

Abandoned Mine Case Study: Esgair Mwyn Lead Mine



Esgair Mwyn Mine sits astride a remote moorland ridge between the Marchnant and Gwyddyl valleys 3km northeast of Pontrhydfendigaid, Ceredigion. The mine is one of three known to have an impact on water quality in the River Teifi, contributing to it failing European Water Framework Directive Standards (WFD) for zinc. The other significant mines in the area are Abbey Consols and Cwm Mawr.

The ancient mine of Esgair Mwyn was rediscovered in 1751, subsequently being worked intermittently with varying degrees of profitability until its closure in 1927. Although noted as a lead mine, quantities of silver, zinc and copper ore were also produced. Since 1948 there have been numerous attempts to reprocess the vast waste dumps remaining on site, including the construction of a large mill and the excavation and enlargement of the tailings lagoon. However, despite trials no significant amount of tailings was ever processed. The site has been abandoned since the early 1990s and is today characterised by a number of disused shafts, leats, derelict buildings and machinery, tailings lagoons, coarse waste dumps and a fine tailings tip estimated at 60,000 tonnes.

The Nant y Garw receives all water draining northwards from the mine, including seepages from the toe of the large spoil tip and discharges from the tailings lagoon system, before joining the River Marchnant 1.5km to the northwest. The Nant y Cwm Gwyddyl receives drainage to the south of the site, including discharge from the collapsed deep adit and run-off from its associated spoil tips. The Gwyddyl flows westerly to join the River Marchnant, forming the River Meurig, which continues south-westerly to its confluence with the River Teifi. Both the Garw and Gwyddyl contain highly elevated concentrations of zinc, lead and cadmium sufficient for the Meurig to fail WFD standards for all three metals. Furthermore, a water quality modelling study carried out by an MSc student in 2010 identified Esgair Mwyn as the largest source of lead to the Teifi, and alone it would cause the river to fail WFD zinc targets.

In 2005 we commissioned Parsons Brinckerhoff Ltd to assess the environmental impacts from the mine and to determine potential remediation options. They highlighted the suitability of the site for passive treatment with anaerobic wetlands, but also recommended further water quality and flow monitoring to improve our understanding of contaminant sources. We completed further monitoring between 2010 and 2012, including a detailed survey of water quality, flow and riverbed-sediment in collaboration with an MSc student from Swansea University. This study identified significantly elevated levels of lead and zinc in sediments downstream of the mine. The data were also used to calculate the size of a Vertical Flow Pond (VFP) passive treatment system required to treat the discharge of the Nant y Garw, and in 2014 we commissioned CH2M Hill Ltd to assess the availability of land to construct such a treatment system.





Impact on receiving watercourses

Length impacted: 15km

WFD water body ecological status:

- | | |
|--------------------------------|----------|
| • Meurig – headwaters to Teifi | Moderate |
| • Teifi – Meurig to Brennig | Moderate |
| • Teifi – Brennig to Dulas | Moderate |

In 2014 a small slippage was discovered in the dam wall of the main tailings lagoon. The southerly outlet pipe had become dislodged and the lagoon had filled to emergency overflow level (approximately 3000m³). As a matter of priority the lagoon was drained down to a safer level by reinstating the northerly outlet pipe, relieving pressure on the dam wall and reducing the likelihood of it failing. We are continuing to monitor the situation.

In 2015 we commissioned AECOM Ltd to assess 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. Their report concluded that the first remedial steps to consider are the diversion of the many surface water channels into the tailings lagoon to rationalise flows, and the arrest of sediment to prevent it entering downstream watercourses. 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 Esgair Mwyn, to identify preferred sites for one or more remediation schemes in the near future, subject to securing funding.

Monitoring data

	Nant y Garw	Nant y Cwm Gwyddyl*
Flow (L/s)	12	45
pH	6.3	7.1
Zinc (µg/L)	1,170	217
Lead (µg/L)	783	73
Cadmium (µg/L)	4.5	0.7
Zinc (kg/yr)	310	284
Lead (kg/yr)	330	96
Cadmium (kg/yr)	1.3	0.8

*data include additional discharge from Llwynllwyd Mine.

Benefits of remediation

- Over 1 tonne of harmful metals could be prevented from entering the River Meurig and subsequently 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.
- Reduced contaminated sediment load to downstream watercourses.
- The receiving water body and those downstream will be more likely to achieve Good Ecological Status, although there are other mining pressures on these water bodies that will need to be addressed.

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