# WFD Investigation: Abandoned Mines Project

## Afon Teifi

### Waterbodies covered

| Waterbody/Action ID | Name | Investigation reference no. | Investigation type | Overall Classification 2010 | Annex 8 & 10 failures 2010 | Biological indicators <Good |
|---|---|---|---|---|---|---|
| GB110062043540_No Action | Teifi - headwaters to confluence with Meurig | - | - | Moderate | Zinc, Copper | Fish, Invertebrates |
| GB110062043550_Actions 1&3 | Meurig - headwaters to confluence with Teifi | WA2009-19696 | Cause of failure | Moderate | Zinc, Copper | Fish, |
| GB110062043520_Action 1 | Teifi - confluence with Meurig to confluence with Fflur | WA2009-19689 | Feasible measures | Moderate | Zinc, Copper | |
| GB110062043500_No Action | Teifi - conf with Fflur to confluence with Camddwr | - | - | Good | N/A | N/A |
| GB110062043562_Action 2 | Teifi - Camddwr confluence to Nant Wern-macwydd confluence | WA2009-19699 | Cause of failure | Moderate | Zinc, Copper | Fish |
| GB110062039200_Action 1 | Clywedog - headwaters to confluence with Teifi | WA2009-19680 | Cause of failure | Moderate | Zinc, Copper | |
| GB110062043561_Action 2 | Teifi - conf with Nant Wern-Macwydd to tidal limit | WA2009-19697 | Feasible measures | Moderate | Zinc, Copper | Fish, Diatoms |

### Reasons for failure

| Waterbody | Tier 1 Issue | Tier 2 Activity/source | Tier 3 Sector | Certainty (Suspected, Probable or Confirmed) | Which quality element? | Apportionment (Major, Moderate or Minor) | Comment |
|---|---|---|---|---|---|---|---|
| GB110062043540 Teifi - headwaters to confluence with Meurig | Point source | Abandoned mine | Non-coal mining | Confirmed | Annex 8 & 10 | Major | Discharge from Abbey Consols Mine is the primary source of Zn load |
| | Diffuse source | Abandoned mine | Non-coal mining | Suspected | Annex 8 & 10 | Unknown | |

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|---|---|---|---|---|---|---|---|
| GB110062043550 Meurig - headwaters to confluence with Teifi | Diffuse source | Abandoned mine | Non-coal mining | Confirmed | Annex 8 & 10 | Major | Drainage from Esgair Mwyn Mine via Garw and Gwyddyl |
| | Point source | Abandoned mine | Non-coal mining | Suspected | Annex 8 & 10 | Unknown | Esgair Mwyn Deep Adit and Llwyn Llwyd Adit are thought to contribute to the metal load in the Gwyddyl. There are also potential point sources at the mine site, contributing to loads in the Garw. An MSc investigation into these sources is due for completion Oct 2012 |
| GB110062043520 Teifi - confluence with Meurig to confluence with Fflur<br><br>GB110062043562 Teifi - Camddwr confluence to Nant Wern-macwydd confluence<br><br>GB110062043561 Teifi - conf with Nant Wern-Macwydd to tidal limit | Point source | Abandoned mine | Non-coal mining | Confirmed<br>In upstream waterbody GB110062043540 | Annex 8 & 10 | | Discharge from Abbey Consols and Cwm Mawr mines |
| | Point source | Abandoned mine | Non-coal mining | Suspected<br>In upstream waterbody GB110062043550 | Annex 8 & 10 | | Suspected point sources at Esgair Mwyn and Llwyn Llwyd mines |
| GB110062043520 Teifi - confluence with Meurig to confluence with Fflur<br><br>GB110062043562 Teifi - Camddwr confluence to Nant Wern-macwydd confluence | Diffuse source | Abandoned mine | Non-coal mining | Confirmed<br>In upstream waterbody GB110062043550 | Annex 8 | | Drainage from Esgair Mwyn Mine via Garw |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| GB110062043500 Teifi - conf with Fflur to confluence with Camddwr | Suspect data | N/A | N/A | Probable | Annex 8 & 10 | | No metals data available but evidence strongly suggests failure for Zn and Cu |
| GB110062043562 Teifi - Camddwr confluence to Nant Wern-macwydd confluence | Diffuse source | Unknown | Unknown | Suspected | Annex 8 & 10 | | |
| GB110062039200 Clywedog - headwaters to confluence with Teifi | Natural | Natural mineralisation | N/A | Suspected | Annex 8 & 10 | | Failures may be due to natural baseline conditions in a mineral-rich region |
| | Diffuse source | Abandoned mine | Non-coal mining | Suspected | Annex 8 & 10 | | Failures may be result of unrecorded mines/mine waste or contaminated sediment |
| GB110062043561 Teifi - conf with Nant Wern-Macwydd to tidal limit | Diffuse source | Unknown | Unknown | Suspected | Annex 8 & 10 | | |

## Recommendations

| Waterbody | Measure Type | Measure/Action Description | Which team? | Resource needed? | Which year? | External Partners? | Priority (H, M, L) |
|---|---|---|---|---|---|---|---|
| GB110062043540 Teifi - headwaters to confluence with Meurig | Extra monitoring | Continue with monitoring programme to inform design of treatment system at Abbey Consols. | A&R/S&C | 2 days per month | Ongoing | No | H |
| GB110062043540 Teifi - headwaters to confluence with Meurig<br><br>GB110062043520 Teifi - confluence with Meurig to confluence with Fflur<br><br>GB110062043500 Teifi - conf with Fflur to confluence with Camddwr<br><br>GB110062043562 Teifi - Camddwr confluence to | Minewater Remediation Schemes | Design and installation of a minewater treatment system at Abbey Consols. | A&R | - | - | Yes Welsh Government & Coal Authority | H |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Nant Wern-macwydd confluence<br><br>GB110062043561 Teifi - conf with Nant Wern-Macwydd to tidal limit | | | | | | | |
| GB110062043550 Meurig - headwaters to confluence with Teifi | Extra monitoring | More detailed monitoring programme in this waterbody. MSc project planned for 2012. | A&R/S&C | - | 2012 | No | H |
| GB110062039200 Clywedog - headwaters to confluence with Teifi | Extra monitoring | More detailed investigation and monitoring programme in this waterbody. | A&R/S&C | - | 2013/14? | No | L |
| All waterbodies | Data Investigation | Desktop study employing Metals Bioavailability Assessment Tool (MBAT). | A&R | 0.5 days per waterbody | 2012 | No | M |

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Author: Tom Williams
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# WFD Abandoned Mines Project: Afon Teifi catchment

## 1. Introduction

This document describes investigative monitoring undertaken in the Afon Teifi catchment as part of a Wales-wide project delivering abandoned mine water investigations for the Water Framework Directive (WFD). The WFD requires that all waterbodies achieve 'Good Ecological Status' (GES) by 2027. Wales' first River Basin Management Plans (RBMPs) for Western Wales, Dee and Severn (2009-2015) show that 67% of waterbodies across Wales fail to achieve the objective of GES unless action is taken. In many cases investigative monitoring is required to identify the issues causing WFD failures, and thus inform the most efficient solutions that will deliver the greatest improvements.

The classification process undertaken by the Agency in 2010 identified a number of waterbodies within the Teifi catchment failing to reach GES due to elevated concentrations of zinc and/or copper (see cover sheet). This investigation seeks to identify and quantify the primary sources of the metalliferous pollution in these waterbodies.

## 2. Study area

The Afon Teifi rises in Llyn Teifi on the western slopes of the Cambrian Mountains. The river flows for approximately 122km in a generally south-westerly then westerly direction before discharging into the Irish Sea at Cardigan. Whilst land-use is now predominantly agricultural, the upper reaches of the Teifi catchment are located in an area with an extensive history of metal mining. Although all mining activities have long since ceased, contaminated spoil heaps and underground workings continue to have a negative impact on the quality of surface waterbodies. Four of the 50 most polluting mines in Wales (EAW, 2002) are located in the Teifi catchment. These are Abbey Consols (GB110062043540), Esgair Mwyn & Glogfawr (GB110062043550) and Llanfair (GB110062039200). Cwm Mawr Mine (GB110062043540) is also thought to be a significant source of metals to local watercourses.

## 3. Methods

### 3.1. Monitoring programme

A programme of water quality spot-sampling was commenced in June 2011 to fill gaps in metals data, and to supplement existing data from previous investigations. Simultaneous flow measurements were also taken at strategic locations in order to calculate metal loads. The sample points selected for analysis are detailed in Appendix 2 (see separate Excel document).

### 3.2. SIMCAT modelling

The water quality modelling tool SIMCAT was employed to apportion sources of metals within the Teifi catchment. SIMCAT is a mathematical model that calculates river quality impacts throughout a catchment resulting from inputs from point-source and diffuse discharges. SIMCAT is able to predict flow and quality distributions at any selected point in the catchment and produce results as statistics for comparison with specific river quality standards. It can therefore be used to plan the action needed to achieve water quality objectives and to improve the effectiveness of water quality monitoring programmes.

The SIMCAT model includes the Afon Teifi and its major tributaries from Strata Florida to the tidal limit near Cilgerran, although only select reaches are reported. See Appendix 1 for a schematic diagram detailing the reaches and features included in the model.

All available metals data were retrieved from WIMS before being screened for outliers and step changes to ensure the time period used was representative of current conditions. Values reported as below the limit of detection (<LOD) were taken as LOD x 0.5. Summary statistics including mean, standard deviation and count were then calculated for input to SIMCAT. As a general rule, only data from the previous 5 years was used when 12 or more samples were available during this time period.
The Area Hydrology team provided flow estimates (mean and 95%ile) for main river and tributary locations using Low Flows Enterprise software. The model was manually calibrated by adjusting diffuse inputs of flow and water quality to match the observed figures as far as possible without resorting to unreasonable values.

See Appendix 2 for further details.

## 4. Results and Discussion

Unless stated otherwise Copper (Cu), Lead (Pb) and Cadmium (Cd) data refers to the dissolved concentration of the metal, whilst Zinc (Zn) refers to the total concentration. Although Nickel (Ni) data was retrieved and analysed, no sample points failed the Environmental Quality Standard (EQS) target and therefore the results are not reported here. All loads were calculated for the total concentration of each metal.

EQS targets (µg/l): Zn = 8; Cu = 1; Pb = 7.2; Cd = 0.08; Ni = 20

### 4.1. GB110062043540: Teifi – headwaters to confluence with Meurig

The upstream monitoring point on the Teifi at Strata Florida (83011) is compliant with EQS for Zn, Cu, Pb and Cd. Approximately 1km downstream, drainage from Abbey Consols Mine discharges to the Teifi. This water contains highly elevated concentrations of Zn, Pb and Cd, and as such provides a significant load of these metals to the Teifi (see Table 1). This input can be clearly seen in the SIMCAT output (Figure 2), although the model appears to be over predicting concentrations when compared to observed values. As a consequence of this discharge, downstream of the mine at 82992, the Teifi is failing EQS for both Zn and Cd, however dilution is sufficient that Pb remains compliant despite a 3-fold increase in concentrations. Zn and Cd continue to exceed quality targets for the remainder of the waterbody.

Drainage from Cwm Mawr Mine is via the Cwm Mawr Stream and Cwm Mawr Adit, which converge before entering the Nant y Cwm, this in turn flows south to enter the Teifi at Pontrhydfendigaid. The total metal loads being discharged from Cwm Mawr Mine are negligible in comparison to those from Abbey Consols (see Table 1), however, they are still sufficient to increase Zn and Cd concentrations to levels in excess of EQS in the Nant y Cwm downstream of the mine at 34446 (see Figure 1). Cu is also marginally failing EQS at this point but the increase compared with upstream of the mine is insignificant.
The SIMCAT model was run with the discharge from Abbey Consols removed in order to gain a better understanding of the impact of Cwm Mawr Mine on the Teifi (Figure 3). SIMCAT predicts that the Zn load in the Nant y Cwm is sufficient to elevate Zn concentrations in the Teifi in excess of EQS for approximately 10km downstream of the confluence. There is no discernible impact on concentrations of Cu, Pb and Cd.

The longer term Cu average (2007-2012) calculated for this investigation at 83001, 0.3km downstream of Nant y Cwm, is very marginally below EQS at 0.98µg/l, whilst the shorter-term dataset (2007-2009) used for classification indicates a failure (1.10µg/l). The elevated Zn at this point is predominantly a result of Abbey Consols discharge, with a smaller contribution from Cwm Mawr Mine. The marginal Cd failure can be attributed to Abbey Consols.

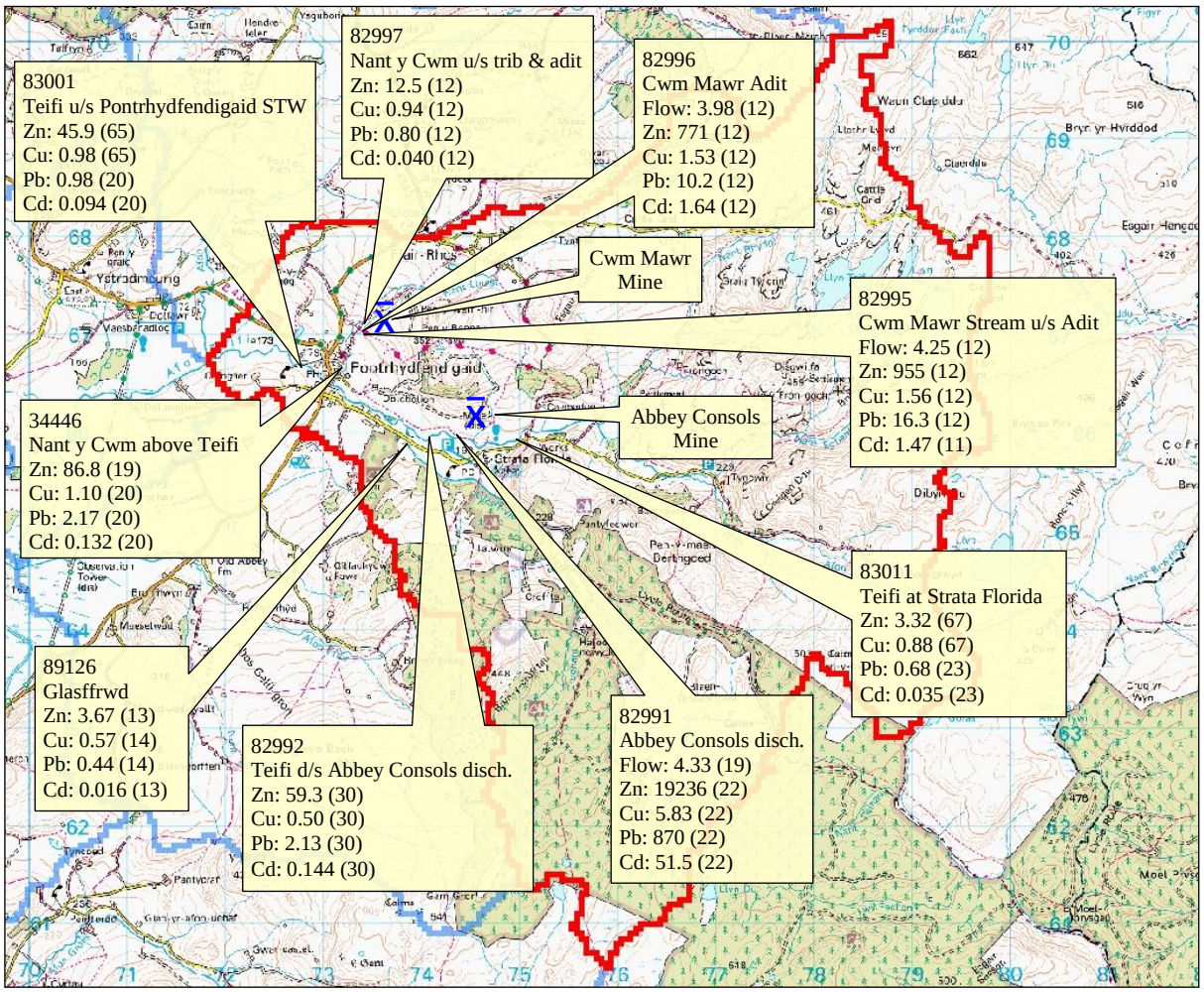



Figure 1. Mean water quality and flow for GB110062043540: Teifi – headwaters to confluence with Meurig. Flow in l/s, metal concentrations in µg/l (number of samples).

Table 1. Metal loads for Abbey Consols and Cwm Mawr mines (kg/yr).

| | Zinc | Copper | Lead | Cadmium |
|---|---|---|---|---|
| **Abbey Consols** | | | | |
| 82991 Discharge to Teifi | 2168 | 1.33 | 156.53 | 5.92 |
| **Cwm Mawr** | | | | |
| 82995 Cwm Mawr Stream | 118 | 0.26 | 10.69 | 0.23 |
| 82996 Cwm Mawr Adit | 92.1 | 0.18 | 2.51 | 0.20 |
| **Total** | **210** | **0.44** | **13.20** | **0.43** |

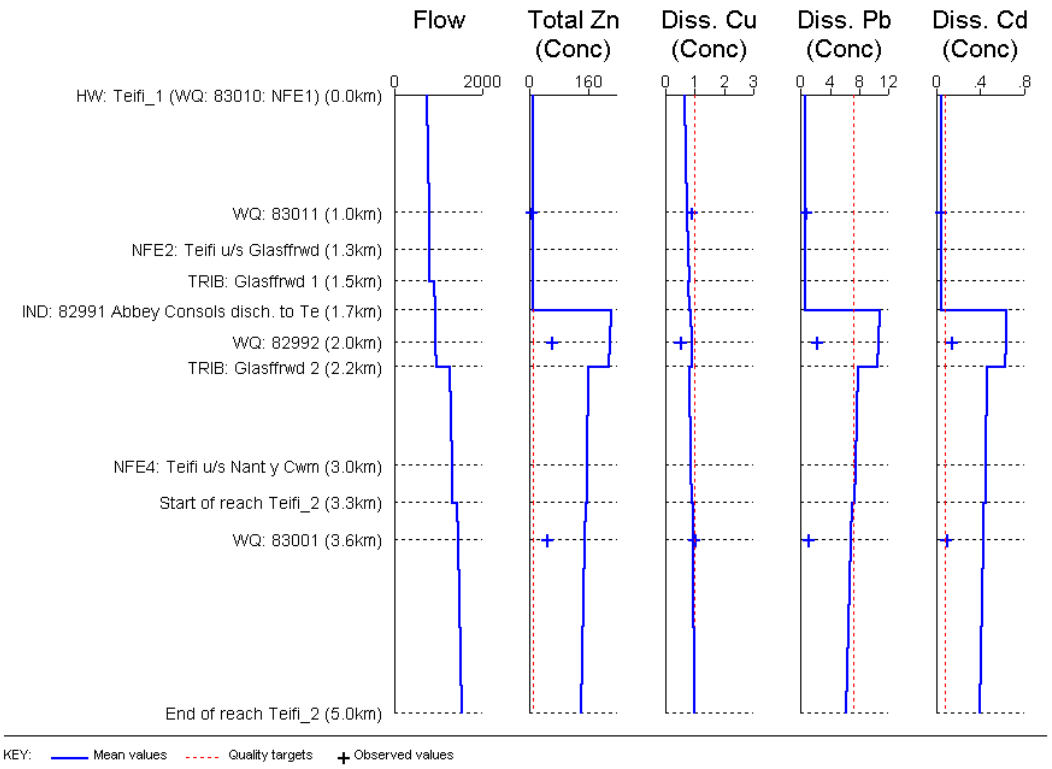



Figure 2. SIMCAT output for GB110062043540: Teifi – headwaters to confluence with Meurig, current situation. Flow in l/s, metals in µg/l.

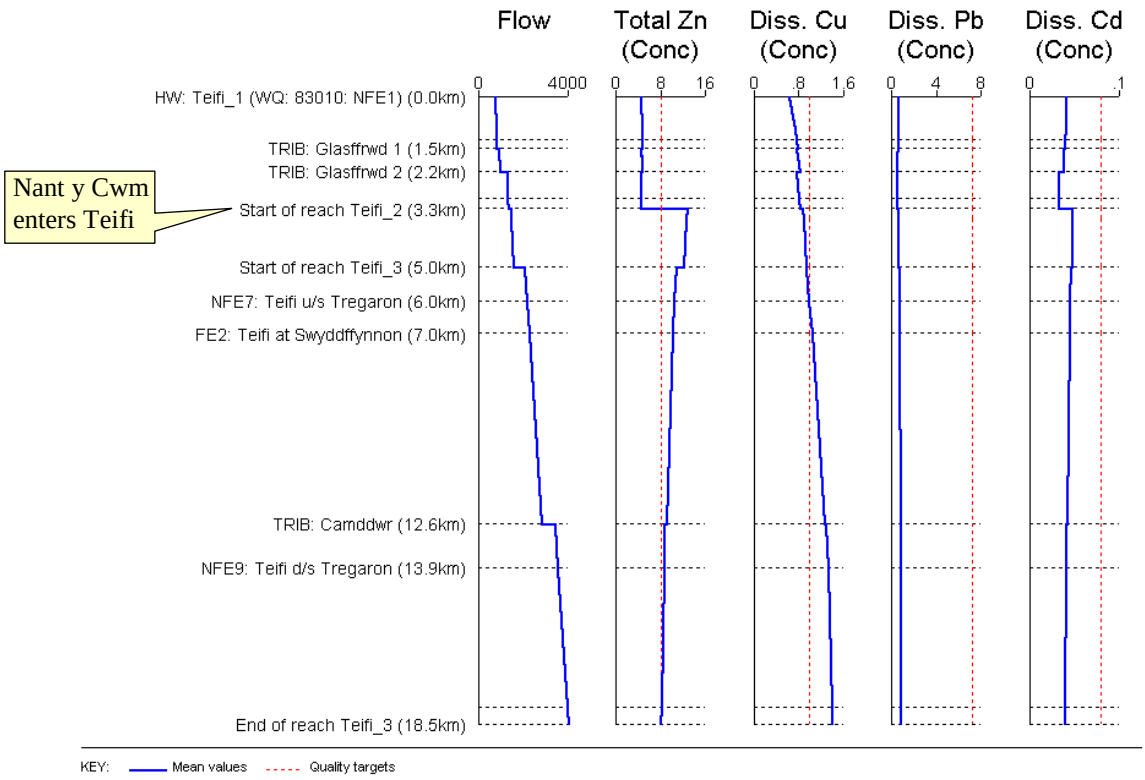



Figure 3. SIMCAT output for the upper reaches of the Teifi. Abbey Consols discharge removed. Flow in l/s, metals in µg/l.

## 4.2. GB110062043550: Meurig – headwaters to confluence with Teifi

The Afon Marchnant upstream of the Nant y Garw is compliant for all metal EQS, indicating that the Glogfawr Mine tips located on the northern boundary of the waterbody are not having a detrimental impact on water quality in this watercourse.

The Garw, which drains Esgair Mwyn mine site to the northwest, contains significantly elevated concentrations of Zn, Cu, Pb and Cd (see Figure 4). The Nant y Gwyddyl which flows westerly, to the south of the mine, also exceeds EQS for all four metals, however concentrations are lower than the Garw with a mean flow approximately five times greater. The Zn and Cd loads are very similar between the two tributaries, however, the Garw discharges around three times the Pb load and twice the Cu load of the Gwyddyl (Table 2).

A feasibility study completed by Parsons Brinckerhoff Ltd (2006) noted the presence of the Llwyn Llwyd Adit, associated with the mine of the same name and not hydrologically linked to Esgair Mwyn, which discharges to the Gwyddyl upstream of the current monitoring point 34455. Further sampling would be required to determine if this adit is a significant source of metals to the Gwyddyl.

Sample point 34408 at the bottom of the waterbody fails EQS for all four metals, showing a significant increase in concentrations compared with those upstream of the Garw and Gwyddyl (see Figure 5).

The SIMCAT model was run with the discharges from Abbey Consols and Cwm Mawr mines removed in order to assess the impact that the Afon Meurig and Esgair Mwyn is having on the Teifi (Figure 6). SIMCAT indicates that the discharge of the Meurig significantly increases concentrations of Zn in the Teifi, causing it to fail EQS for approximately 20km below the confluence. Although the Meurig also acts to increase concentrations of both Pb and Cd in the Teifi, neither are sufficient to surpass EQS. The increase in Cu is negligible.

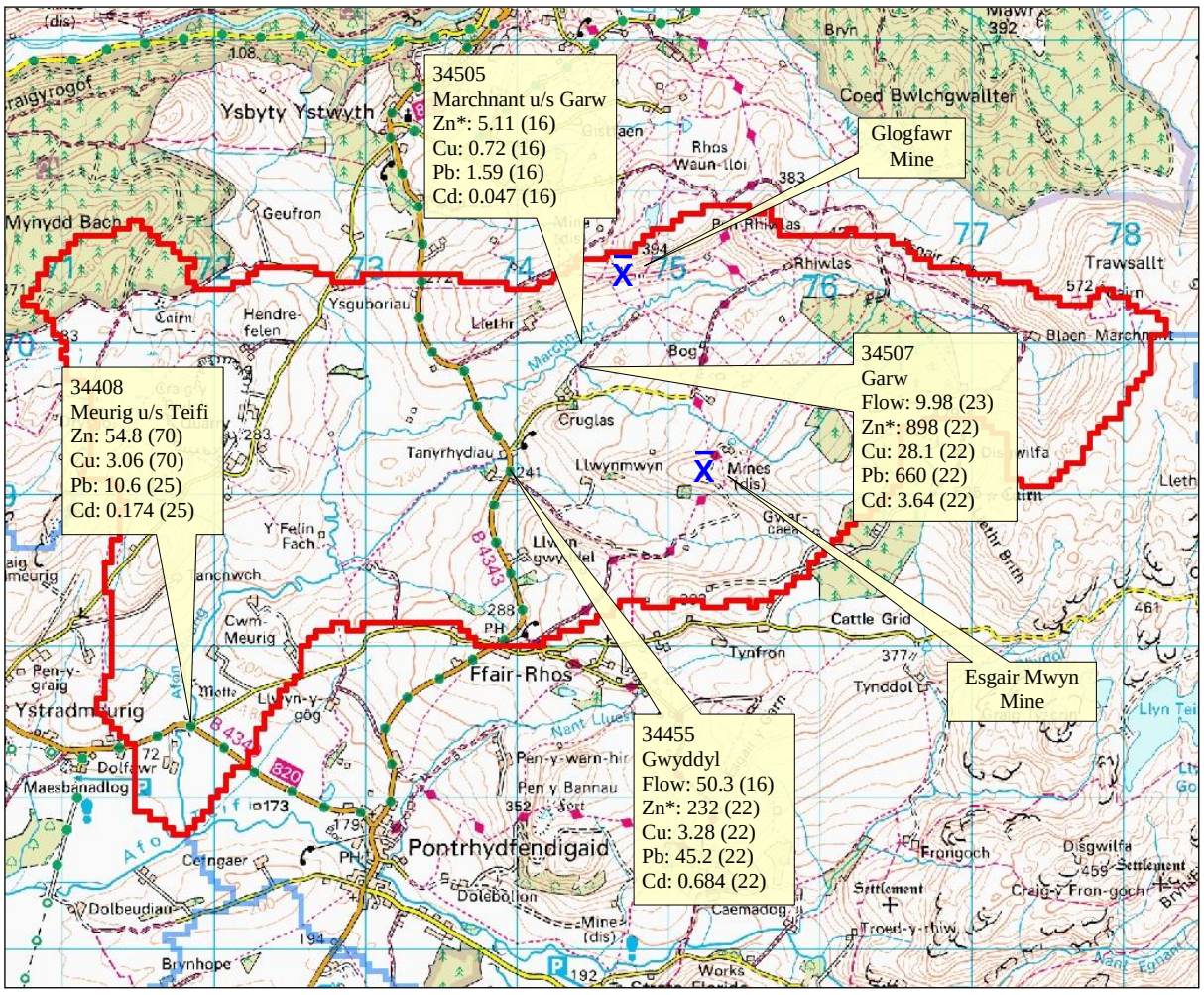



Figure 4. Mean water quality and flow for GB110062043550: Meurig – headwaters to confluence with Teifi. Flow in l/s, metal concentrations in µg/l (number of samples) * denotes dissolved Zn data.

Table 2. Metal loads for the Garw and Gwyddyl (kg/yr).

| | Zinc | Copper | Lead | Cadmium |
|---|---|---|---|---|
| **Esgair Mwyn** | | | | |
| 34507 Nant y Garw | 351 | 13.31 | 347 | 1.43 |
| 34455 Nant y Cwm Gwyddyl | 381 | 6.05 | 116 | 1.10 |
| **Total** | **732** | **19.35** | **463** | **2.54** |

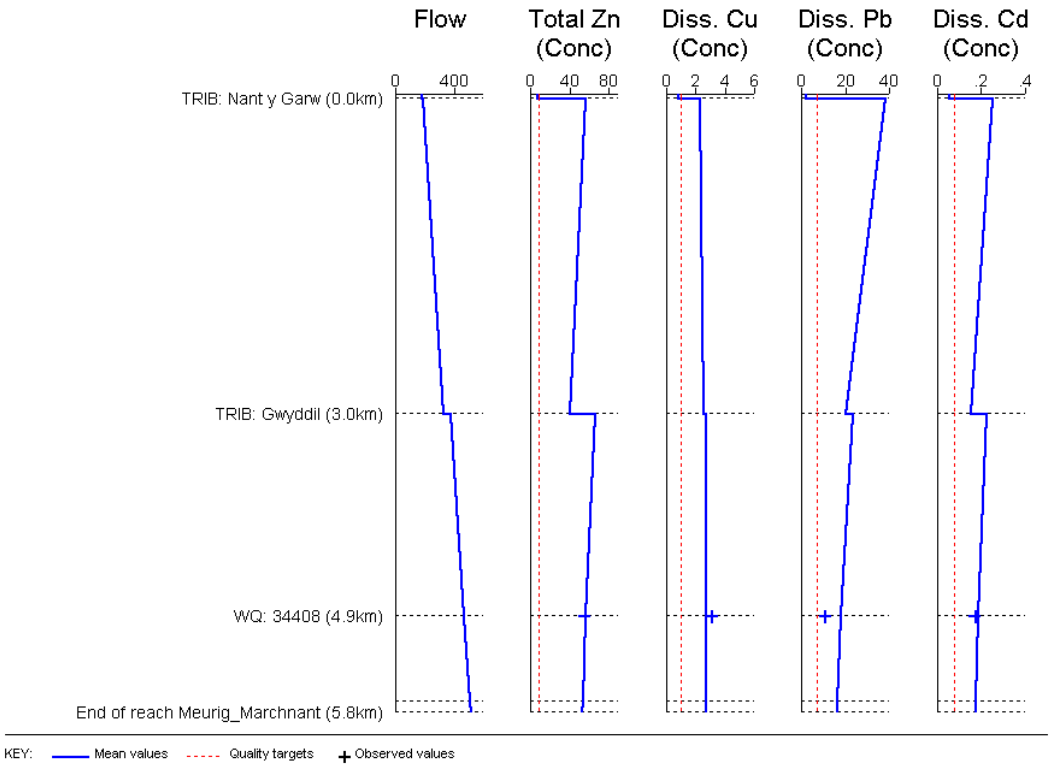



Figure 5. SIMCAT output GB110062043550: Meurig – headwaters to confluence with Teifi. Flow in l/s, metals in µg/l.

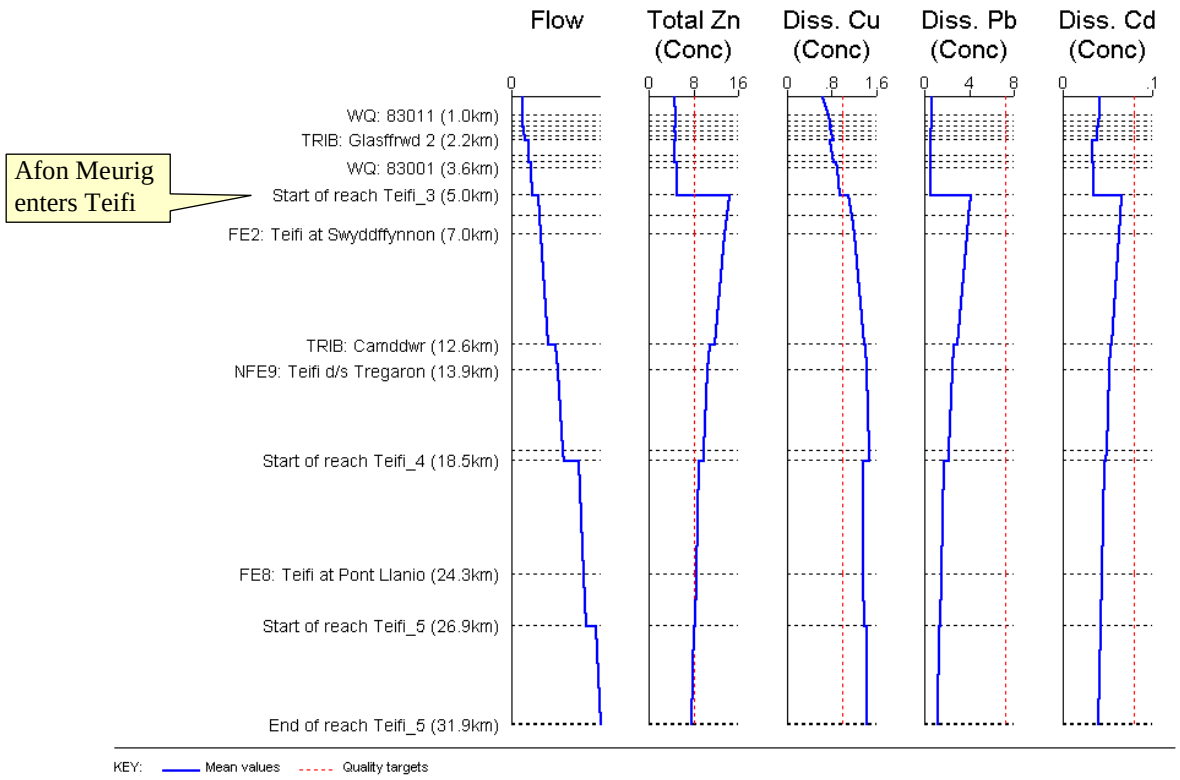



Figure 6. SIMCAT output for the upper reaches of the Teifi. Abbey Consols and Cwm Mawr discharges removed. Flow in l/s, metals in µg/l.

### 4.3. GB110062043520: Teifi – confluence with Meurig to confluence with Fflur & GB110062043500 Teifi - conf with Fflur to confluence with Camddwr

Waterbody GB110062043520 is significantly failing EQS for Zn, with marginal failures for Cu and Cd. The Zn and Cd failures can be attributed to discharges into the two upstream waterbodies, primarily from Abbey Consols and Esgair Mwyn mines, with a smaller contribution from Cwm Mawr. SIMCAT (Figure 8) indicates that the Meurig is acting to marginally increase Cu concentrations in the Teifi, leading to the failure at 34407. However, Cu remains elevated for the remainder of the Teifi downstream, suggesting an issue other than discharge from abandoned mines. It is believed that implementation of the Metals Bioavailability Assessment Tool (MBAT) will lead to many of the current Cu failures reaching EQS targets. The Meurig is also causing an approximate 3-fold increase in Pb concentrations in the Teifi between 83001 and 34407, however this is not sufficient for EQS to be exceeded.

Waterbody GB110062043500 was classified as Good overall in 2010, however there was no metals data available for sample point 34565 to classify Annex 8 & 10 elements. The data at sample points 34407 upstream and 34403 downstream, along with the SIMCAT output (Figure 8), indicate that this waterbody would fail EQS for Zn and Cu.

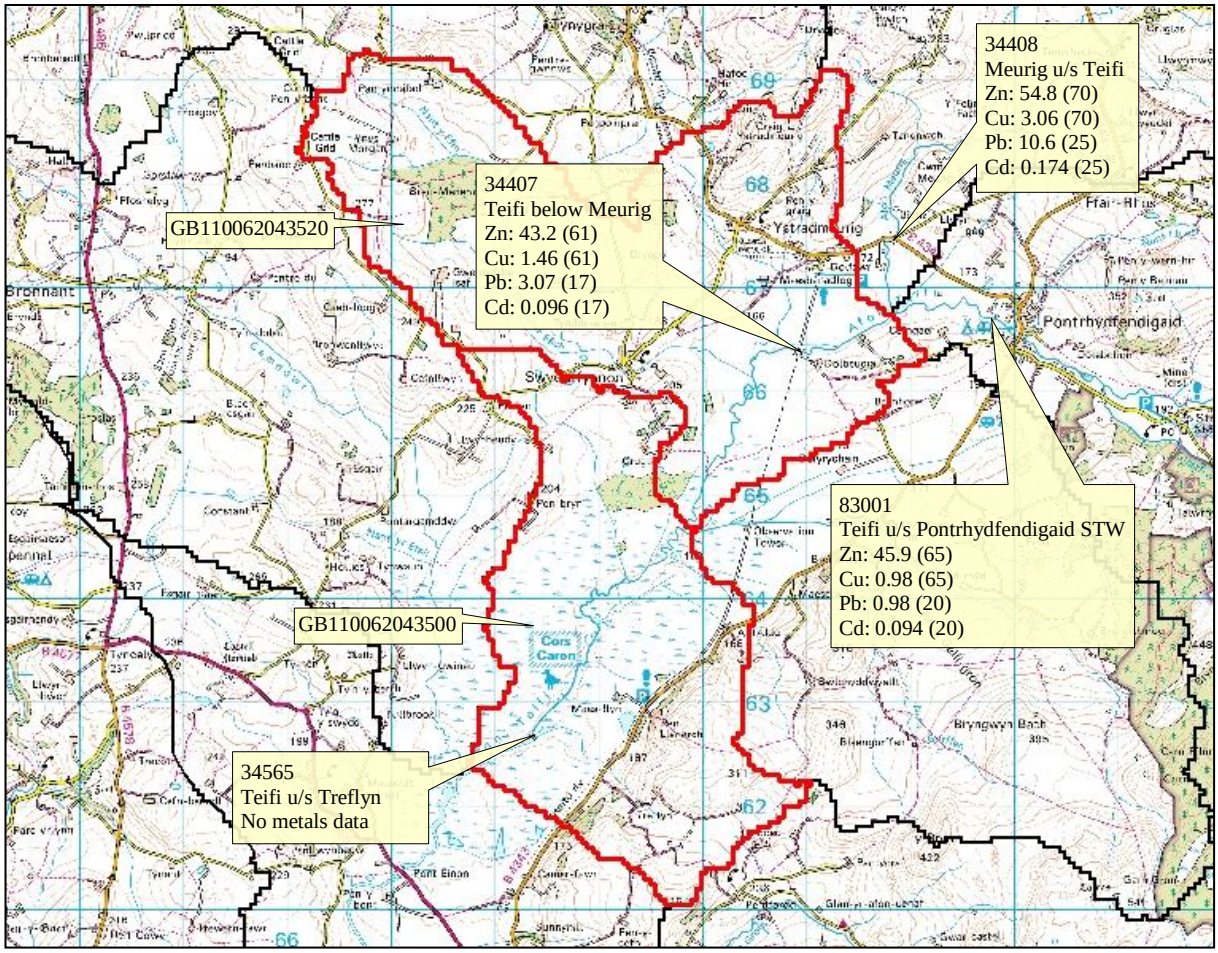



Figure 7. Mean water quality for GB110062043520: Teifi – confluence with Meurig to confluence with Fflur. Metal concentrations in µg/l (number of samples).

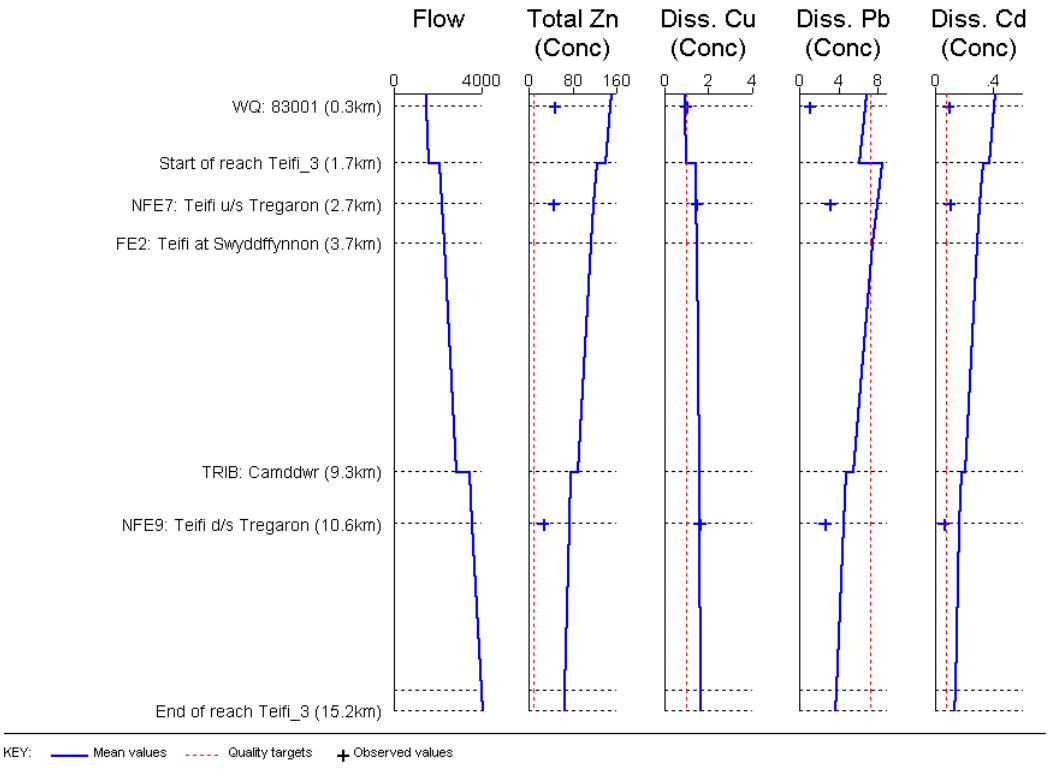



Figure 8. SIMCAT output including waterbodies GB110062043520: Teifi – confluence with Meurig to confluence with Fflur and GB110062043500 Teifi - conf with Fflur to confluence with Camddwr. Flow in l/s, metals in µg/l.

## 4.4. GB110062039200: Clywedog – headwaters to confluence with Teifi

Llanfair Mine lies within the Clywedog catchment and although it features on the Agency's Top 50 list, little is known about the mine and the extent of workings or spoil tips. Two smaller/trial mines are listed in the catchment near the confluence of the Clywedog-uchaf and Clywedog-ganol.

As well as monitoring conducted for this investigation, data was also retrieved from two historical points upstream (34593) and downstream (34515) of Llanfair Mine. These were each sampled for water quality and flow four times in 2005. No data is available for the Clywedog-ganol.

The Clywedog-uchaf and Clywedog-isaf, both above Llanfair Mine, display very similar metal concentrations. Zn is marginally failing EQS whilst Cu and Pb are compliant. Cd levels are at or slightly below EQS (Figure 9). There is no significant change in metal concentrations in the Clywedog downstream at its confluence with the Teifi, although Cu is now marginally in excess of EQS.

The historical data from 2005 indicates a similar trend, with no apparent change in water quality upstream and downstream of Llanfair Mine. Both sample points marginally fail EQS for Zn and Cu, with Pb concentrations compliant. All Cd data was below the limit of detection. This would suggest that Llanfair Mine is not a significant source of metals to the Clywedog and therefore not a cause of the Annex 8 failures.

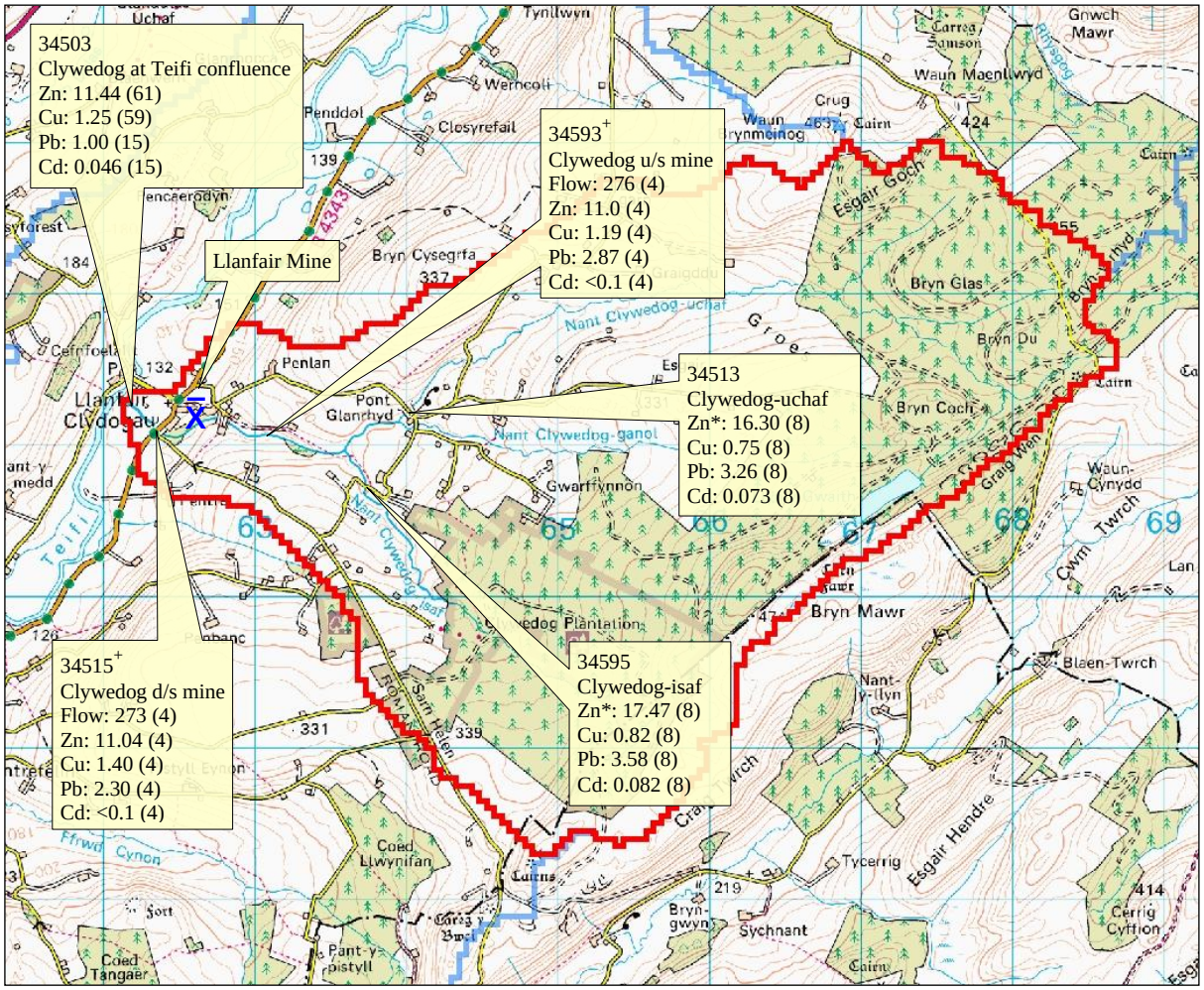



Figure 9. Mean water quality and flow data for GB110062039200: Clywedog – headwaters to confluence with Teifi. Flow in l/s, metal concentrations in µg/l (number of samples). * dissolved Zn data + historical data from 2005.

## 4.5. GB110062043562: Teifi – Camddwr confluence to Nant Wern-Macwydd confluence & GB110062043561: Teifi – confluence with Nant Wer-Macwydd to tidal limit

Zn continues to remain elevated above EQS through these two waterbodies as a result of the mine discharges into GB110062043540 and GB110062043550 upstream. A gradual decline in concentrations is seen downstream due to natural precipitation and dilution, with no further significant sources to the Teifi identified (Figure 10 & Figure 11). Cu concentrations are relatively consistent across all sample points in both waterbodies, being slightly above EQS. Evidence is not sufficient to indicate that abandoned mines are responsible for these Cu failures and it is thought that many will become compliant with the implementation of MBAT. No Pb or Cd failures were identified in either waterbody.

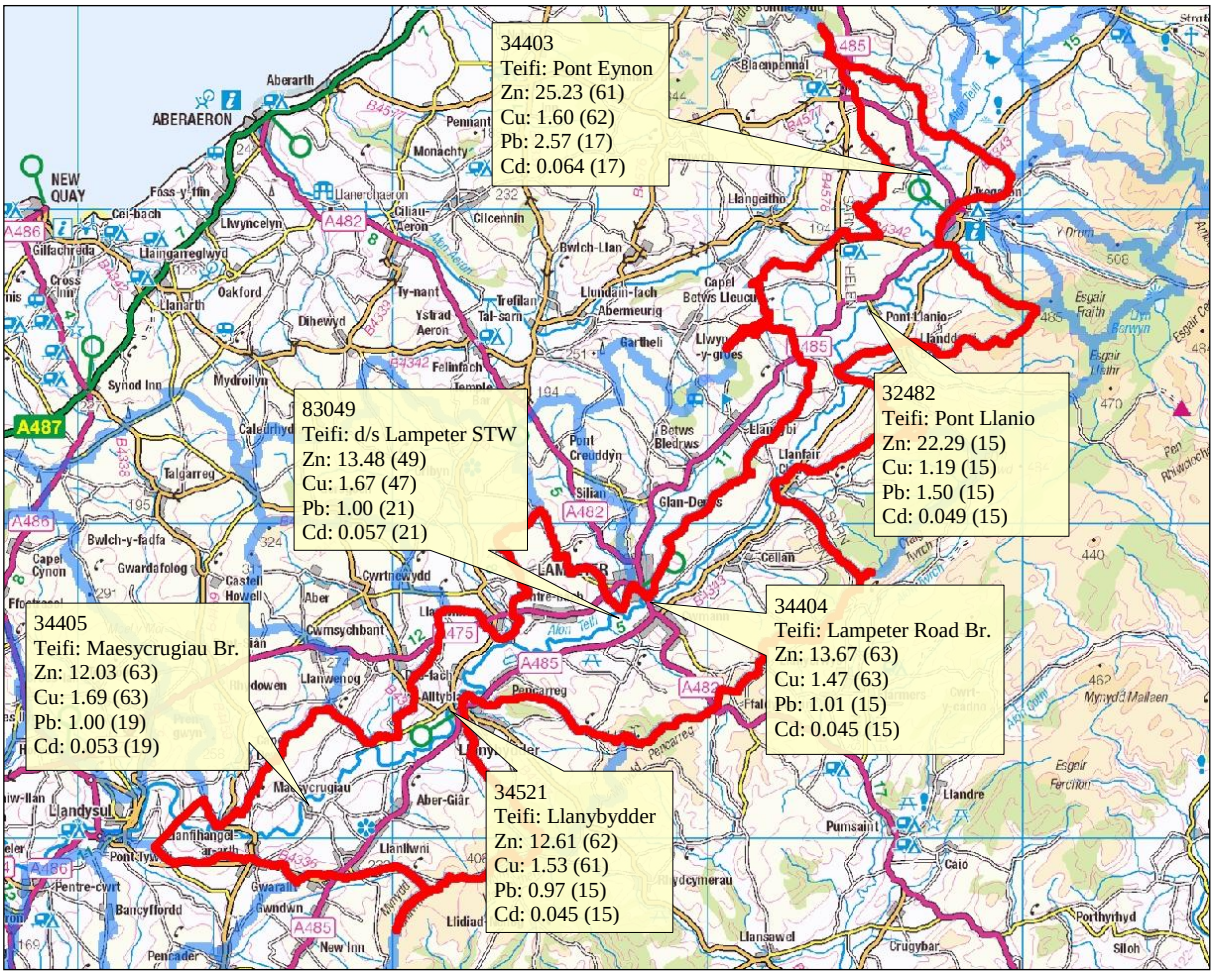



Figure 10. Mean water quality data for GB110062043562: Teifi – Camddwr confluence to Nant Wern-Macwydd confluence. Metal concentrations in µg/l (number of samples).

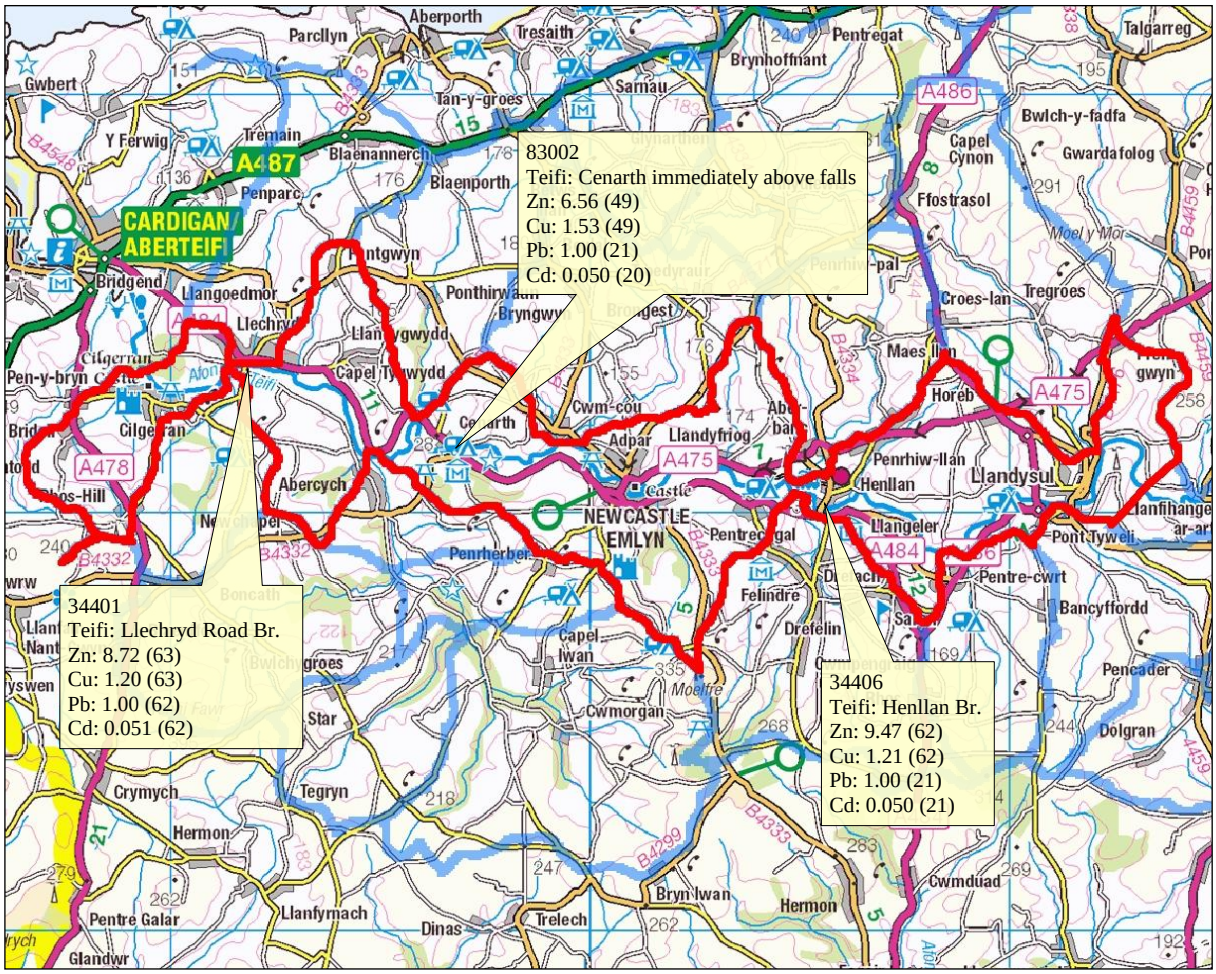



Figure 11. Mean water quality for GB110062043561: Teifi – confluence with Nant Wer-Macwydd to tidal limit. Metal concentrations in µg/l (number of samples).

## 5. Conclusions and Reasons for Failure

5.1. GB110062043540: Teifi – headwaters to confluence with Meurig

- Abbey Consols Mine is the largest source of metals load in the waterbody, averaging approximately10-times that of Cwm Mawr Mine.
- Abbey Consols is causing the Teifi to fail EQS for Zn and Cd for the length of the waterbody below the discharge.
- Cwm Mawr Mine is responsible for the Nant y Cwm failing EQS for Zn, Pb and Cd at 34446. The Cu load discharged from the mine is unlikely to be responsible for the marginal Cu failure at this point.
- SIMCAT predicts that Cwm Mawr would cause the Teifi to fail Zn EQS for approximately 10km in the absence of Abbey Consols.
- There is insufficient evidence to conclude that the Cu failure indicated in the classification data downstream Pontrhydfendigaid at 83001 is attributable to any abandoned mines in the catchment. The longer-term time series of Cu data used in this investigation results in a mean concentration marginally below EQS at this point.

5.2. GB110062043550: Meurig – headwaters to confluence with Teifi

- The two tributaries of the Meurig receiving drainage from Esgair Mwyn Mine, the Garw and Gwyddyl, both contain significantly elevated concentrations of Zn, Cu, Pb and Cd.
- This in turn is causing the failure of EQS for all four metals at 34408 (Meurig u/s Teifi).

- The Garw and Gwyddyl contribute very similar quantities of Zn and Cd to the Marchnant/Meurig. However, the Pb and Cu loads in the Garw are approximately 3 times and 2 times that of the Gwyddyl respectively.
- The Llwyn Llwyd Adit may be contributing to metal loading in the Gwyddyl; water quality and flow monitoring would need to be undertaken to quantify this.

5.3. GB110062043520: Teifi – confluence with Meurig to confluence with Fflur & GB110062043500 Teifi - conf with Fflur to confluence with Camddwr

- The Zn failure in GB110062043520 is due to the discharges from Abbey Consols, Cwm Mawr and Esgair Mwyn mines into upstream waterbodies, with Abbey Consols being the primary contributor.
- The Cu failure may be due in part to drainage from Esgair Mwyn Mine entering the Teifi via the Meurig. However, Cu concentrations do not decline downstream as would be expected through natural precipitation and dilution, indicating an issue other than abandoned mines in the catchment.
- Although classified as Good, and with no metals data available, evidence from the upstream and downstream waterbodies indicate that GB110062043500 would fail EQS for Zn and potentially Cu.

5.4. GB110062043520: Clywedog – headwaters to confluence with Teifi

- Data indicates that Llanfair Mine is not having an impact on water quality in the Clywedog, with no significant change in metal concentrations upstream and downstream of the mine.
- With the Annex 8 failures identified only marginally above EQS, and a lack of significant sources of metals, it is suggested that the Zn and Cu concentrations could be a result of minor unrecorded mines/mine waste, or natural baseline conditions in a mineral-rich region.

5.5. GB110062043562: Teifi – Camddwr confluence to Nant Wern-Macwydd confluence & GB110062043561: Teifi – confluence with Nant Wern-Macwydd to tidal limit

- The Zn failures are probably due to the discharges from Abbey Consols, Cwm Mawr and Esgair Mwyn mines in upstream waterbodies. Although concentrations have gradually decreased downstream of the mines through dilution and precipitation, they are still sufficiently elevated to exceed EQS.
- Given the relatively uniform concentrations of Cu that are only marginally above EQS, and a lack of any significant sources, it is suggested that Cu concentrations could be the result of contaminated sediments from historical mining activities, or natural baseline conditions.

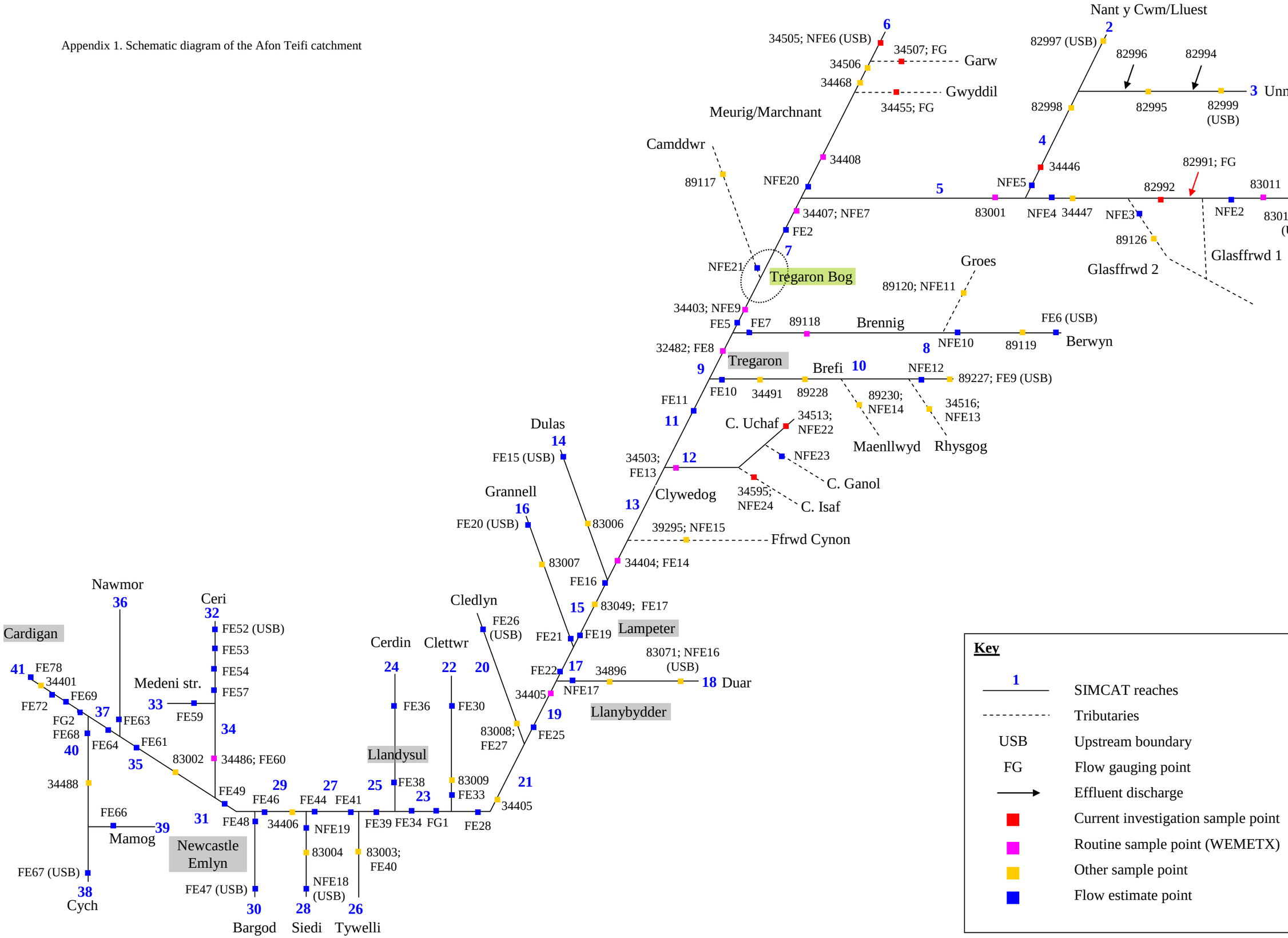
## 6. References

Environment Agency Wales (EAW)., (2002) ‘Metal Mine Strategy for Wales’. Environment Agency Wales, Cardiff.

Parsons Brinckerhoff Ltd., (2006) ‘Remedial Design for Esgair Mwyn Old Mine, Ceredigion, Wales’. Parsons Brinckerhoff Ltd, Bristol.

Williams, T., (2010) ‘A SIMCAT model to assess the impact of abandoned metal mines on the Afon Teifi, Wales’. MSc dissertation, Swansea University.

Appendix 1. Schematic diagram of the Afon Teifi catchment




**Key**

| | |
|---|---|
| 1 | SIMCAT reaches |
| ---------- | Tributaries |
| USB | Upstream boundary |
| FG | Flow gauging point |
| → | Effluent discharge |
| ■ | Current investigation sample point |
| ■ | Routine sample point (WEMETX) |
| ■ | Other sample point |
| ■ | Flow estimate point |