ ft/m Slot ____

Filter Pack
Volume used ____ Depth to top of f.p. ____

Grout
Used? ☐ Yes ☐ No Volume used ____
☐ Neat Cement ☐ Bentonite ☐ ____
Method of installation
Depth: from ____ ft/m to ____ ft/m
from ____ ft/m to ____ ft/m

Development
Method ____ Duration ____
Dates ____ Sand content after ____ hrs. ____

Static Water Level
____ ft/m ☐ below ☐ above grade
Date measured ____

Pumping Water Level
____ ft/m ☐ below ☐ above grade Date ____
After ____ hrs. pumping at ____ gpm/lpm

Pump
Date installed ____ Type ____
Manufacturer ____ Model No. ____
H.P. ____ Volts ____ Capacity ____
Depth of pump intake setting ____ No. of stages ____
Material of drop pipe ____

Water Quality
Sample taken? ☐ Yes ☐ No
Where analyzed ____

NGR SO 0900 2704 Licence No. ____

Formation Log	Colour	Hardness	From	To
CLAY	RED	SOFT	0	6'
SAND. GRAVEL (WATER BEARING).	RED	SOFT	6'	15'
CLAYS	RED	SOFT	15'	28'
SANDSTONE	RED	MED	28'	54'
MARL	RED	SOFT/ MED.	54'	253'
			77.11m	

QUATERNARY
OLDRED SANDSTONE

Water Made @ ____ ft/m

Drilling Crew G.PRICE & S.ASPEY Rig DANDO.

Date started ____ completed 6.91.

MJB/D/1900

MJB1/110

DATA ACQUISITION SHEET

NRA region: Welsh

File Number:

Pump Well Identification:

NRA id No:

BGS (WL) No: SO02/2

NGR: SO 0895 2707

Elevation: c. 145 m AOD

Measuring Point:

Site Name: Greenway Farm
Llanhamlach

Locality: Brecon

Well details:

depth of pumping well: 77.1m

diameter: 203mm to 8.53m
? 165mm to base.

casing details: Boode plastic screen installed but no details given.

☒ observation boreholes

number of obs bhs:

obs bh details:

Aquifer Details:

confined / semi-confined / unconfined

confining layer:

Borehole Stratigraphy	from	to	thick	units
Alluvium → clay/sand+gravel/clay	0	c. 8	c 8	m
(AQUIFER → (+ gravel above)) → Old Red Sandstone (ORS series) marl	c 8	c. 16 ~~27m~~	c. 8	m
	c. 16	77.1	61.1	m

Pumping Test Details:

date of test: 13 Oct 1993 (0917hr)

length of test: 24 hr

RWL: 0.94 m
(DD = 12.028m)
PWL: 12.968 m

pumping rate: 0.7 l/s (59.2 m³/d)

Additional Well Information:

- ☐ Well Loss Data: B..... C..... Efficiency.....
- ☐ Well Acidified
- ☐ Flow Logs
- ☐ Other Geophysical Logs
- ☐ Fissure Information: major inflows from.....to.....
  from.....to.....
  from.....to.....

Aquifer Parameters:

Analysis Type	Transmissivity	Storativity
Boulton Drawdown		
Early	1 m^2/day	
Late	4 m^2/day	
Theis Recovery		
Early recovery time	2 m^2/day	
Late " "	1 m^2/day	

Confidence:

excellent ☐ ☑ ☐ ☐ ☐ very poor

Notes: Equilibrium not achieved after 24 hours

? Delayed yield - ? from gravels or nearby stream?

Appendix B

Pumping Test Data (Digital)