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Abandoned Mine Case Study: Abbey Consols Lead & Zinc Mine

Abbey Consols Mine (also known as Bronberllan, Florida or Cwm Mawr No. 2) lies 1km east of the village of Pontrhydfendigaid, Ceredigion and overlooks Strata Florida Abbey on the opposite bank of the River Teifi. The mine is one of three known to have an impact on water quality in the River Teifi, causing it to fail European Water Framework Directive (WFD) standards for zinc. The other significant mines in the area are Esgair Mwyn and Cwm Mawr.

Strata Florida Abbey was founded in the year 1164 and, given its close proximity and the lead mining interest of Cistercian Monks, it is likely that mining has taken place here since at least this time. With a total recorded output of 1,236 tons of lead and 1,765 tons of zinc between 1848-1909, Abbey Consols was a small mine in comparison to its more illustrious neighbours such as Frongoch and Cwmystwyth. The last recorded output from the mine was in 1913. Past reclamation works have destroyed many of the mine's features and today the site is characterised by spoil tips estimated at 32,000 tonnes, a number of shafts and the remains of a water wheel pit, dressing floors and filter beds. Two nationally rare lichen species have also been identified on the spoil tips.

Pollution at Abbey Consols originates from both point and diffuse sources. Contaminated groundwater emerges in the north eastern corner of the site, thought to be from the collapsed portal of the deep adit. This flows along the eastern and southern boundaries of the spoil tips, where it receives additional inputs of contaminated water from the toe of the tips and also from surface water run-off across the tips, before discharging to the River Teifi.

In 2008 we commissioned Enviros Ltd to carry out a scoping study on metal mines in the upper River Teifi. This study recommended further water quality and flow monitoring at Abbey Consols, which was carried out during 2010, funded by the Welsh Government's Contaminated Land Capital Fund. The data were used in a water quality modelling study also carried out in 2010 by an MSc student from Swansea University. This study identified Abbey Consols as the largest source of zinc to the River Teifi (Esgair Mwyn is the greatest contributor of lead) and the primary cause of the river failing to achieve its zinc WFD target for almost 30km.

In March 2011, following recommendations by Atkins Ltd, we completed modifications to site drainage channels to enable us to gather more accurate flow data to refine the water quality model and improve our understanding of contaminant sources at the site. This was followed by a further 18 months of water quality and flow monitoring. These data were then used to calculate the size of a Vertical Flow Pond (VFP) passive treatment system required to treat the final discharge from the mine, and in March 2014 we commissioned CH2M Hill Ltd to assess the availability of land to construct such a treatment system.

Impact on receiving watercourses

Length impacted:	29km
WFD water body ecological status:	
• Teifi – headwaters to Meurig	Moderate
• Teifi – Meurig to Brennig	Moderate
• Teifi – Brennig to Dulas	Moderate
• Teifi – Dulas to Clettwr	Moderate

During the summer of 2014, in conjunction with an MSc student from Swansea University, we carried out a detailed geochemical assessment of the site. As well as further water quality and flow monitoring, this included characterisation of the spoil tips using a portable X-ray fluorescence (pXRF) spectrometer, and lab analysis of their leachable metal content. These surveys identified the fine grained tailings in the southeast of the site as the most contaminated area and likely to be contributing the greatest metal load from surface run-off.

In 2015 we commissioned AECOM Ltd to assess remediation options to reduce the mobilisation of metals from the waste tips and thus the volume of contaminated water that would need to be treated in future. This report concluded that the three main options for consideration are: surface water diversion and channel containment for the adit drainage, containment/capping of the fine grained tailings and excavation and disposal of the fine grained tailings. We have since commissioned field surveys to identify areas of high archaeological and ecological interest across the site, providing information that will be key to safeguarding these features during the design of remedial works.

In 2016 the Coal Authority will review all available information on a number of the most polluting metal mines across Wales, including Abbey Consols, to identify preferred sites for one or more remediation schemes in the near future, subject to securing funding.

Monitoring data

Final discharge to the River Teifi:

Flow (L/s)	3	pH	6.8
Zinc (µg/L)	16,600	Zinc load (kg/yr)	1,740
Lead (µg/L)	1,200	Lead load (kg/yr)	140
Cadmium (µg/L)	45	Cadmium load (kg/yr)	4.7

Benefits of remediation

- Approximately 2 tonnes of harmful metals (primarily zinc) could be prevented from entering the River Teifi each year. The Teifi is one of the most important salmon and sea trout fisheries in Wales and is designated as a Special Area of Conservation for a number of habitats and species including salmon, otter, bullhead and the three UK lamprey species.
- A reduced contaminated sediment load to the River Teifi.
- The receiving water body and those downstream will be more likely to achieve Good Ecological Status, although there are other mining pressures in the Teifi catchment that will need to be addressed.

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