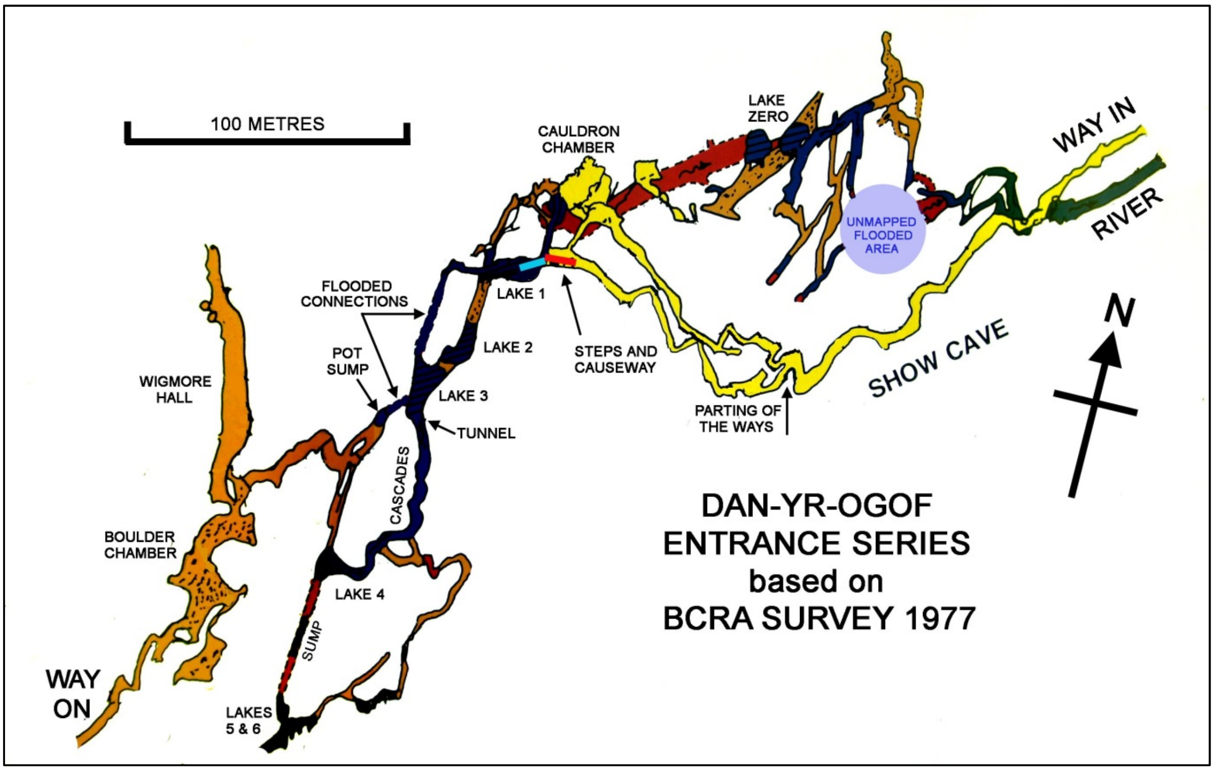
DAN-YR-OGOF CAVING TELEMETRY SERVICE

A GUIDE FOR CAVERS



SUMMARY

Referring to the BCRA survey above, the Tunnel through which cavers wade or swim just after Lake 3 has the lowest roof in the cave zone that floods seriously. When that happens, the water starts to back up the Cascades, and it rises too at the steps near Lake 1 (drawn in red above) reaching the Show Cave area too in particularly bad weather.

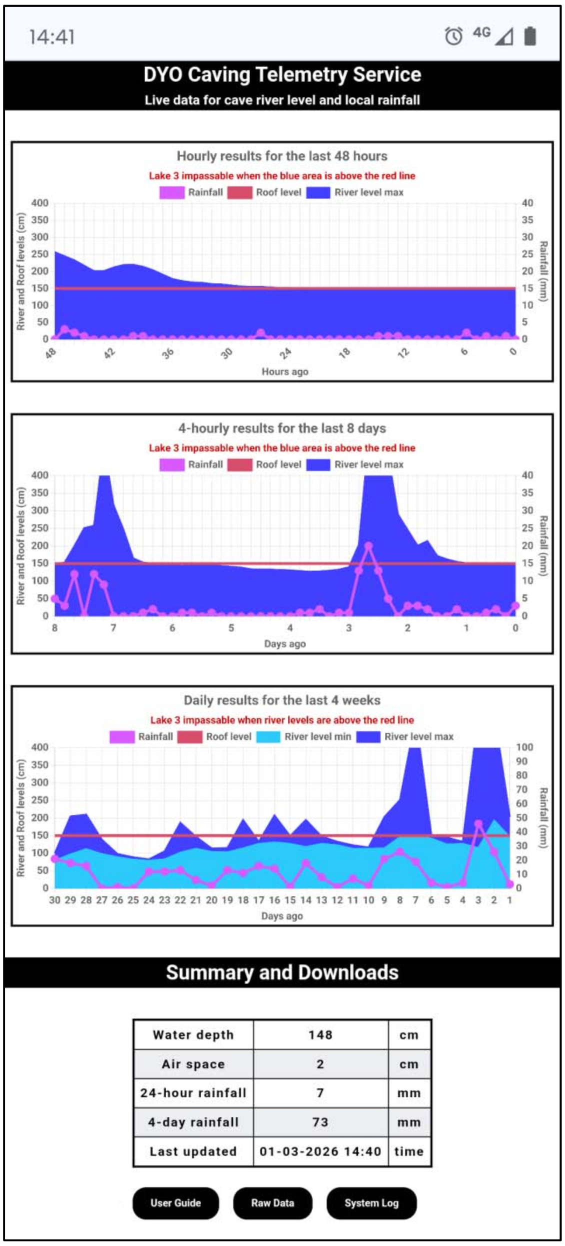
The Telemetry Service tracks the water level in Pot Sump which is connected to Lake 3 by a U-tube and so it is about the same level. The Lake 4-5-6 water can also go another way to reach the top of Pot Sump in major floods as well as down the Cascades and into Lake 3. The local rainfall is also monitored in real time and charted alongside the water depth data.

The main objective is to provide cavers with near real-time information about the current or potential flooding situation, including recent rainfall, so that an informed decision can be made about the practicality of any caving visit into the further reaches of the cave system. Adopting a conservation stance, the equipment and techniques were chosen to avoid creating any new bolts or otherwise altering the cave as a result of running this project.

This project has been privately funded and had the practical support of other cavers to bring it to fruition with encouragement from the DYO landowners. All this is kindly acknowledged. All photos and diagrams, unless credited, are by the author.

WEBPAGE

The data summary page consists of three charts and a summary table shown in the screen-shot below taken on 01/03/2026 with a smartphone. To see the chart detail more clearly the smartphone is best rotated into landscape view. The webpage is updated approximately once per hour by an app running on a Windows laptop in the show cave ticket office. The app records 15-minute readings to a log data file which is uploaded on an hourly basis.



The top chart begins '48 hours ago' at the end of a flood with the river level settling at the roof level of Lake 3. The middle chart shows 4-hour results for the past 8 days with two dramatic flood pulses, and for all practical purposes the cave has been inaccessible for over a week. The bottom chart shows the min/max river level and daily rainfall for 30 days which was plentiful on most of those days. The light blue area (minimum level daily) is trending upwards which suggests a rising water table where even small amounts of new rain will have a dramatic effect.

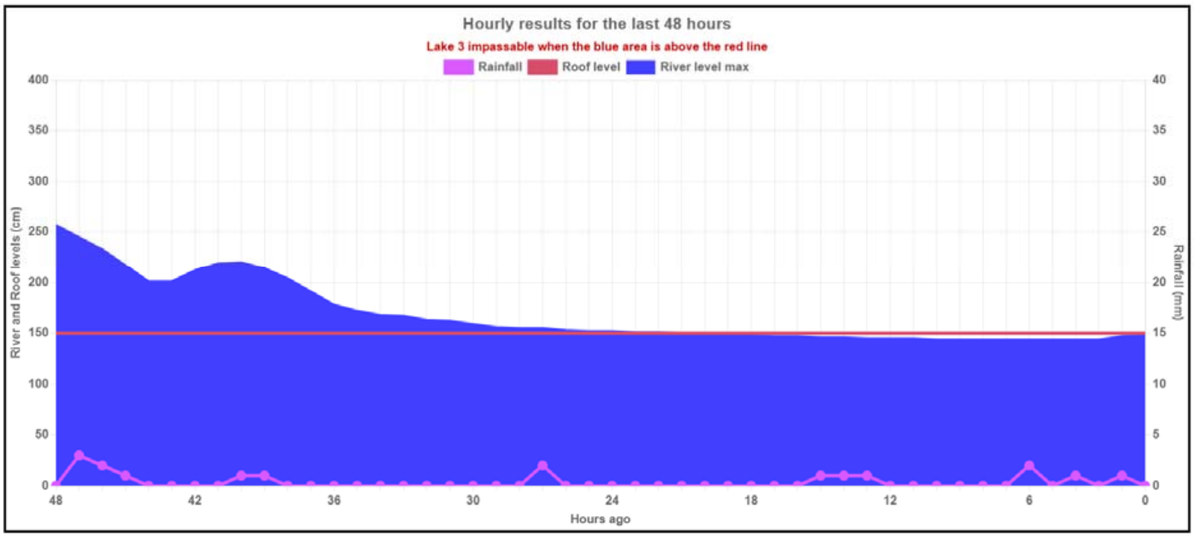
The solid red line indicates the lowest roof between the far end of Lake 3 and the Cascades, set at 150cm by the app at the time. The purple dotted line is the rainfall in mm on a secondary y-axis. The dark blue area shows maximum river depth.

The summary table shows the water depth at Pot Sump relative to where the sensor device is attached to the fixed ladder. This tracks the level of Lake 3 because they are connected together by a submerged water-filled passage which acts like U-tube. The red line is an estimate of the lowest roof point which is obviously the first place to get flooded.

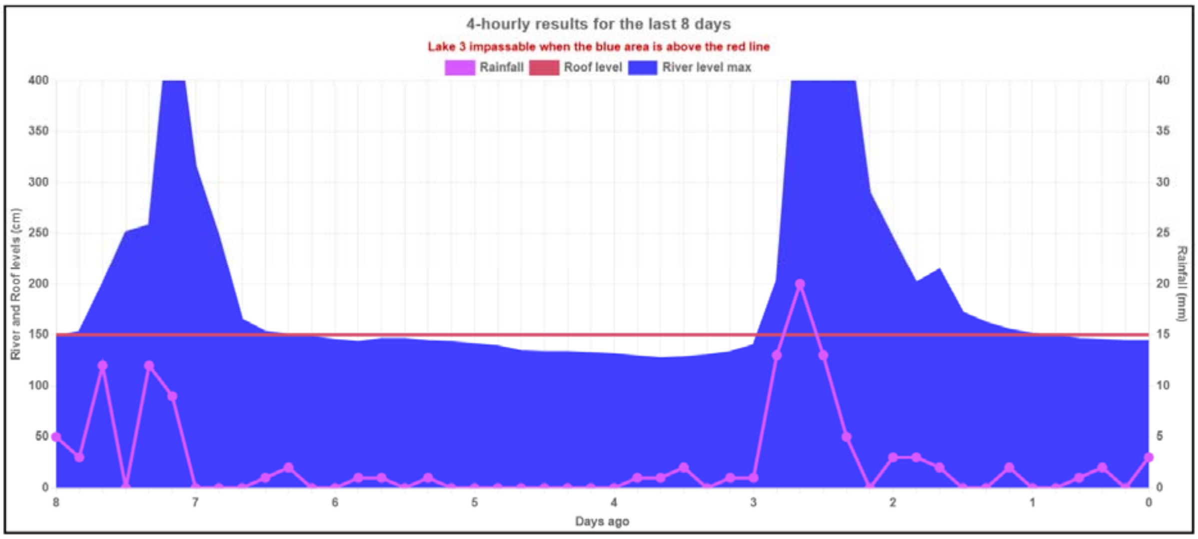
The Raw Data button downloads a CSV file with 15-minute readings for the current month. The System Log records PC app events such as Windows being rebooted and upgrades. The User Guide button downloads this document. The live results and log files are closed as each month ends and they then become downloadable by specifying the year and month in the URL as shown below. New live data and log files are then opened for the new month. For example, to download the August 2025 raw data and system log file you should visit:

https://linetop.co.uk/dyo/dyodata-2508.csv
https://linetop.co.uk/dyo/dyoevents-2508.csv

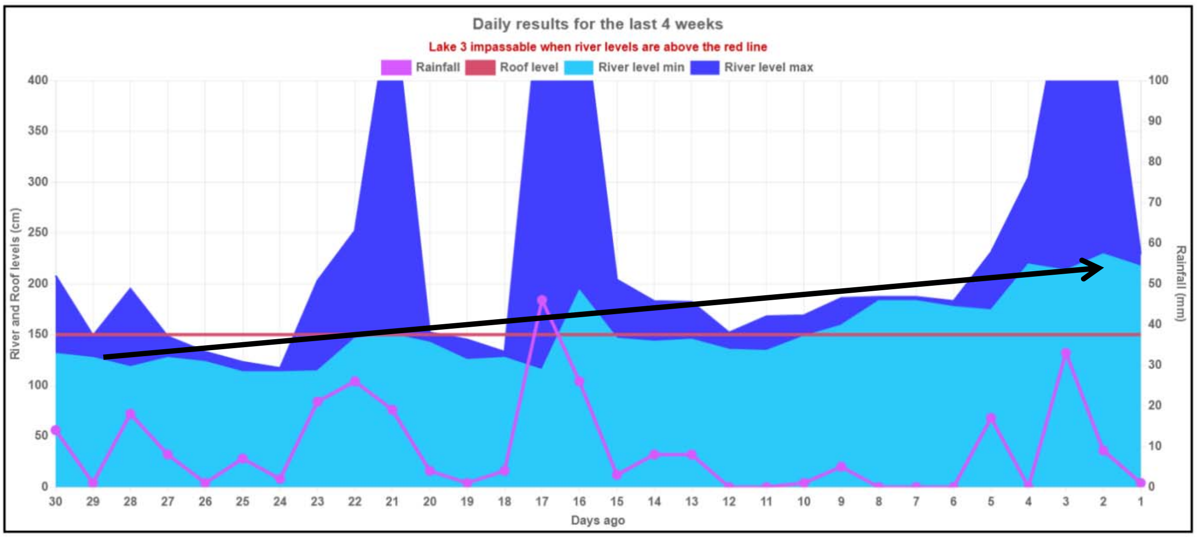
The first column in the raw data files is the timestamps. The second and third columns are water depths in cm and rainfall in mm per 15 minutes approximately. The format of the system log file is a column of timestamps and a column of event descriptions.



The chart above is the top one in the smartphone image on the previous page. It was captured with a PC browser. The water level has fallen over the course of a couple of days to a few cm below the roof level of Lake 3 then a rising trend as more rain arrives during the most recent 6 hours. There is generally a 4-hour delay after rain before it starts to rise.



Above is an expanded view of the middle chart in the smartphone image. Anyone taking 'advantage' of the tiny fall in water level, perhaps 20cm below roof level, as it was '4 days ago' could have got trapped in the cave for 2+ days by the flood that started '3 days ago'.



This chart shows the daily max/min water level and rain for the ‘last 30 days’. This is not an expanded view of the third chart in the smartphone screenshot on page 2, but the situation 14 days later (what it had developed into by 15/03/2026) going from bad to worse with another big flood. The light blue area for minimum river level has remained above roof level at Lake 3 for a week, so sumped off, and the light blue area is going steadily upwards (the added black trend line) suggesting rising ground saturation in the DYO catchment area.

A software update on 4/4/2026 added a creation date-time stamp to the titles in the three charts in response to a suggestion. The lowest roof level, shown as 150cm in the chart examples shown above, has been reset at 200cm which is less pessimistic in terms of caving opportunities but it remains to be seen how realistic that is in the light of visitor experience. Feedback from visiting groups is invited about the minimum air space at the red line actually seen by them, and ideally measured, corresponding to the red line in the photo on page 9.

The advice is that cavers should **not** attempt a crossing of Lake 3 when the water level is anywhere near to roof level; **not** when there is any rain in the weather forecast; **not** if there has been significant rain during the last 8 hours to allow time for its transit through the cave; and **not** when ground water saturation in the catchment appears to be rising.

EARLIER STUDIES

DYO water depth logging started with [France 1999] by which time micro-electronics had evolved to make doing this straightforward and affordable. Earlier work by [Coase 1977] and [Egan 19XX] installed V-notches and used other manual methods to obtain water depth readings to estimate various river flow rates. Egan’s flow figures showed that most of the resurgence water exiting DYO is percolation water rather than due to river capture which can be confirmed visually simply by comparing the outflow at the resurgence to the inputs at the two main sinks in dry weather where the latter dry up but the former always flows.

[Eason 2024] reports a 7-month study from August 2023 comparing sinking stream depths with the outfall pool depth just below the resurgence using commercial instruments. This pool is between the resurgence waterfall and a reservoir with a weir that supplies the show cave turbine. Water temperature was also logged. Their examples included only one of the 10 storms named by the Met Office within their study period. Nonetheless results were consistent with [France 2007] who had used self-designed instruments to log the resurgence water level and observe the very small water temperature fluctuations in a narrow channel that acted as a flume within the resurgence cave to enable flow rates to be calculated.

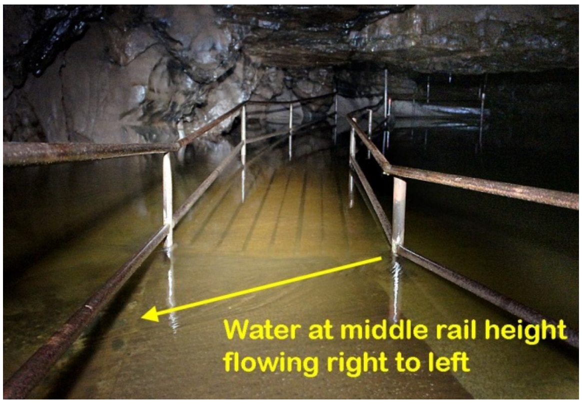
Both the above studies speculated that obtaining real-time depth data for the main underground river and putting that into the local rainfall context would be useful for informing cavers about how practical and safe any potential underground visit would be. That vision has now been realised by the new telemetry system installed by [France 2023] but it was only brought into service in August 2025 following prototyping issues arising from extreme weather events. The underground part of the system is powered by internal small alkaline batteries, expected to last one year per set, managed by the local microprocessor software. The photo left shows the current cave system being set up during the summer of 2025.

SEVERITY OF FLOODS

The 2023 version was destroyed by a severe flood rising **above** the top of the fixed ladder where the control box had been attached.   A replacement system was installed in summer 2024 with the new control box attached to a wall bolt on the rope traverse line 2m above the ladder. During the next winter another severe flood reached that too with about an inch of water getting inside the box. The minor damage was repairable and the equipment was then re-instated in July 2025 with the addition of a float switch to protect the electronics whilst a flood exceeds 5 metres depth. The control box has been moved to an even higher position at the Twin Tunnels. This box survived an even bigger flood during 8-10 December 2025 (Storm Bram) but the protective float switch 5m up the ladder became stuck which inhibited the system for 3 weeks. This switch has been freed up and is working again, and the plan is to replace it with a more resilient device when underground access is practical.

From a practical viewpoint, if the cave river is flowing anywhere near to the height of the **middle** rail of the metal fencing along the concrete causeway leading to Lake 3 (i.e. more than welly deep) then it is pointless to continue on to Lake 3. At this water level the far end of Lake 3 just below the Cascades may have reached the lowest roof point, especially if no discernible draught can be felt at the causeway.

Note also that the water crossing the causeway in bad weather is only a small fraction of the outflow from the cave. Most of the resurgence water takes other routes. So the flow at the causeway is **not** a guide to the throughput of the whole cave. The first photo below shows the causeway with moving but non-turbulent water up to its middle rail. There was no draught at that time and Lake 3 would have been flooded to the roof. The second photo shows the vast amount of river water just below the resurgence at almost the same time.



These two photos were taken half an hour apart.

As cavers know to avoid DYO in bad weather for the obvious reasons, very few have insight into the true severity of its internal floods. In a massive flood the river can rise up the causeway steps and go higher still – almost lapping at the floor of Cauldron Chamber.

HOW DOES DAN-YR-OGOF FLOOD?

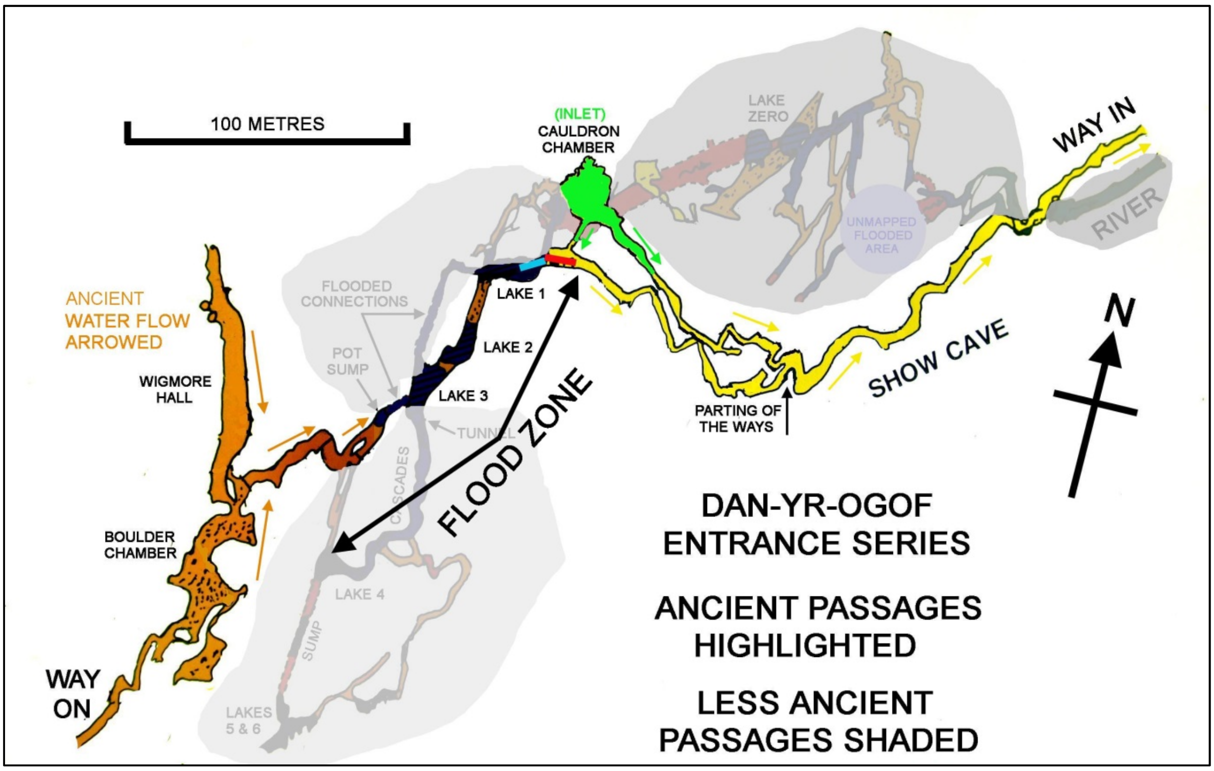
DYO is probably the biggest cave resurgence in Wales, on a completely different scale to the others. The only entrance into the cave is at the resurgence end involving some wading or swimming through deep water. These areas can flood to the roof cutting off entry to or exit from the vast area of 'wild cave' which is everything else discovered by cavers, mainly from the 1960s onwards, that tourists do not get to see on their show cave tours.

It is useful to speculate about the geological formation of the cave system to understand better how it floods today. It seems possible to the author, simply on the basis of their relative size, that the water which formed the huge passages in DYO2-3 did not necessarily come out of the tourist entrance nor via the river resurgence just below the show cave.

This begs the question of how these adjacent portals came into existence. They are at two levels: the upper dry one where tourists enter and leave, and the lower wet one where the

Afon Llynfell emerges. The active river portal would be the more recent. No river water flows in the show cave now except in quite extreme floods, perhaps once in each 20 years. Having passed the river section, cavers emerge higher up in the 1937 Series which includes the large Boulder Chamber and Wigmore Hall which now never see river water at all. These meet at a low point in between them: the ancient water collecting there would have run down into Pot Sump and thus into what is now Lake 3 and out through the present show cave. It is suggested that Lakes 5-6 and the resurgence cave did not exist then.

On that basis the ancient and original cave is as drawn on the modified survey below – apart from Cauldron Chamber (CC) which is a later but significant inlet from the many high-level passages above it that that few people ever see. The CC water would have 'gone down the steps to the balcony at the end of the show cave' route to combine with water coming across what is now Lake 3 to emerge at what is the now the tourist entrance. Some other water from CC found its own more direct route to the Parting of the Ways in the show cave.



Clearly the limestone beds on Cribarth have been uplifted and deformed quite some time after they were laid down at the same time as all the adjoining laminar limestone remaining in this area. We could speculate that some massive cave system, what some cavers believe is a "Giedd System", would have continued straight on towards Abercrave or, combined with another wacky idea of a "Twrch System", could have combined and gone West towards Ystradgynlais rather than to Pen-y-Cae. The postulated Giedd System would still exist under the present gritstone-topped hills whereas any lower Twrch System would be eroded away.

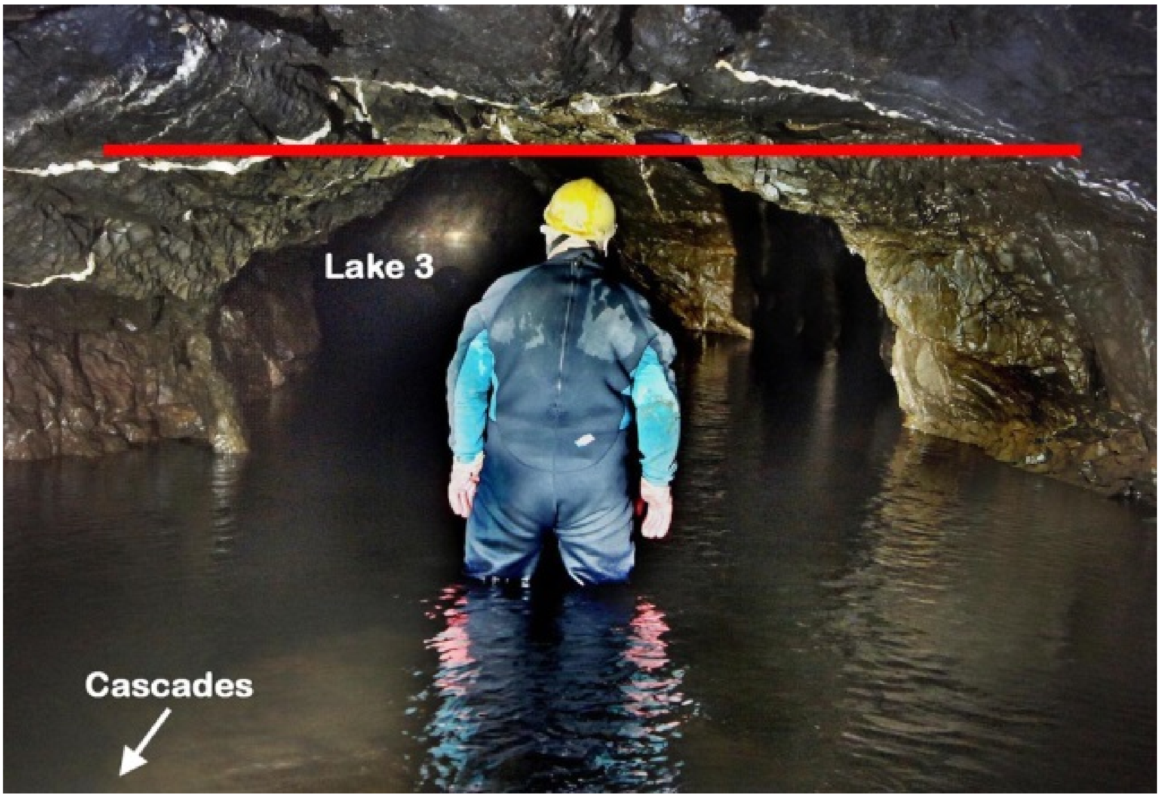
For whatever reason, the Giedd water and that in DYO2-3 was stopped by faults at Cribarth and had to go somewhere else other than straight ahead down dip. That was resolved in favour of turning East towards the upper Swansea Valley at DYO giving the complete cave survey its strange shape of a 'reversed tick' symbol. The water made its own route from almost beneath Cribarth eventually to re-appear at Lakes 5-6 and this water is now the main underground river at DYO. In extreme weather it can overflow through the bypass passage to reach Pot Sump, but in benign weather it simply trundles down the Cascades and then through the lower connecting tunnel and finally into Lakes 3-2-1-0 and out to daylight.

Lake 3 has no obvious outflow or 'plughole' for its water to leave, but submerged passages of small but diveable bore exist connecting it to Lake 1 which is turn is connected by even more concealed drainage that is a very difficult diving route, to the present resurgence. All this constricted drainage network limits the outflow rate of the lakes and so their level rises until the water pressure limits further increase in depth, like the level in a bath with no plug in the plughole and the taps full on. The modern watercourse that we see now in DYO is still under active development as cave, cutting deeper and boring out new flooded passage on a geological timescale. The inflow and outflow of Lake 3 (thus its ambient level) varies on a week-to-week and year-to-year timescale due to the amount of sediment being carried by the river during flood events and where that is deposited and whether that deposit limits flow. The ever-changing flood dynamics are insufficiently understood right now which could become a medium-term problem for the telemetry project or others to address.

WHERE IS THE CAVING PROBLEM IN ALL THIS?

Referring to the first cave survey above, cavers and tourists enter the cave at **Way In** and follow **Show Cave** (shaded yellow) to reach the fenced off concrete **steps** (red) leading down to the **causeway** raised concrete path (light blue). The steps are the turn-back point for tourists but cavers climb over the fence and head upstream over the causeway towards Lake 3. Normally the causeway is dry, but if the water here is more than welly deep then trouble may lie ahead because Lake 3 will also be high. Downstream of the causeway, Lake 1 has significant depth at all times and cavers would not normally go that way. Lake 2 is just an overflow of Lake 3 – usually a small static shallow pool surrounded by sandbanks.

The bottom of the Cascades levels off and the water deepens just before the tunnel which delivers the 'modern' river water into the 'ancient' Lake 3. The open tunnel is about 2 metres high with 20cm of water depth in drought conditions, but it also fills to the roof in floods. By that time the water will be backing up the Cascades which can also fill to the roof and the current becoming fearsome. This would prevent cavers from reaching the wild cave, or others who are already there from leaving. The photo below shows a caver about to enter the low tunnel (i.e. ahead of him and trending left) with Lake 3 in the background. This view is heading out of the cave. The position of the red line drawn on this photo is intended to correspond to the red line seen on the webpage charts that shows the lowest roof level.

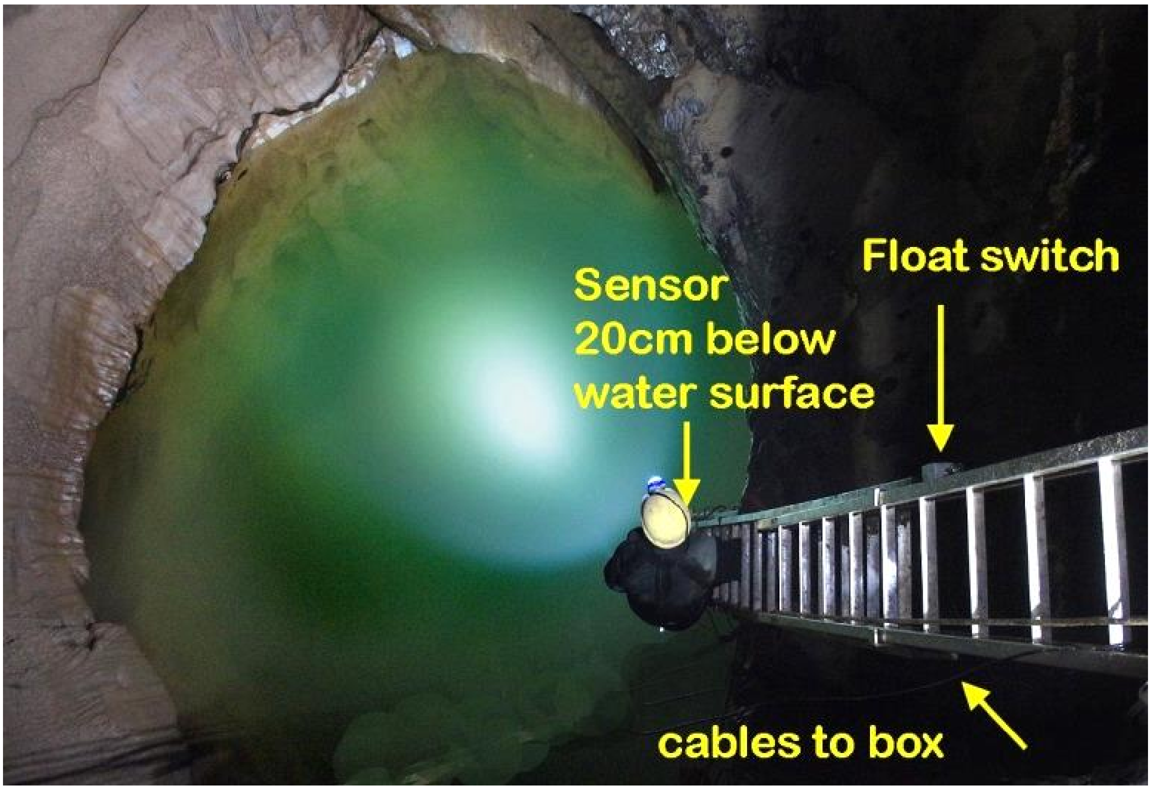


*The low tunnel connecting the Cascades to Lake 3, seen here during **drought** conditions.*

If the water rose another 2 metres here then the tunnel ahead would be flooded to the roof, and the current intimidating too, cutting off access to Lake 3 and the way out. The river can become much more serious than that, rising 10+ metres deep during extreme weather, and then sometimes being quite slow to recede.

Floods of this magnitude in the active river are of course reflected at Pot Sump which is always a sump and connected by a U-tube with Lake 3, so the water levels at both ends will be similar at all times. Pot Sump acts as a natural 'stilling well' to house the water depth gauge away from turbulence and torrents that beset the main river. Conveniently, there is also the fixed aluminium stage ladder there which is perfect for attaching the submersible depth sensor just below drought water level and providing safe access for maintaining it.

The water level at Pot Sump, seen in the photo below during a drought with the depth sensor about 15cm below the water, can rise 10+ metres during very wet weather. That means the **top** of the fixed ladder can go 3 metres under water. In the unlikely event of entrapment in the cave due to floods, the owners and cavers have equipped an emergency camp in Wigmore Hall which, along with Boulder Chamber near it, are large and relatively flat passages that never flood because they were formed in a different epoch by ancient rivers flowing on surface ground that no longer exists in the form that it was.

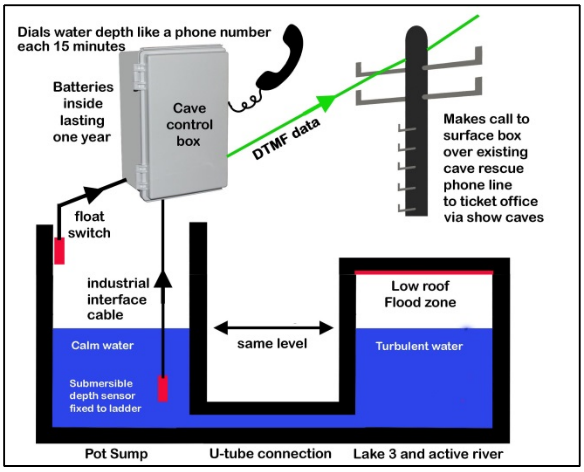


Pot Sump in drought conditions. Water rises here in severe floods to well above the top of this ladder.

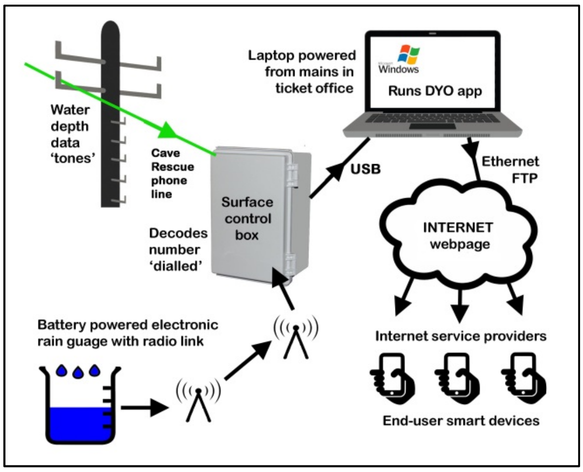
The depth sensor is fixed to one upright side of the ladder in the water just below the caver's position. A float switch on the ladder 5m above the water level seen disables the sensor system during floods which are beyond its intended operating range. Dummy 500cm readings are then generated and transmitted by the box until the water level drops back.

The Twin Tunnels that once fed combined water from Boulder Chamber and Wigmore Hall into Pot Sump.
The latest and highest telemetry equipment box is hopefully out of harm's way roped to the wall here.

THE TELEMETRY SYSTEM



Underground part



Surface part

Data is transmitted using battery power from Pot Sump to the Ticket Office via an existing single-wire permanent cable installed for a cave rescue phone link during incidents in the cave. The depth reading is encoded as DTMF tones, as heard on touch-tone telephones. So in effect Pot Sump dials out the current water depth like dialling a phone number, and the laptop PC in the ticket office works like a telephone exchange to process the dialled digits.

The ticket office PC app combines 15-minute depth readings with live local rainfall data and tracks the maximum depth and total rainfall on a 1-hour, 4-hour and daily basis. It is those derived views on the raw data that are presented to cavers in the three charts and tabular summary box seen on the public webpage. Our data logger project two decades prior to the telemetry system discovered that DYO floods gradually on a timescale of 4-8 hours, sometimes in two stages with the second stage having greater effect. This is quite different to the flash flooding which characterizes the Ogof Ffynnon Ddu streamway over the valley.

In simple terms, the contrast between their underground hydrodynamics is due to the OFD streamway being more like one storm drain while DYO is more like a gigantic sponge that channels water towards the river resurgence. The 'sponge' has great capacity to absorb rain and percolation water but when it reaches a critical degree of saturation then it can absorb no more and the stored water (plus any more still going in on top) runs out from it for a long time thereafter. Thus the river level near Lake 3 is not governed by the same maths as applies either to the nearby surface rivers or to the OFD streamway.

FUTURE PLANS

It remains to be seen how useful access to near live data actually is in terms of informing cavers about the safety of any intended visit. The data will also be useful for cave science.

As already suggested, DYO cannot be considered to be like a simple river running in an open channel that obeys the normal river maths – the relation between flow rate and depth along with the characteristic shape of flood pulses. The critical zone inside DYO that concerns cavers is more like a series of reservoirs or bathtubs that overflow from one into the next along short sections of open river passages or via unseen ‘plugholes’ into ‘drain pipes’ of restricted bore within the limestone beneath. This is further complicated by the fact that most of the resurgent water arises from percolation rather than surface river capture, so the ground above the cave, which consists of broken rock and peat etc, acts like a sponge absorbing and holding water until it is saturated after which that water flows through the matrix with a momentum all of its own, maintaining that character unlike a normal river.

Perhaps a mathematical model can be developed to predict flooding if there is a certain amount of new rain in the coming 24 hours. Alternatively, an AI approach to depth dynamics might be feasible, given enough training examples. What-if questions could be prompted by an online weather forecast service like Meteosource which is free to use at modest scale and convenient to access programmatically. The computation of river levels 24-hours ahead could then be presented as an extra chart on the public webpage.

Please do not open the box in the cave to discover more. Circuit designs and software source code can be made available. Contact me via the caving.wales website for more information or to help with this project. It will need some maintenance as the ‘AA’ batteries underground are expected to last only one year (from July 2025) and the sensor calibration will need re-checking as extreme winter floods might have a lasting adverse effect.

Stuart France,
April 2026.

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