

# Abandoned Mine Case Study: Level Fawr



Level Fawr (Great Level) is located in the village of Pont-rhyd-y-groes, Ceredigion, and was identified as one of the top 50 polluting sites in our 2002 Metal Mine Strategy for Wales. The level, also known as Probert's Level, was commenced in 1785 by John Probert to serve as a drainage adit for Logaulas Mine, whose surface remains lie on rising ground to the southeast of Pont-rhyd-y-groes. Over the course of the next century it was gradually extended to also serve Penygist, Glogfach and eventually Glogfawr mines, making it the longest drainage level in Mid-Wales at approximately 1.7km. The area in front of its portal was used as an extensive dressing floor for the ore extracted from these mines, and was the site of the Lisburne Mines headquarters throughout the 19<sup>th</sup> century.

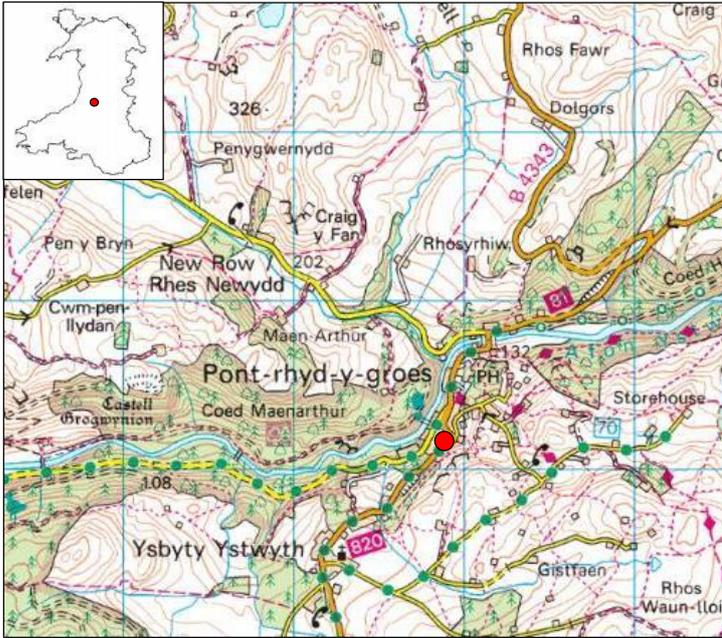
Logaulas Mine closed prior to 1900 but Level Fawr continued to discharge the pumpwater from Glogfawr Mine until it closed in 1923. Since the pumps were decommissioned and the mines subsequently flooded, Level Fawr has acted as a natural drain for the extensive mining complex southeast of Pont-rhyd-y-groes. Today the discharge from Level Fawr flows through the garden of the former Lisburne Mines Count House, before passing over a reconstructed waterwheel erected in 2009 with funding from the Spirit of the Miners Objective 1 project. The discharge continues down the steep valley slopes to enter the River Ystwyth via a waterfall near the Miner's Bridge.

The lower Ystwyth water body fails European Water Framework Directive (WFD) standards for zinc, lead and cadmium. Whilst Level Fawr contributes to these failures, there are more significant inputs of metals from Cwmystwyth and Frongoch mines further upstream. The water quality of Level Fawr was monitored periodically between 1980 and 2012, however no flow data is available for this period. To enable the metals load in the discharge to be calculated we carried out a programme of concurrent water quality and flow monitoring during 2013. The resulting data showed that Level Fawr discharges over 1 tonne of harmful metals to the River Ystwyth each year, including approximately 900kg of zinc and 200kg of lead. This is the second largest adit source of lead to the Ystwyth catchment after the Frongoch Adit.

We have used the metals loading data to calculate the size of a Vertical Flow Pond (VFP) passive treatment system required to treat the discharge. The area of reactive media required within the VFP is approximately 4,900m<sup>2</sup>, which equates to a total treatment system footprint of approximately 12,200m<sup>2</sup>.

Level Fawr has also been used as a field trial site by Aberystwyth University as part of their DEFRA funded project investigating minewater treatment with biochar, a type of charcoal produced by heating organic material in the absence of oxygen. Over the course of the trial 820,000 litres of minewater were treated, with an average reduction in lead and zinc concentrations of 94% and 73% respectively. It is estimated that to treat the total load of zinc discharged from Level Fawr each year 1600m<sup>3</sup> of biochar would be required, with a treatment system footprint of approximately 800m<sup>2</sup>.





**Impact on receiving watercourses**

Length impacted: Currently unknown\*

WFD water body ecological status:

- Lower Ystwyth to tidal limit Moderate

\*additional significant metals sources upstream from Frongoch and Cwmystwyth mines which contribute to WFD failure.

**Monitoring data**

Flow (L/s)	21
pH	7.4
Zinc (µg/L)	1,105
Lead (µg/L)	233
Cadmium (µg/L)	2.0
Zinc load (kg/yr)	875
Lead load (kg/yr)	227
Cadmium load (kg/yr)	1.6

**Benefits of remediation**

- Over 1 tonne of harmful metals could be prevented from entering the River Ystwyth each year.
- The receiving water body will be more likely to achieve Good Ecological Status, although there are other mining pressures on this water body that will also need to be addressed.
- Reduced metals load to the Cardigan Bay Special Area of Conservation.
- Reduced contaminated sediment load to the River Ystwyth.
- There may be opportunities for the creation of wetland habitat, with biodiversity benefits.
- Potential to develop partnerships with important stakeholders, including the local community.
- Potential to develop an educational resource at the site in conjunction with the reconstructed waterwheel, Miner's Bridge and Maenarthur Trail.

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