



Prioritisation of abandoned non-coal mine impacts on the environment

SC030136/R6 The Western Wales River Basin District

The Environment Agency is the leading public body protecting and improving the environment in England and Wales.

It's our job to make sure that air, land and water are looked after by everyone in today's society, so that tomorrow's generations inherit a cleaner, healthier world.

Our work includes tackling flooding and pollution incidents, reducing industry's impacts on the environment, cleaning up rivers, coastal waters and contaminated land, and improving wildlife habitats.

This report is the result of research commissioned and funded by the Department for Environment, Food and Rural Affairs (Defra) and the Welsh Government in collaboration with the Environment Agency.

Published by:

Environment Agency, Horizon House, Deanery Road, Bristol, BS1 5AH

www.environment-agency.gov.uk

ISBN: 978-1-84911-255-0

© Environment Agency – March 2012

All rights reserved. This document may be reproduced with prior permission of the Environment Agency.

The views and statements expressed in this report are those of the authors alone. The views or statements expressed in this publication do not necessarily represent the views of the Environment Agency or Defra and the Environment Agency and Defra cannot accept any responsibility for such views or statements.

Further copies of this report are available from: The Environment Agency's National Customer Contact Centre by emailing: enquiries@environment-agency.gov.uk or by telephoning 08708 506506.

Main Authors:

Mayes, W.M.,¹ and Jarvis, A.P.¹

Contributing Authors:

Coulon, P.,² Fox, A.,² Hill, S.,³ Johnston, D.,⁴ Potter, H.A.B.,⁴ Thorn, P.,² Watson, I.A.³

¹Newcastle University, ²Atkins Ltd, ³Coal Authority, ⁴Environment Agency

Dissemination Status:

Publicly available

Keywords:

Abandoned metal mines, mine water, pollution, river catchments, impact assessment, remediation, Water Framework Directive

Research Contractor:

Atkins Ltd., Coal Authority, Newcastle University. Contact: Dr. Adam Jarvis, Newcastle University Email: adam.jarvis@ncl.ac.uk

Environment Agency's Project Manager:

Dr Hugh Potter, Operations Directorate

Collaborators:

Department for Environment, Food and Rural Affairs
Welsh Government
Department for Communities and Local Government

Project Number:

SC030136/14

Product Code:

SCHO1111BUVB-E-E

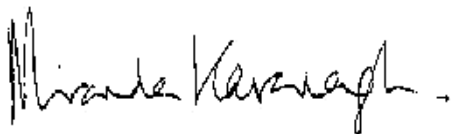
Evidence at the Environment Agency

Evidence underpins the work of the Environment Agency. It provides an up-to-date understanding of the world about us, helps us to develop tools and techniques to monitor and manage our environment as efficiently and effectively as possible. It also helps us to understand how the environment is changing and to identify what the future pressures may be.

The work of the Environment Agency's Evidence Directorate is a key ingredient in the partnership between research, guidance and operations that enables the Environment Agency to protect and restore our environment.

This report was produced by the Research, Monitoring and Innovation team within Evidence. The team focuses on four main areas of activity:

- **Setting the agenda**, by providing the evidence for decisions;
- **Maintaining scientific credibility**, by ensuring that our programmes and projects are fit for purpose and executed according to international standards;
- **Carrying out research**, either by contracting it out to research organisations and consultancies or by doing it ourselves;
- **Delivering information, advice, tools and techniques**, by making appropriate products available.



Miranda Kavanagh
Director of Evidence

Contents

1. Introduction	1
2. Water body impact categories	2
3. Water body validation and prioritisation	3
4. Mine site and discharge identification	3
5. Preparing for remediation: further investigations and monitoring (Programmes of Measures)	6
5.1 <i>Probably Impacted</i> water bodies	6
5.2 Catchment investigations – <i>Impacted</i> and <i>Probably Impacted</i> water bodies	7
6. Conclusions	8
References	8

List of tables

Table 1. Summary statistics showing final categorisation of water bodies across England and Wales (Stage 4, March 2009)	2
Table 2. Key information requested in Environment Agency questionnaire	6
Table 3. Example sites at which a phased approach to catchment monitoring is being undertaken by the Environment Agency	8
Table 4. Prioritisation of <i>Impacted</i> water bodies in the Western Wales RBD (all water bodies shown)	9
Table 5. Prioritisation of <i>Probably Impacted</i> water bodies in the Western Wales RBD (all water bodies shown)	12
Table 6. Mining discharge responses for Western Wales RBD (all sites for which data provided by Environment Agency)	14
Table 7. Mine sites in the Western Wales RBD where risk of sudden outbreak is confirmed or suspected to exist	20

List of figures

Figure 1. Water bodies <i>Impacted</i> or <i>Probably Impacted</i> by abandoned non-coal mines in the Western Wales RBD	4
Figure 2. Non-coal mine impact scores for <i>Impacted</i> and <i>Probably Impacted</i> water bodies in the Western Wales RBD	5

1. Introduction

The *Prioritisation of abandoned non-coal mine impacts on the environment* project has generated the most definitive evaluation to date of the impacts on the water environment from abandoned non-coal mines across England and Wales. For the first time, an objective assessment has been carried out to prioritise the rivers in England and Wales where pollution from these mines has the highest impact, and where there is the greatest risk that water bodies (river stretches) will fail to meet the objectives of the Water Framework Directive (European Community, 2000) due to abandoned non-coal mines. The specific water bodies which should be the focus of immediate attention in River Basin Management Plans (RBMPs) have been identified, and the work needed to address mining pollution through both research into passive treatment technologies and catchment monitoring investigations is outlined.

This is one of 13 reports that detail the final results of the implementation of the methodology across England and Wales. This particular report presents the finalisation of the categorisation of surface water bodies for the Western Wales River Basin District, and also details of mine sites and mine waters, to be used as a basis for directing future remediation planning and / or further data collection.

In every report the 13 reports that comprise the outputs of the project are listed, so that the reader may cross-reference between them at need. They are:

- I. *A methodology for identification and prioritisation of abandoned non-coal mines in England and Wales*
- II. *Prioritisation of abandoned non-coal mine impacts on the environment: The national picture*
- III. *Prioritisation of abandoned non-coal mine impacts on the environment in the Dee River Basin District*
- IV. *Prioritisation of abandoned non-coal mine impacts on the environment in the Northumbria River Basin District*
- V. *Prioritisation of abandoned non-coal mine impacts on the environment in the South West River Basin District*
- VI. *Prioritisation of abandoned non-coal mine impacts on the environment in the Western Wales River Basin District*
- VII. *Prioritisation of abandoned non-coal mine impacts on the environment in the Humber River Basin District*
- VIII. *Prioritisation of abandoned non-coal mine impacts on the environment in the North West River Basin District*
- IX. *Prioritisation of abandoned non-coal mine impacts on the environment in the Severn River Basin District*
- X. *Prioritisation of abandoned non-coal mine impacts on the environment in the Anglian, Thames and South East River Basin Districts*
- XI. *Prioritisation of abandoned non-coal mine impacts on the environment in the Solway-Tweed River Basin District*
- XII. *Future management of abandoned non-coal mine water discharges*
- XIII. *Hazards and risk management at abandoned non-coal mine sites*

Much of the text in the individual River Basin District (RBD) reports (reports III-XI) are common to all 9 reports, though the information in the tables is different. A detailed description of the methodology used to produce these results is provided in Report I, while Report II provides a national overview of the findings. Implications of the results for future management of abandoned non-coal mine sites is dealt with at length in Report XII, while specific detail of the outputs of the data collated on mine hazards and risk management is provided in Report XIII. It is recommended that the individual RBD reports are read in conjunction with these other national-level reports.

2. Water body impact categories

The initial stage of the prioritisation exercise comprised use of existing data, from various sources, to categorise surface water bodies as *Impacted*, *Probably Impacted*, *Probably Not Impacted* and *Not Impacted*. This exercise was based on the spatial relationship between Environmental Quality Standard (EQS¹) failures in mining areas, or EQS failures immediately downstream of a mining area as described in detail in the Methodology report. The impact categories grade from *Impacted* where water quality failures are coincident in a water body with former mine sites, to catchments where the quality failures are either not associated with any former mining areas, or there are no reported water quality issues (*Not Impacted* water bodies). The risk categories prefixed “probably” are there to indicate uncertainty in the nature and extent of the link between mining and pollution. *Probably Impacted* describes a water body where there is a pollution problem but uncertainty persists as to whether the mining activity and downstream pollution issue are explicitly connected, either due to distance between source and receptor, or where there are no recorded mine sites in a polluted former mining area. *Probably Not Impacted* water bodies are those in mining areas where there is no water quality concern either in the host or downstream water body. The final numbers of water bodies in each of the impact categories are detailed by RBD in Table 1.

Table 1. Summary statistics showing final categorisation of water bodies across England and Wales (Stage 4, March 2009)

River Basin District (RBD)	Impacted	Probably Impacted	Probably Not Impacted	Not Impacted	Total
Anglian	0	1	181	831	1013
Dee	9	10	10	71	100
Humber	13	18	151	734	916
North West	15	27	63	427	532
Northumbria	28	39	38	262	367
Severn	31	32	89	599	751
Solway-Tweed	3	6	29	149	187
South East	0	0	88	308	396
South West	57	73	325	680	1135
Thames	0	0	154	490	644
Western Wales	70	37	143	619	869
Grand Total	226	243	1271	5170	6910

¹ The EQS values used for this project are detailed in the methodology report – see reference list. The metals / metalloids assessed were cadmium, lead, nickel, zinc, copper, iron, manganese, and arsenic.

3. Water body validation and prioritisation

After the initial categorisation of water bodies an online questionnaire was used to collate data from local experts at the Environment Agency. This process served to clarify whether the categorisations were valid (e.g. were area staff aware that the pollution in the mining area was due to something other than abandoned non-coal mines?) and to gather information on the extent of impact of non-coal mine pollution on other receptors (ecology, groundwater and water resources). Figure 1 shows the categorisation of water bodies in the Western Wales RBD. This information was used to allocate an individual score to each of the *Impacted* and *Probably Impacted* water bodies to describe the extent of the impacts of abandoned non-coal mine drainage, shown in Figure 2 (for details of the scoring system refer to the Methodology report).

Tables 4 and 5 (located at the end of the report) show the respective impact scores for the *Impacted* and *Probably Impacted* water bodies in the Western Wales RBD. By reading this report in conjunction with Report II (*The National Picture*), it is possible to see how the results fit into the national prioritisation. These tables contain only a selection of the results with the full details available as a database or a series of GIS (Geographical Information System) layers.

4. Mine site and discharge identification

The online questionnaire also collated data specific to mine sites themselves within the priority water bodies. A range of information was collected (Table 2) covering known polluting sites, the presence of point and diffuse pollution, water quality, flow rates, stakeholder concerns and risks and hazards at abandoned sites. This stage provides the crucial link between prioritising impacted water bodies (Tables 4 and 5) and identifying the polluting mine sites within them that could be the focus for future catchment scoping studies (see Section 5).

Summary details of all mining discharges identified in the Western Wales RBD are presented in Table 6 while Table 7 shows all sites identified where outbreak risk received either a 'Suspected' or 'Yes' response. It is important to note that not all of the data gathered during the project is shown in the tables. This is simply because it is not possible to present all of this information in a written report such as this. The main items that have been omitted are:

- Water quality and flow-rate data for discharges where it is available
- Text comments relating to evidence of impacts and risks, and whether stakeholder issues are converging or diverging
- Detailed geographical references, such as grid references and water body identifier codes.
- Stability, airborne pollution, safety issues, public / animal health concern information which is summarised nationally in the *Hazards and Risk Management* report and presented in their entirety in the database.

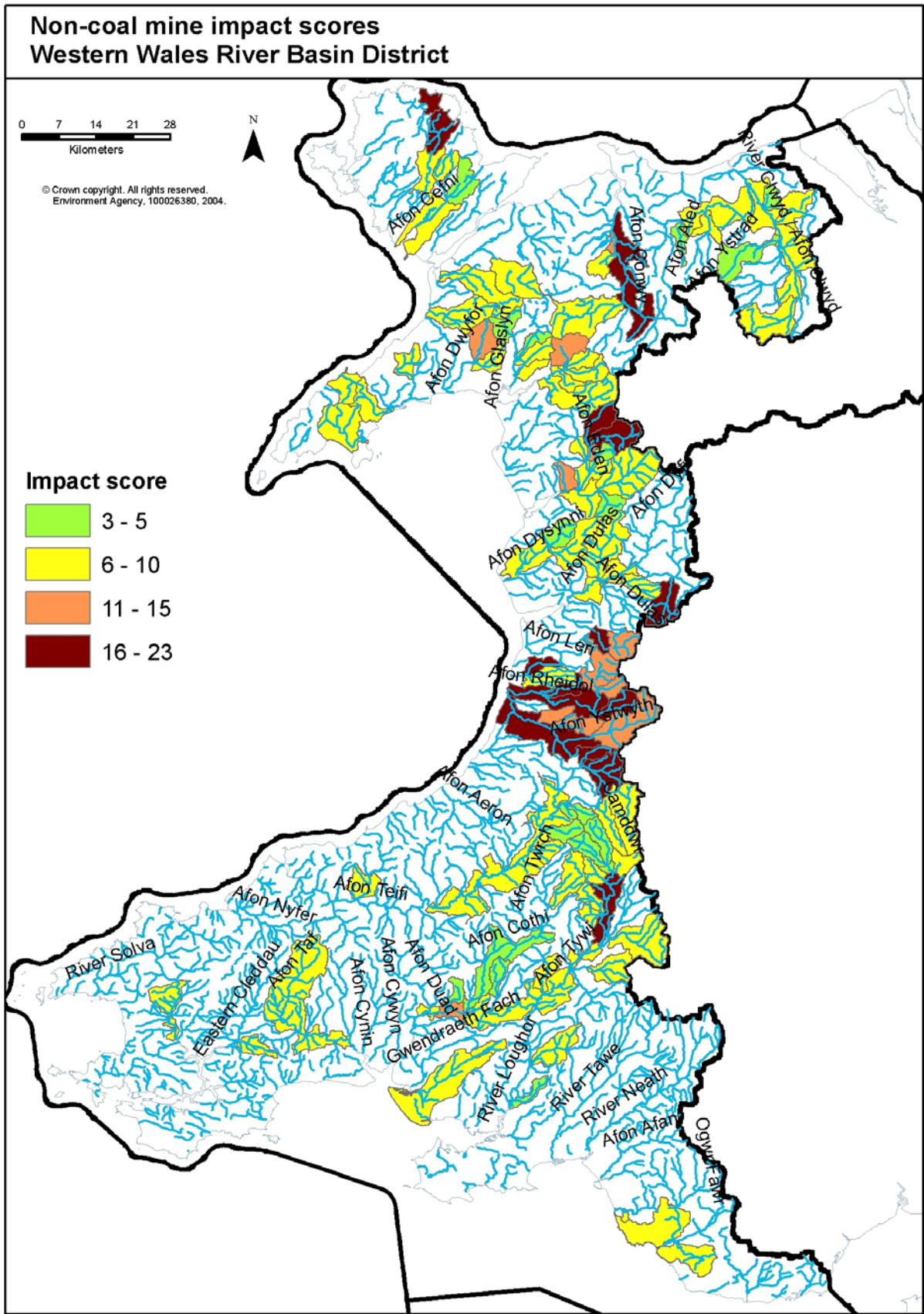


Figure 2. Non-coal mine impact scores for *Impacted* and *Probably Impacted* water bodies in the Western Wales RBD

Table 2. Key information requested in Environment Agency questionnaire

Question / information requested	Comment
Water Body ID and Name	Information provided by Consortium
EQS failure co-ordinates and score	Information provided by Consortium
Categorisation (e.g. <i>Impacted</i> etc.)	Information provided by Consortium
Locations of point mine water discharges within water bodies with EQS failures, or in water bodies immediately upstream of water body with EQS failure	Required to characterise <i>Impacted</i> and <i>Probably Impacted</i> water bodies
If there is a mine water discharge (either point or diffuse) known or suspected then further information on the discharge is required	Including receiving watercourse name, groundwater, ecological and higher impacts, stakeholder information, and water quality
Knowledge of historical mines, irrespective of water pollution issues	Including mine location and name (if known), airborne pollution risk, safety concerns, stability concerns and outbreak risk

5. Preparing for remediation: further investigations and monitoring (Programmes of Measures)

This project has identified the surface water bodies which show the greatest impacts from abandoned non-coal mines, and so should be prioritised for action in the first cycle of River Basin Planning (RBP).

5.1 *Probably Impacted* water bodies

Many water bodies in mining areas are in the *Probably Impacted* category since we do not have water quality data from within the water body itself. We know that abandoned non-coal mines are present but not if they are the specific cause of the downstream pollution. Collecting new data on metal concentrations in these rivers would allow these water bodies to be moved either to *Probably Not Impacted* (if no EQS failures are identified) or to *Impacted* (if EQS are exceeded). All the data tables within the database are editable beyond the timescale of the project to allow such re-categorisation as new information comes to light.

Monitoring would need to be carried out over a 12 month period (ideally at monthly frequency) to ensure variation due to seasonal and flow effects is evaluated. It is recommended that collection of these data is prioritised in the first RBP cycle for the *Probably Impacted* water bodies with the highest impact scores (see Table 5).

5.2 Catchment investigations – *Impacted and Probably Impacted* water bodies

Unfortunately, with very few exceptions, we do not have sufficient monitoring data in any water bodies to allow remediation measures to be designed and implemented. This is the case even in the *Impacted* water bodies where we are confident that the pollution is due to abandoned mines, and have been able to identify significant point sources. This is a function of the type of monitoring data that need to be collected to characterise mine water pollution for remediation. Concentrations of metals in rivers or mine water discharges alone are not adequate, the flow must also be measured so that the loading (flux) can be calculated. Such data are rarely available from the Environment Agency's routine monitoring.

As a result, the first stage of implementing Programmes of Measures (POMs) for abandoned non-coal mine pollution is to carry out detailed synchronous monitoring of water quality and flow over at least a 12 month period in affected catchments. These further investigations will allow management and remediation schemes to be implemented in the second and third RBP cycle. If these data are not collected during the first RBP cycle, then it will not be possible to address the threat that pollution from abandoned mines poses to good ecological and chemical status.

The design and execution of such catchment monitoring programmes is described in the accompanying *Future Management of Abandoned Non-Coal Mine Discharges* report, and a comprehensive example of such a study is provided by Mayes *et al.* (2008). In general terms a phased approach is recommended:

1. Scoping study of the catchment (water body scale) to identify main sources of pollution using existing water quality data and other information sources. The data reported in Tables 4, 5 and 6 will inform these studies.
2. Design and implementation of detailed monitoring programmes to collect synchronous measurements of water quality and flow, as well as investigation of the river ecology over a period of at least 12 months.
3. Subject to the results of the monitoring programme, carry out feasibility study for the design and implementation of appropriate management and remediation measures, including pilot-scale treatment trials where appropriate. The suitability of various passive approaches to treatment is provided in the *Future Management of Abandoned Non-Coal Mine Discharges* report, and also by PIRAMID Consortium (2003).
4. Construct and operate management and remediation measures.

Examples of sites at which this phased approach is being implemented by the Environment Agency are shown in Table 3.

Table 3. Example sites at which a phased approach to catchment monitoring is being undertaken by the Environment Agency

RBD	Mine site / catchment
Western Wales	Parys Mountain, Cwm Rheidol, Dylife, Frongoch, Cwmystwyth, Conwy (Nant Gwydyr/Afon Crafnant)
Dee	Clywedog
Northumbria	Saltburn Gill, Rookhope Burn
North West	Coledale Beck

6. Conclusions

By assessing mine waters using water quality, ecological, groundwater and higher impact metrics it has proved possible to objectively prioritise *Impacted* and *Probably Impacted* water bodies into ranked lists. Furthermore, additional data stored in the database enables environmental managers to assess what the other issues are at these sites, such as safety issues, outbreak risk and stakeholder concerns. This information can be used to inform future management of pollution from abandoned non-coal mine sites.

References

- European Community (2000). Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy. The Official Journal of the European Communities.
- Mayes, W.M., Gozzard, E., Potter, H.A.B. and Jarvis, A.P. (2008) Quantifying the importance of diffuse minewater pollution in a historically heavily coal mined catchment, *Environmental Pollution*, **151**, 165-175.
- PIRAMID Consortium (2003) *Engineering guidelines for the passive remediation of acidic and/or metalliferous mine drainage and similar wastewaters*. Passive In-situ Remediation of Acidic Mine / Industrial Drainage (PIRAMID) report, European Commission Fifth Framework Programme. Newcastle University.

Table 4. Prioritisation of *Impacted* water bodies in the Western Wales RBD (all water bodies shown)

RBD priority rank ²	Water body name	Water Body ID	EQS Score	Ranked EQS Score	Ecological Impact score	Higher Impact score	Groundwater Impact score	Overall Impact score ¹
1	Rheidol - confluence with Castell to tidal limit	GB110063041570	18	8	5	5	3	21
2	Tywi - conf with Doethie to conf with Gwydderig	GB110060036350	17	8	5	5	3	21
3	Goch Amlwch	GB110102059230	19	9	2	5	3	19
=	Gain	GB110064054640	19	9	2	5	3	19
5	Llechwedd Mawr - HW to Nant y Moch reservoir	GB110063041650	10	6	5	5	3	19
=	Melindwr - headwaters to confluence with Rheidol	GB110063041590	10	6	5	5	3	19
7	Mawddach - upper	GB110064054620	19	9	1	5	3	18
8	Meurig - headwaters to confluence with Teifi	GB110062043550	12	6	5	5	2	18
9	Goch Dulas	GB110102059000	15	7	2	5	3	17
10	Twymyn - upper	GB110064048320	14	7	5	5	0	17
11	Teifi - headwaters to confluence with Meurig	GB110062043540	6	4	5	5	3	17
12	Bow Street Brook - headwaters to conf with Clarach	GB110063041630	5	4	5	5	3	17
13	Conwy - tidal limit to Merddwr	GB110066060030	10	6	2	5	3	16
=	Ystwyth - conf with Cwmnewydion to tidal limit	GB110063041710	10	6	2	5	3	16
15	Goedol	GB110065053720	15	7	2	5	1	15
16	Mawddach - middle	GB110064048730	9	5	2	5	3	15
17	Hengwm - conf with Llechwedd-mawr to Rheidol conf	GB110063041640	6	4	2	5	2	13
=	Castell - headwaters to confluence with Rheidol	GB110063041580	6	4	2	5	2	13
19	Cwmnewydion - headwaters to conf with Ystwyth	GB110063041670	15	7	2	0	3	12
20	Magwr - headwaters to confluence with Ystwyth	GB110063041680	13	7	2	0	3	12
21	Dwyfawr - upper	GB110065053740	5	4	2	5	1	12
22	Cwm-Mynach	GB110064048820	2	3	2	5	2	12
23	Hengwm - headwaters to Nant y Moch reservoir	GB110063041660	1	3	2	5	2	12
24	Ystwyth - headwaters to conf with Cwmnewydion	GB110063041720	12	6	2	0	3	11
25	Tywi - confluence with Cothi to spring tidal limit	GB110060029290	2	3	1	5	2	11
26	Alun - headwaters to confluence with Ewenny	GB110058026220	8	5	0	5	0	10
=	Dwryrd - lower	GB110065053600	8	5	0	5	0	10

=	Clarach - headwaters to conf with Bow Street Brook	GB110063041610	8	5	2	0	3	10
=	Gwydderig - headwaters to confluence with Bran	GB110060035940	8	5	0	5	0	10
30	Kenfig - Nant Cwm Philip conf to Margam Moors conf	GB110058026160	4	4	1	5	0	10
31	Dulas North	GB110064048570	2	3	1	5	1	10
=	Llyfni	GB110065053970	2	3	1	5	1	10
33	Cwmystradllyn	GB110065053690	1	3	2	5	0	10
34	Teigl	GB110065053670	6	4	0	5	0	9
=	Teifi - Camddwr conf to Nant Wern-macwydd conf	GB110062043562	6	4	0	5	0	9
36	Aman - conf with Garnant to conf with Loughor	GB110059032140	4	4	0	5	0	9
=	Dysynni - upper	GB110064048530	4	4	0	5	0	9
=	Dyfi - tidal limit to Afon Twymyn	GB110064048390	4	4	0	5	0	9
39	Crafnant	GB110066054880	2	3	1	5	0	9
=	Clwyd - tidal limit to Hesbin	GB110066059960	2	3	1	5	0	9
41	Ceri - headwaters to confluence with Teifi	GB110062039110	1	3	1	5	0	9
=	Dulais - conf with Ddu to confluence with Tywi	GB110060036210	1	3	1	5	0	9
43	Ogmore - confluence with Llynfi to tidal limit	GB110058026280	3	3	0	5	0	8
=	Gwendraeth Fawr - Afan Goch to tidal limit	GB110060029062	3	3	0	5	0	8
=	Gwendraeth Fawr - headwaters Afan Goch	GB110060029061	3	3	0	5	0	8
=	Taf - headwaters to confluence with Cynin	GB110060036280	3	3	0	5	0	8
=	Tywi - Bishop's Pond to conf with Gwili and TL	GB110060029590	3	3	0	5	0	8
48	Lledr	GB110066054940	2	3	0	5	0	8
=	W. Cleddau - Anghof conf to Cartlett Brook conf	GB110061031340	2	3	0	5	0	8
=	Gwyrfai	GB110065054190	2	3	0	5	0	8
=	Nant Peris	GB110065054010	2	3	0	5	0	8
=	Prysor	GB110065053750	2	3	0	5	0	8
53	Elwy - Clwyd to Afon Melai	GB110066060020	1	3	0	5	0	8
=	Soch	GB110065053760	1	3	0	5	0	8
=	Cynfal	GB110065053630	1	3	0	5	0	8
56	Bran - headwaters to confluence with Ydw	GB110060036220	11	6	1	0	0	7
57	Mawddach - lower	GB110064048710	7	5	2	0	0	7
58	Cothi - headwaters to confluence with Twrch	GB110060036050	5	4	1	0	2	7
59	Camddwr - headwaters to Llyn Brianne reservoir	GB110060041350	6	4	2	0	0	6

60	Tywi - headwaters to Llyn Brianne reservoir	GB110060041360	5	4	2	0	0	6
=	Tywi - Llyn Brianne to confluence with Doethie	GB110060036380	5	4	2	0	0	6
62	Clywedog - headwaters to confluence with Teifi	GB110062039200	3	3	1	0	2	6
63	Gaseg - upper	GB110065053840	1	3	2	0	1	6
64	Colwyn	GB110065053950	5	4	0	0	0	4
65	Brefi - headwaters to confluence with Teifi	GB110062039250	4	4	0	0	0	4
66	Nanmor	GB110065053930	2	3	1	0	0	4
67	Brennig - headwaters to confluence with Teifi	GB110062043480	3	3	0	0	0	3
=	Berwyn - headwaters to confluence with Groes	GB110062043470	3	3	0	0	0	3
=	Wen (Mawddach)	GB110064048740	3	3	0	0	0	3
70	Doethie - Pysgotwr Fawr conf to conf with Tywi	GB110060036360	2	3	0	0	0	3

Note: 1. Overall impact score = Ranked EQS + Ecological Impact + Higher Impact + Groundwater Impact. 2. EQS Score used to determine Overall priority rank where Overall impact scores are equal

Table 5. Prioritisation of *Probably Impacted* water bodies in the Western Wales RBD (all water bodies shown)

RBD priority rank ²	Water body name	Water Body ID	EQS Score	Ranked EQS Score	Ecological Impact score	Higher Impact score	Groundwater Impact score	Overall Impact score ¹
1	Mynach - headwaters to confluence with Rheidol	GB110063041560	18	8	1	5	2	16
2	Llanfihangel - headwaters to conf with Ystwyth	GB110063041690	10	6	1	5	0	12
3		GB110066060040	10	6	0	5	0	11
4	Gwenffrwd - headwaters to confluence with Tywi	GB110060036370	17	8	2	0	0	10
5	Dwryrd - upper	GB110065053610	8	5	0	5	0	10
6	Dunant - headwaters to confluence with Tywi	GB110060036320	17	8	1	0	0	9
7	Croesor	GB110065053890	6	4	0	5	0	9
8	Nant Gwydol	GB110064048340	4	4	0	5	0	9
=	Dulas South - lower	GB110064048290	4	4	0	5	0	9
10	Cefni - tidal limit to Ceint	GB110102058670	3	3	1	5	0	9
=	Erch - upper	GB110065053700	3	3	1	5	0	9
12	Wheeler - lower	GB110066059930	2	3	1	5	0	9
13	Aled - Elwy to Deunant	GB110066059770	1	3	1	5	0	9
=	Wnion - upper	GB110064048840	1	3	1	5	0	9
=	Wnion - lower	GB110064048800	1	3	1	5	0	9
16	Gwenlais - headwaters to confluence with Tywi	GB110060036340	17	8	0	0	0	8
17	Narbeth Brook - headwaters to conf with E. Cleddau	GB110061030660	3	3	0	5	0	8
18	Dysynni - lower	GB110064048440	2	3	0	5	0	8
=	Tywi (Llandovery Bran to Cothi confl)	GB110060036250	2	3	0	5	0	8
=	Clwyd - upstream Hesbin	GB110066054670	2	3	0	5	0	8
=	Geirch	GB110065054130	2	3	0	5	0	8
18	Penrhos	GB110065054120	2	3	0	5	0	8
23	Cefni - Cefni reservoir west	GB110102058790	7	5	1	0	0	6
=	Cefni - Cefni reservoir east	GB110102058780	7	5	1	0	0	6
=	Eden - lower	GB110064048750	7	5	1	0	0	6
26	Dulais - headwaters to confluence with Loughor	GB110059032080	4	4	1	0	0	5
27	Ystrad	GB110066054950	2	3	2	0	0	5
28	Cadair	GB110064048520	4	4	0	0	0	4

29	Ceint	GB110102058940	3	3	1	0	0	4
30	Bach	GB110066059950	2	3	1	0	0	4
=	Pysgotwr Fawr - headwaters to conf with Doethie	GB110060036390	2	3	1	0	0	4
=	Annell - headwaters to confluence with Tywi	GB110060029350	2	3	1	0	0	4
33	Nant Melai	GB110066059710	1	3	1	0	0	4
=	Clywedog (Wnion)	GB110064048790	1	3	1	0	0	4
=	Sannan - headwaters to confluence with Dulas	GB110060036200	1	3	1	0	0	4
36	Cothi - headwaters to confluence with Tywi	GB110060036300	2	3	0	0	0	3
=	Doethie - headwaters to conf with Pysgotwr Fawr	GB110060036400	2	3	0	0	0	3

Note: 1. Overall impact score = Ranked EQS + Ecological Impact + Higher Impact + Groundwater Impact. 2. EQS Score used to determine Overall priority rank where Overall impact scores are equal

Table 6. Mining discharge responses for Western Wales RBD (all sites for which data provided by Environment Agency)²

Water Body	Discharge name	Associated mine(s)	Receiving watercourse	Diffuse Pollution	Eco. Impact	G/W Impact	Higher Impact	Visual Impact	Stakeholder Issues	Complaints
GB110060029290		Cystanog	Tywi - confluence with Cothi to spring tidal limit	Suspected	Unknown	Suspected	Unknown	No	Unknown	No
GB110060036050		Dolaucothi	Cothi - headwaters to confluence with Twrch	Suspected	Unknown	Suspected	No	No	Suspected	Unknown
GB110060036350	Nant y Mwyn Upper Boat Adit	Nant y Mwyn	Nant y Bai (Twyi)	Yes	Suspected	Suspected	No	No	Suspected	No
GB110060036350	Nant y Mwyn Lower Boat Adit	Nant y Mwyn	Nant y Mwyn (Twyi)	Yes	Yes	Suspected	Yes	Yes	Yes	Yes
GB110062039200		Llanfair	Clywedog - headwaters to confluence with Teifi	Yes	Unknown	Suspected	No	No	Suspected	No
GB110062043540	Cwm Mawr Adit	Cwm Mawr	Nant y Cwn/Nant Lluet (Teifi)	Unknown	No	Suspected	Suspected	No	Unknown	No
GB110062043540	Cwm Mawr Stream	Cwm Mawr	trib from Penwern Hir (Teifi)	Suspected	No	Suspected	Suspected	No	Unknown	No
GB110062043540	Abbey Consoles Stream 1	Abbey Consoles	Teifi - headwaters to confluence with Meurig	Unknown	Yes	Suspected	Yes	No	Yes	No
GB110062043540	Abbey Consoles Stream 2 fines runoff	Abbey Consoles	Teifi - headwaters to confluence with Meurig	Suspected	Yes	Yes	Yes	No	Yes	No
GB110062043550	Esgair Mwyn Tailings runoff	Esgair Mwyn Old	Nant Garw (Meurig)	Yes	Yes	Suspected	No	No	Yes	Yes
GB110062043550	Nant Garw	Esgair Mwyn Old	Marchnant (Meurig)	Yes	Yes	Suspected	No	No	Yes	Yes
GB110062043550	Esgair Mwyn Adit	Esgair Mwyn New	Nant Cwm Gwydyll (Meurig)	No	Unknown	Suspected	No	No	Yes	No
GB110062043550	Llwynllwyd Adit	Llwynllwyd	Nant Cwm Gwydyll (Meurig)	Suspected	Suspected	Suspected	No	No	Unknown	No
GB110063041560		Nant y Creiau	Myherin (Mynach - headwaters to	Yes	Unknown	Suspected	No	No	Suspected	No

² Note that not all information gathered is included in this table; limited data included only due to difficulties of presentation of all data in printed format. The complete dataset is available with the GIS files associated with these reports.

			confluence with Rheidol)							
GB110063041570	Cwm Rheidol Adit 6	Cwm Rheidol	Rheidol via filter	Suspected	Yes	Suspected	No	Yes	Yes	No
GB110063041570	Cwm Rheidol Adit 9	Cwm Rheidol	Rheidol via filter	Suspected	Yes	Suspected	No	Yes	Yes	No
GB110063041570	Tynyfron adit	Tynyfron	Nant Harvest Hall (Rheidol)	Suspected	Yes	Suspected	No	Yes	Yes	Yes
GB110063041570		Gwaithgoch	Rheidol	Yes	Suspected	Suspected	No	No	Suspected	Yes
GB110063041570		Temple	Rheidol	Suspected	Suspected	Suspected	No	No	Suspected	Yes
GB110063041570		Ystumtuen	Tuen (Rheidol)	Yes	Suspected	Suspected	No	No	Suspected	Yes
GB110063041570		Pooles	Llywernog (Rheidol)	Yes	Suspected	Suspected	No	No	Suspected	Yes
GB110063041570		Bwadrain	Bwadrain and Rheidol	Suspected	Unknown	Suspected	Yes	No	Suspected	No
GB110063041570		Powells	Llywernog (Rheidol)	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041570		Clara	Llywernog (Rheidol)	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041570		Caegynon	Rheidol	Yes	Unknown	Suspected	Unknown	No	Yes	Yes
GB110063041570		Erwtomau	Rheidol	Suspected	Unknown	Suspected	No	No	Suspected	No
GB110063041570		Llywernog	Llywernog (Rheidol)	Yes	Unknown	Suspected	No	No	Yes	No
GB110063041570		Llwynteifi	Rheidol	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041570		Penrhiw	Tuen and Rheidol	Yes	Suspected	Suspected	Suspected	No	Yes	Yes
GB110063041570		Nantglas	Rheidol	Yes	Unknown	Suspected	No	No	Unknown	No
GB110063041570		Rhiwrugos	Rheidol	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041570		Foxpath	Rheidol	Suspected	Unknown	Suspected	Suspected	No	Yes	Yes
GB110063041570		Nantglas Uchaf	Rheidol	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041570		Alltddu	Rheidol	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041580		Castell	Castell	Yes	Suspected	Suspected	No	No	Suspected	Yes
GB110063041580		Esgairlle	Castell	Yes	Suspected	Suspected	No	No	Suspected	Yes
GB110063041590	Bwlch Adit	Bwlch	Melindwr	Suspected	Suspected	Suspected	No	No	Yes	No
GB110063041590	Goginan scheme drainage	Goginan	Melindwr	Yes	Suspected	Suspected	No	No	Yes	No
GB110063041590		Bryn Pica	Melindwr - headwaters to confluence with Rheidol	Suspected	Unknown	Suspected	No	No	Unknown	Unknown

GB110063041590		mine u/s Cwmbrwyno Br	Melindwr	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041590		cwmbrwyno	Melindwr	Yes	Suspected	Suspected	No	No	Unknown	No
GB110063041590			Melindwr - headwaters to confluence with Rheidol	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GB110063041610	Bwlch upstream pipe in headwall	Bwlch	Nant Erfyn (Clarach)	Suspected	Suspected	Yes	No	No	Yes	Yes
GB110063041610	Daren Olivers Adit	Daren	Nant Erfyn (Clarach)	Suspected	Unknown	Yes	No	Yes	Suspected	No
GB110063041610	Daren Bushells Adit	Daren	Nant Peithyll (Clarach)	Yes	Unknown	Suspected	No	No	Suspected	No
GB110063041610	Cwm Symlog concrete channel	Cwm Symlog	Nant Symlog (Clarach)	Yes	No	Suspected	No	No	Suspected	Yes
GB110063041610	Cwm Symlog upwelling	Cwm Symlog	Nant Symlog (Clarach)	Yes	No	Suspected	No	Yes	Suspected	Yes
GB110063041610		Penycefn	trib Stewi (Clarach)	Yes	Unknown	Suspected	No	No	Yes	No
GB110063041610		Bronfloyd	Silo (Clarach)	Yes	Suspected	Suspected	No	No	Unknown	No
GB110063041630		Elgar	Bow Street Brook - headwaters to conf with Clarach	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041630		Mynydd Gorddu	Bow Street Brook - headwaters to conf with Clarach	Yes	Unknown	Suspected	No	No	Suspected	No
GB110063041630			Bow Street Brook - headwaters to conf with Clarach	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GB110063041640		Bryn yr Afr	Dam (Hengwm)	Yes	Unknown	Suspected	No	No	Suspected	No
GB110063041640		Camdwr Bach	Hengwm - conf with Llechwedd-mawr to Rheidol conf	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041640		Esgair Hir	Hengwm - conf with Llechwedd-mawr to Rheidol conf	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041640		Camdwr Bach	Hengwm - conf with Llechwedd-mawr to Rheidol conf	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041640		Bog	Hengwm - conf with Llechwedd-mawr to Rheidol conf	Suspected	Unknown	Suspected	No	No	Unknown	No

GB110063041650	Copper shaft adit a	Esgair Ffraith	Lluestgota (Llechwedd Mawr)	Yes	Suspected	Suspected	No	No	Yes	No
GB110063041650	Copper shaft adit b	Esgair Ffraith	Lluestgota (Llechwedd Mawr)	Yes	Suspected	Suspected	No	No	Yes	No
GB110063041650	East Level	Esgair Ffraith	Lluestgota (Llechwedd Mawr)	Yes	Yes	Yes	No	Yes	Yes	No
GB110063041660		Esgair Hir	Nant Ddu (Hengwm)	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041670	Frongoch Adit	Frongoch	Cwmnewyddion	Yes	Suspected	Yes	No	No	Yes	No
GB110063041680		Graig goch	Magwr - headwaters to confluence with Ystwyth	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041680		Wemyss	Magwr - headwaters to confluence with Ystwyth	Yes	Suspected	Suspected	No	No	Suspected	Yes
GB110063041680		Frongoch West	Magwr - headwaters to confluence with Ystwyth	Suspected	Unknown	Suspected	No	No	Unknown	No
GB110063041710	Level Fawr	Glogfawr, Glogfach, Logaulas and Penygist	Ystwyth - conf with Cwmnewyddion to tidal limit	Yes	Suspected	Yes	Yes	No	Yes	Yes
GB110063041710	Frongoch stream	Frongoch	Cell (Ystwyth)	Yes	Suspected	Yes	No	No	Yes	No
GB110063041710		Grogwynion	Ystwyth - conf with Cwmnewyddion to tidal limit	Yes	Suspected	Suspected	No	No	Yes	No
GB110063041720	Pughs Adit	Cwmystwyth	Ystwyth - headwaters to conf with Cwmnewyddion	Yes	Suspected	Yes	No	Yes	Yes	Yes
GB110063041720	Gills Lower adit	Cwmystwyth	Ystwyth - headwaters to conf with Cwmnewyddion	Yes	Suspected	Yes	No	No	Suspected	No
GB110063041720	Kingside adit	Cwmystwyth	Ystwyth - headwaters to conf with Cwmnewyddion	Yes	Suspected	Yes	No	No	Suspected	No
GB110063041720	Ystwyth Fault	Cwmystwyth	Ystwyth - headwaters to conf with Cwmnewyddion	Yes	Suspected	Yes	No	No	Suspected	No

GB110064048320	Dylife	Dylife	Twymyn - upper		Yes	No	YES			
GB110064048440	Tonfanau Quarry	Tonfanau quarry (granite quarry)	Afon Dysynni	No	No	No	No	No	Yes	Yes
GB110064048570	Not known	Not known (Old slate quarry at Corris Craft centre, uncertain of exact location of mine discharge)	Afon Deri (Dulas North)	Yes	Unknown	Unknown	Unknown	No	No	No
GB110064048570	Abercwmeiddaw	Abercwmeiddaw - old slate workings site drainage. Site landscaped late 1980's.	Nant Cwmeiddaw (Dulas North)	Yes	Unknown	Unknown	Unknown	No	No	No
GB110064048570	Aberllefenni Slate Quarry	Aberllefenni Slate Quarry consented site drainage. Consent CG0119001.	Dulas North	Yes	Unknown	Unknown	Unknown	No	No	Yes
GB110064048730	Gwynfynydd	Gwynfynydd	Mawddach - middle	Suspected	Suspected	Yes	Yes	No	Yes	Yes
GB110064048730	Not known	Not known. Located next to Ferndale house	Afon Mawddach (middle)	Unknown	Unknown	Unknown	Yes	No	Yes	No
GB110064048820	Clogau	Clogau (gold mine)	Afon Cwm Llechen (Cwm-Mynach)	Yes	Suspected	Suspected	No	No	No	No
GB110064054620	Gwynfynydd Gold Mine	Gwynfynydd	Mawddach - upper	Yes	Unknown	Unknown	Yes	Yes	Yes	Yes
GB110065053720	Oakley Quarry	Oakley Quarry (slate quarry)	Afon Barlwyd (Goedol)	Yes	Suspected	Unknown	Yes	No	No	Yes
GB110065053720	Llechwedd quarry consented discharge	Llechwedd quarry (slate quarry)	Afon Barlwyd (Goedol)	Yes	Suspected	Unknown	Yes	No	No	Yes
GB110065053720	Llwyn y Gell	Llechwedd quarry (slate quarry)	Afon Barlwyd (Goedol)	Yes	Unknown	Unknown	Yes	No	No	Yes
GB110065053720	Lord's Street	Llechwedd quarry (slate quarry)	Afon Bowydd (Goedol)	Yes	Unknown	Unknown	Unknown	No	No	Yes

GB110065053740	Not known	Moel Hebog Mine	Afon Cwm Llefrith (Dwyfawr – upper)	Suspected	Unknown	Unknown	No	Yes	Yes	No
GB110065053840	Level Goch	Not known. Level Goch?	Afon Glaslyn (Gaseg – upper)	Suspected	No	Unknown	No	Yes	Yes	Yes
GB110065053840	Not known	Hafod y Porth	Afon y Cwm (Gaseg – upper)	Suspected	Unknown	Unknown	No	Yes	Yes	Yes
GB110065053970	Drws y Coed	Drws y Coed Copper mine	Afon Drws y Coed (Llyfni)	Suspected	Unknown	Unknown	No	No	No	No
GB110065053970	Dorothea discharge	Dorothea slate quarry	Afon Llyfni	Suspected	No	No	No	Yes	No	Yes
GB110066060030	Parc mine	Parc mine	Nant Gwydir (Conwy)	Yes	Suspected	Yes	Yes	Yes	Unknown	No
GB110066060030	Gwaenllifon adit	Parc mine	Llyn Parc (Conwy)	Yes	Suspected	Yes	Unknown	No	Unknown	No
GB110066060030	Pool adit / Pwl adit	Don't know	Afon Llugwy (Conwy)	Suspected	Unknown	Yes	Unknown	Yes	Unknown	Yes
GB110102059000	Dyffryn Coch	Parys Mountain mines complex	Southern valley lagoons and then into Afon Goch Dulas	Yes	Suspected	Yes	Yes	Yes	Yes	No
GB110102059000	Southern Lagoon	Parys Mountain mines complex	Afon Goch Dulas	Yes	Suspected	Suspected	Yes	No	Yes	Yes
GB110102059000	Mona adit	Parys Mountain mines complex	Mona and Henwaith ponds and then the Afon Goch Dulas	Yes	Suspected	Yes	Yes	No	Yes	No
GB110102059000	Mona / Henwaith ponds	Parys Mountain mines complex	Afon Goch Dulas	Yes	Suspected	Yes	Yes	No	Yes	No
GB110102059230	Dyffryn Adda adit (or Joint Level)	Parys Mountain mines complex	Afon Goch Amlwch	Yes	Suspected	Yes	Yes	Yes	Yes	Yes
GB110102059230	Morfa Ddu adit	Morfa Ddu mine	Afon Goch Amlwch	Yes	Suspected	Yes	Yes	No	Yes	No
GB110102059230	Run off from mountain and car park area	Parys Mountain mines complex	Stream draining to Afon Goch Amlwch	Yes	Suspected	Unknown	Yes	No	Yes	No
GB110064043570	Allt y Crib West Adit	Allt y Crib	Leri - lower	Suspected	Suspected	Suspected	No	No	Suspected	No
GB110064043570		Allt y Crib	Leri - lower	Suspected	Unknown	Suspected	No	No	Yes	Yes

Table 7. Mine sites in the Western Wales RBD where risk of sudden outbreak is confirmed or suspected to exist

Water Body	Mine	Outbreak Risk	Receiving watercourse	Details
GB110064043570	ALLTYCRIB	Yes	Leri	only if adit does collapse - it's full of water with no outfall at present
GB110063041570	CAEGYNON	Yes	Rheidol	suspicious upwelling in highway in high flows near buried adit
GB110063041570	CWM RHEIDOL	Yes	Rheidol	adit 9 unless it is drained down, adit 6 if stream breaks in to workings
GB110064048340	CWM NANT DDU	Yes	Nant Gwydol	Sizable copper mine - also lead present. Linked to Castle Rock and Dyfn gwm (large mine) - connected through. At Dyfn Gwm bags of zinc concentrate rotting adjacent to river.
GB110060036350	NANTYMWYN DEEP BOAT LEVEL I	Yes	Tywi - conf with Doethie to conf with Gwydderig	Adit 'fountains' to about 15ft in high flows
GB110060036350	NANTYMWYN	Suspected	Nant y Bai, Rhandirmwyn stream, Tywi	deep boat level 'fountains' about 15ft in high flows
GB110064048320	DYLIFE	Yes	Twymyn - upper	There is a flooded shaft on site above the level of the river
GB110063041640	HENFWLCH	Suspected	trib Nant y Moch dam (Hengwm)	No details
GB110063041720	CWMYSTWYTH	Suspected	Ystwyth - headwaters to conf with Cwmnewydion	Effluent may be emerging in river bed
GB110063041610	GWAITHCOCH	Suspected	Silo (Clarach - headwaters to conf with Bow Street Brook)	There is a concreted off adit just below the lake. the miners blocked it
GB110060036280	LLANFYRNACH	Suspected	Taf - headwaters to confluence with Cynin	don't know
GB110066060030	PARC	Suspected	Nant Gwydir (Conwy)	Suspected underground blockage
GB110064054620	GWYNFYNYDD	Suspected	Mawddach - upper	If pipe blocks
GB110064048730	GLASDIR MINE	Suspected	Afon Las / Afon Babi (Mawddach – middle)	It is alleged that there is an underground dam.

**Would you like to find out more about us,
or about your environment?**

Then call us on

08708 506 506* (Mon-Fri 8-6)

email

enquiries@environment-agency.gov.uk

or visit our website

www.environment-agency.gov.uk

incident hotline 0800 80 70 60 (24hrs)

floodline 0845 988 1188

* Approximate call costs: 8p plus 6p per minute (standard landline).
Please note charges will vary across telephone providers



Environment first: This publication is printed on recycled paper.