Inventory of closed mining waste facilities

Version 2, January 2014

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Executive summary

In 2006 the European Commission introduced a **Directive on the management of waste from the extractive industries** (The Mining Waste Directive). This aims to reduce the impacts of mining on the environment. Each Member State must produce an inventory of closed mining waste facilities that are causing serious environmental impacts by May 2012. This will improve our knowledge and facilitate rehabilitation, particularly to help deliver the environmental improvements necessary to achieve good ecological and chemical status for the Water Framework Directive.

The Department for Environment, Food and Rural Affairs (Defra) and Welsh Government appointed the Environment Agency to collate the inventory for England and Wales.

The UK has a long history of mining for minerals including metals, coal, aggregates, building stone and industrial minerals. This has contributed to our economic wellbeing but has left us with a legacy of hundreds of thousands of closed sites. Since 1969, we have had the legislation and organisations, including local authorities and ourselves, to prevent sites posing a risk to the public. Through the 1970s, 80s and 90s, the national provision of derelict land grants resulted in the reclamation of a large number of nuisance tips.

Using our data and information from the British Geological Survey, local authorities and others, we have applied risk assessment criteria to determine which sites are causing serious environmental impacts.

We have identified closed and abandoned mining waste facilities where the environmental impacts are sufficiently serious to be included in this inventory. The great majority of these sites are included because of the pollution they cause to rivers and streams. Other sites have been identified by local authorities as being "contaminated land", on fire or posing a risk because of instability.

In May 2012, the inventory included 148 sites in England and Wales. We have gathered further data and in January 2014, have identified 150 sites causing serious environmental impacts.

The Directive does not directly require us to take action to deal with the risks posed by these sites, but that action is being progressed by other means. Local authorities can use the Mines and Quarries (Tips) Act to ensure waste tips are stabilised and the Contaminated Land Regulations to address human health risks. We aim to reduce the water pollution from these sites through our work to meet the environmental improvement objectives of the Water Framework Directive.

Contents

1 Introduction and background

In 2006 the European Commission introduced **Directive 2006/21/EC of the European Parliament and of the Council on the management of waste from the extractive industries** (The Mining Waste Directive) (European Commission 2006).

The Directive's aim is to reduce as far as possible the negative effects of mining and to regulate the waste produced by mining industries. In summary, waste management plans and permits are required at operational waste facilities, and impacts of closed facilities are assessed for an inventory.

The Directive came into force in England and Wales on 7 July 2009 implemented by the Environmental Permitting (England and Wales) Regulations 2009.

Article 20 of the Directive requires Member States to publish, by 1 May 2012, an inventory of closed and abandoned mining waste facilities that are causing serious environmental impacts or have the potential to cause such an impact.

The objective of the inventory is to improve knowledge and facilitate rehabilitation, and it will help deliver the environmental improvements necessary to achieve good ecological and chemical status for the Water Framework Directive.

This report summarises the results of the inventory in England and Wales, and explains the methodology used. In January 2014, the report and inventory were updated in light of additional data.

1.1 The situation in England and Wales

We have an extensive legacy of mining and quarrying in England and Wales. Flint was mined in Norfolk on a semi industrial scale in the Neolithic period and there are numerous examples of Bronze Age copper workings, for example at the Great Orme in North Wales. The Roman occupation led to an expansion in lead, gold and silver mining but it was the industrial revolution that brought Britain's mining industry to its peak of production in the 18th and 19th centuries. Estimates of the number of mines vary but it is known that there are over 170,000 coal mine entries and at least 5,500 non-ferrous metal mines. There are also significantly more workings for sand, gravel, aggregates and building stone. The great majority of these workings have been abandoned. The 2008 Directory of Mines and Quarries (Cameron, 2008) identified 2,455 active mineral workings in the United Kingdom as a whole, of these no more than 35 were underground (deep) mines.

The first legislation specifically to deal with the management of mineral waste facilities arose from the Aberfan disaster of 1966 with the Mines and Quarries (Tips) Act 1969. The 1969 Act places a duty on local authorities to inspect all disused tips (waste facilities) and to ensure that they do not present a danger to the public by way of instability. If they do, remedial action can be enforced by a notice served on the owner or action taken by the local authority itself. The outcome of this was a comprehensive programme of land reclamation across the country through the 1970s, 80s and 90s which has resulted in the near eradication of nuisance tips that were unstable or otherwise posed a risk to human health. This vast programme of environmental improvements was largely financed by the provision of Derelict Land Grants, available to local authorities and development agencies to aid economic and environmental regeneration in areas blighted by industrial dereliction (Richards et al 1993).

The 1969 Act also made the mine or quarry manager responsible for the safety of the tips in his control at working sites and required the owner to deposit plans with the

Health and Safety Executive (Mines Inspectorate) on abandonment. Alongside planning laws (Mineral Planning Guidance) enforced by local authorities, this has meant that facilities closed since 1969 have been left in a stable and safe condition.

Since 2000, local authorities have a duty under the Contaminated Land Regulations (Part 2A, Environment Protection Act 1990) to inspect sites where land contamination is suspected to be causing human health, water pollution, ecology and property impacts. This includes mine sites, though it does exclude mine waters from mines abandoned before 1999, commensurate with our pollution control legislation. A small number of mine sites have already been formally determined as "contaminated land" under Part 2A. Many other potentially contaminated sites have not yet been inspected and so current local authority records are likely to underestimate the scale of the problem.

The problem of water pollution from abandoned mine sites has been recognised as a significant issue since at least the early 1990s (Environment Agency, 2008). The main pollutants are zinc, iron, cadmium, lead and copper. The Water Framework Directive has focussed attention on the issue through the 2009 River Basin Management Plans[1] which set out programmes of measures to address and improve the condition of water bodies that are failing to achieve Good Status[2]. Pollution from abandoned coal and non-coal mines contributes to 7% of status failures[3]. Unfortunately in most cases, no-one can be held liable for water pollution arising from mines that closed before 1999.

A study of abandoned non-coal mine pollution (NoCAM project), commissioned by Defra, Welsh Government and the Environment Agency, correlated known failures of water quality standards with the locations of abandoned non-coal mines to obtain a national picture of the scale of the problem (Environment Agency, 2012a, b, c). Sub-catchments defined as Water Framework Directive river water bodies were used as the base unit. 7% of water bodies were found to be impacted or probably impacted by abandoned non-coal mines. The NoCAM project did not differentiate between pollution caused by mine water discharges and that from mining waste facilities as abandoned mine sites typically have multiple sources contributing to the overall pollution. Local authorities were asked to identify sites where there were concerns about risks to human or animal health, stability, fire or air pollution (Environment Agency, 2012c). A large number of mining waste sites with the potential to cause environmental impacts were identified.

Detailed monitoring studies in numerous catchments show that during times of low to average flow, mine water discharges tend to dominate the impact on water quality. However at higher flow and particularly during heavy rainfall, mobilisation of contaminants from spoil heaps, tailings dams etc. becomes more significant (Mayes et al., 2008; Mayes et al., 2009; Gozzard et al., 2011). More detail on the pollution caused by abandoned mines can be found in Younger et al. (2002).

[1] See http://www.environment-agency.gov.uk/research/planning/33106.aspx
[2] To be at "good status", a surface water body needs to pass ecological and chemical quality elements.
[3] See http://www.environment-agency.gov.uk/business/topics/pollution/36564.aspx

2 Methodology development and assumptions

Article 20 of the Mining Waste Directive states:

“Member States shall ensure that an inventory of closed waste facilities, including abandoned waste facilities, located on their territory which cause serious negative environmental impacts or have the potential of becoming in the medium or short term a serious threat to human health or the environment is drawn up and periodically updated. Such an inventory, to be made available to the public, shall be carried out by 1 May 2012, taking into account the methodologies as referred to in Article 21[4], if available.”

This chapter explains the methodology and data used to create the inventory in England and Wales.

2.1 European Commission guidance

The European Commission and Member States set up a working group[5] in 2008 to aid the development of inventories, and implement Article 21 of the Directive which states:

"1. The Commission, assisted by the Committee referred to in Article 23, shall ensure that there is an appropriate exchange of technical and scientific information between Member States, with a view to developing methodologies relating to:

(a) the implementation of Article 20;

(b) the rehabilitation of those closed waste facilities identified under Article 20 in order to satisfy the requirements of Article 4. Such methodologies shall allow for the establishment of the most appropriate risk assessment procedures and remedial actions having regard to the variation of geological, hydrogeological and climatological characteristics across Europe."

Therefore the Directive requires Article 20 inventories to be based on risk assessment methods but does not require Member States to apply a standard harmonised risk assessment methodology. The working group published guidance (European Commission, 2011) in February 2011 with the following objective:

"…to provide guidance to Member States on the use of the Pre-selection Methodology established during consultations of the AHG [Ad-hoc Working Group] for the development of the inventory required by Article 20 of the MWD. It is not intended that the method provide either a rigid protocol or definitive advice on a Pre-selection methodology. The template presented offers an option on how the issue might be addressed, on how the protocol may be used by Member States if they believe that it is appropriate to their circumstances. Also some Member States may have already devised their own system or be advanced in the preparation of their inventory. The risk-based pre-selection protocol presented in this document should not replace the work already undertaken by Member States."

[4] See section 2.1
[5] Inventory of Closed Waste Facilities Ad-hoc Group, a sub-committee of the Technical Adaptation Committee for Directive 2006/21/EC.

This document provides useful guidance on how to interpret various terms in Article 20 and informed the development of the inventory in England and Wales. The "pre-selection protocol" could be used to screen closed waste facilities to assess whether they potentially met the criteria for the inventory and so should be considered for a detailed inspection. This screening protocol relied on having detailed site-specific information about all closed or abandoned mining waste facilities. An initial review of the data available for England and Wales determined that we did not hold sufficient information on the vast majority of sites and so application of the pre-selection protocol would not aid the creation of the inventory. However we did apply the principles set out in the guidance.

Notably the Directive does not define "closed" or "abandoned" mining waste facilities. For the inventory, these terms have been defined as (European Commission, 2011):

- "closed" means a waste facility where mining activity has ceased, there is an identified former owner or licensee, and the facility closed in accordance with relevant regulations.

- "abandoned" refers to a waste facility where mining activity has ceased, there is no identified former owner or licensee, and the facility was not closed in a regulated manner.

In this report, the term "closed waste facilities" should be considered to include "abandoned waste facilities".

2.2 Approach in England and Wales

There are estimated to be nearly 100,000 closed or abandoned mines in England and Wales, with mining waste facilities at most. The vast majority of these mines were abandoned before the early 20th Century and very few detailed records of mining waste facilities, processing plants and other infrastructure are available. The mining history and practices in England and Wales have resulted in a great number of small, often interconnected mines rather than a small number of distinct large sites. A single mine site typically contains numerous individual waste facilities and other mine water discharges that contribute to pollution across a large area, so the impacts can rarely be apportioned to discrete facilities. We know that many waste facilities which were abandoned in the 19th and early 20th centuries continue to be a source of pollution or have other environmental impacts. For this reason we did not apply any cut off date before which a facility would not be considered for the inventory.

Article 3(15) of the Directive defines a waste facility as "any area designated for the accumulation or deposit of extractive waste". When active, even the oldest mines would have had some infrastructure constructed and maintained for the disposal of waste, in an area specifically designated by the operator for that purpose. For this reason any discrete accumulation of mining or quarrying waste can be considered to be designated for that purpose, as its location and construction was a deliberate act. At the vast majority of sites, we do not have sufficient information to differentiate between spoil heaps, tips and tailings ponds. Therefore "waste facilities" on the inventory may include a variety of waste deposits. We did not consider accumulations of waste caused by erosion and deposition remote from the mine site, or by later extraction of the waste for construction purposes. Therefore the inventory does not cover the widespread contamination of sediments and floodplain soils many kilometres downstream of the mines. Since we know that existing data are incomplete, the inventory will be updated periodically and as new information is obtained.

The approach taken in England and Wales will facilitate the future rehabilitation of abandoned mining waste facilities envisaged by Article 21(b) of the Directive, and the delivery of good ecological and chemical status for the Water Framework Directive.

2.3 Hazard-pathway-receptor

The UK approach to assessing environmental impacts is based on the Hazard-Pathway-Receptor framework where there must be a proven linkage from the source of a hazard (i.e. the waste facility), to a receptor, such as a river. The potential pollutant linkages considered in developing the inventory are summarised in Table 1.

Table 1. Hazard-pathway-receptor linkages at closed mining waste facilities

Hazard	Pathway	Receptor
Pollution	Leaching	Rivers, streams (surface water quality) Groundwater
	Erosion	Rivers, streams (surface water quality) Ecology (surface water) Ecology (protected sites) Crops, livestock
	Windblown dust	Human health Ecology (protected sites) Crops, livestock
	Dermal contact, ingestion	Human health Livestock
Stability	Heap, dam or pond failure	Rivers, streams (surface water quality) Ecology (surface water) Human health Ecology (protected sites)
Flammability	Smoke, heat, dust, gas	Human health Property

2.4 Serious environmental impacts

The Directive does not define "serious negative environmental impacts or…the potential of becoming in the medium or short term a serious threat to human health or the environment". The working group guidance referred to Commission Decision 2009/337/EC (European Commission, 2009) and recommended the interpretation summarised in Table 2.

Table 2. Defining serious environmental impacts

Impact	Serious environmental impact
Human health	Loss of life Injuries leading to disability or prolonged states of ill health
Environment	Intensity of the potential contaminant source strength is not decreasing significantly within a short time Leads to any permanent or long-lasting environmental damage Affected environment cannot be restored through minor clean-up and restoration efforts

We applied these definitions for serious environmental impacts together with the detailed criteria set out in Table 3.

Table 3. Criteria for assessing serious environmental impacts

Hazard	Magnitude
Water pollution	• Site causes failure of Environmental Quality Standard (EQS[6]) in surface water over a distance of more than 500 metres, or • Site causes pollution of groundwater extending more than 50 metres in a principal aquifer or 250 metres in a secondary aquifer
Contaminated land	Site determined as "contaminated land" for Part 2A due to "significant harm" or "significant possibility of significant harm" to defined receptors: • Human health • Ecology • Buildings, services, crops • Livestock, pets, wild animals
Instability	Stability risk assessment or inspection has indicated a risk of instability and receptors present
Particulates	Site causes local air quality to fail to meet Air Quality Objective for PM[7]2.5 or PM10
Suspended solids	Site causes surface water to fail to achieve "good ecological status" due to suspended solids
Fire	Combustion of wastes identified within the past 10 years and not permanently remediated, and any of following receptors present: • Human health • Ecology • Buildings, services, crops • Livestock, pets, wild animals

[6] EQS defined by UK or EU legislation. Values used: cadmium = 0.08 - 0.25 µg/l (hardness-related); copper = 1 - 28 µg/l (hardness-related); iron = 1,000 µg/l; lead = 7.2 µg/l; zinc = 0.08 - 0.25 µg/l (hardness-related); dissolved concentrations except for zinc.

[7] PM_X = particulate matter which passes through a size-selective inlet at X µm aerodynamic diameter

3 Populating the Inventory

Populating the inventory required two phases, data collection and data assessment. Different methods of data collection were required for different linkages and are explained below.

3.1 Data Collection

At the outset of the project, it was agreed with Defra and Welsh Government that data provided by local authorities that related to harm to human health, stability and combustion would be accepted at face value. The level of assessment necessary for the local authority to have deemed the site to be causing harm was sufficient that it did not require further evaluation and thus any site nominated was included on the inventory.

In contrast, water quality data collected by the Environment Agency and others had not been assessed in a way that allowed the inventory to be prepared. The further data analysis and risk assessment carried out for water pollution is discussed in more depth in Section 3.2.

A standard pro-forma was used to collate data on potential inventory sites from local authorities and others (see Appendix 1). Results were collated in a geodatabase to facilitate data analysis and interpretation.

Table 4. Main sources of information gathered to populate the inventory

Type of impact	Organisation
Water quality Suspended solids	Environment Agency Local authorities British Geological Survey English Heritage, Natural England, Cadw, Countryside Council for Wales Universities
Human health	Local authorities
Flammability	Local authorities Coal Authority
Instability	Local authorities Coal Authority English Heritage, Natural England, Cadw, Countryside Council for Wales

3.1.1 Review of abandoned mining wastes

The British Geological Survey (BGS) reviewed information on mineral waste associated with closed mining and quarrying sites in England and Wales. They used various datasets to show the locations of known mineral workings and associated waste tips (Palumbo-Roe and Colman, 2010). Mineral production for each area was estimated

and used as a proxy for waste production. Accurate figures are not available but thousands of millions of tonnes of wastes, much of which is inert, have been produced.

The mining wastes include those from the extraction of:

- Crushed rock, sand and gravel, silica sand
- Building stone
- Clay, shale, fireclay, slate, china clay, ball clay, fuller's earth
- Gypsum/anhydrite, salt, potash
- Fluorspar, barytes
- Limestone/dolomite
- Peat
- Coal
- Metalliferous deposits

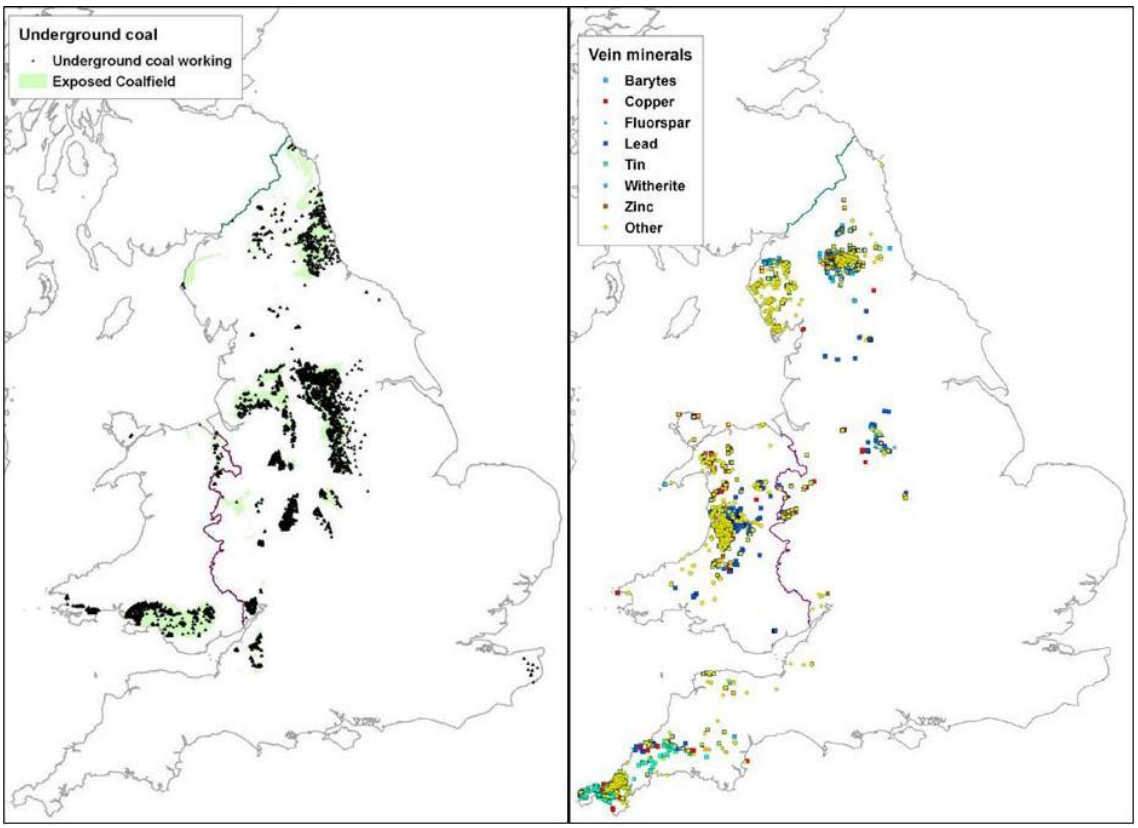

Figure 1. Distribution of coal and vein mineral workings in England and Wales (from Palumbo-Roe and Colman, 2010)

3.1.2 Stability

Local Authorities have had a duty since 1969 under the Mines and Quarries (Tips) Act to inspect any "disused tips" in their areas and identify any issues with stability that would constitute a public danger. This duty and the requirement to serve notice on a landowner to take remedial action or to undertake that action themselves has resulted in the problem of unstable tips being greatly reduced. The duty is only to inspect for instability that would cause a public danger, i.e. where human health was at risk. Many waste facilities at long closed metal mines or other mineral workings may have

elements of instability that pose a risk to water quality or the environment. For example being undermined by watercourses with the potential for gradual erosion of spoil or landslips.

There is no requirement for local authorities to maintain a public register of their inspections or of sites they consider to pose a risk. Thus the information on stability issues was obtained by canvassing local authorities.

The Mines and Quarries (Tips) Act also placed a duty on the manager of a site to submit plans of closed tips to the Health and Safety Executive (HSE) on abandonment. The regulation of tipping during operation and the need for submission of plans for a formal closure has ensured that recently closed facilities have been left in a safe condition, thus allowing us to make the assumption that tips abandoned since the 1969 Act did not pose a risk of collapse at that time. Discussions with the HSE have indicated that they consider this to be the case.

3.1.3 Flammability

Colliery tips can contain significant quantities of coal that makes them potentially flammable. Tips can ignite spontaneously because of pyrite oxidation, which is an exothermic reaction, or by an external influence, for example a bonfire. A burning tip can remain alight for many years if not dealt with and causes a significant air pollution risk. The burning coal discharges considerable volumes of particulates, carbon dioxide and sulphur dioxide. An acute risk can be posed to human health if residential properties are nearby. As air pollution and the public nuisance caused by burning tips are primarily within the remit of local authorities, information on such problems was obtained by canvassing them.

3.1.4 Contaminated Land

Impacts on human health, property, livestock, ecology or the water environment from mining waste facilities fall within the Contaminated Land Part 2A regime (Defra, 2012). If significant harm is being caused or there is a significant possibility of significant harm then the land can be determined as contaminated by the local authority.

Local authorities have a duty to inspect their areas for such land and if any sites have been determined, or are under consideration they will have a record of them. This information was obtained by canvassing the local authorities. Local authorities have taken different approaches to implementing Part 2A and so this information will need to be updated over time as their inspection strategies evolve and new sites are either identified or treated.

3.1.5 Prioritisation of abandoned non-coal mine impacts on the environment: Hazards and risk management at abandoned non-coal mine sites

The Environment Agency, Defra and Welsh Government commissioned a series of reports on the impacts of abandoned metal mines on the water environment (Contractors: Newcastle University, the Coal Authority and Atkins). A number of concerns at these sites relating to stability, safety, airborne pollution and other human health and animal risks were identified (Environment Agency, 2012c).

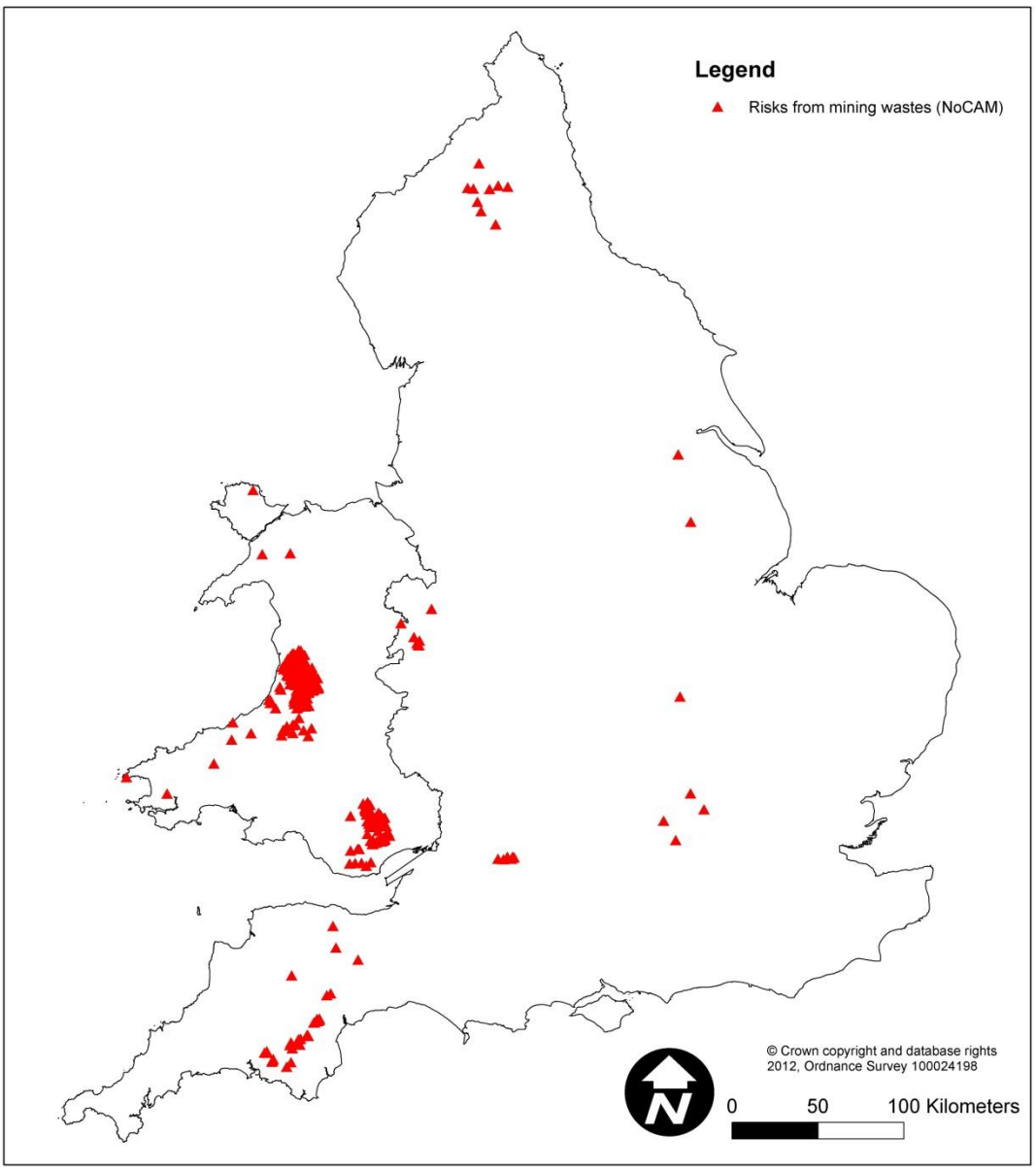

Figure 2. Known or suspected risks from abandoned non-coal mining sites (Local authority responses from Environment Agency, 2012c)

3.2 Data collection and assessment for water quality

Information on water pollution was collated from existing reports and local knowledge held by the Environment Agency, public authorities, the Coal Authority, the British Geological Survey (BGS), universities and others. For example, the Environment Agency's national water quality archive was interrogated along with the results of the NoCAM project (Environment Agency, 2012a). In addition two GIS (geographical information system) screening exercises were carried out to identify potential inventory sites for further investigation; these are described in sections 3.2.1 and 3.2.2.

In many cases, it was decided that existing data were not sufficient to isolate the pollution caused by waste facilities from other sources, notably mine waters. At these sites, further investigations were undertaken to collect additional water quality data (section 3.2.3).

3.2.1 British Geological Survey screening

The British Geological Survey (BGS) compared the locations of mining waste facilities with existing chemical analyses of stream waters and sediments using GIS. The objective was to identify potential inventory sites by spatially linking water and/or sediment data that exceeded specified chemical quality assessment criteria with the mining wastes. The most impacted sites would then be investigated through field visits and further water quality sampling.

The key stages in the study are summarised below:

- Identify mine sites within the study areas (see Figure 3) from historical data;
- Report principal commodities worked at each site and estimate area of mining wastes from digitised historic maps;
- Appraise potential environmental impact using geochemical data for stream water and sediment samples held by the BGS (GBase database) and Environment Agency (As, Cu, Cd, Fe, Mn, Ni, Pb, Zn, Sn);
- Link geochemical data to mine sites using river network and proximity (only consider samples up to 1 km downstream of mine site and in same river catchment);
- Estimate potential environmental impact by comparing geochemical data with appropriate quality assessment criteria and report significance using a simple numeric score indicating magnitude of failure (<1X, >3X and >5X).

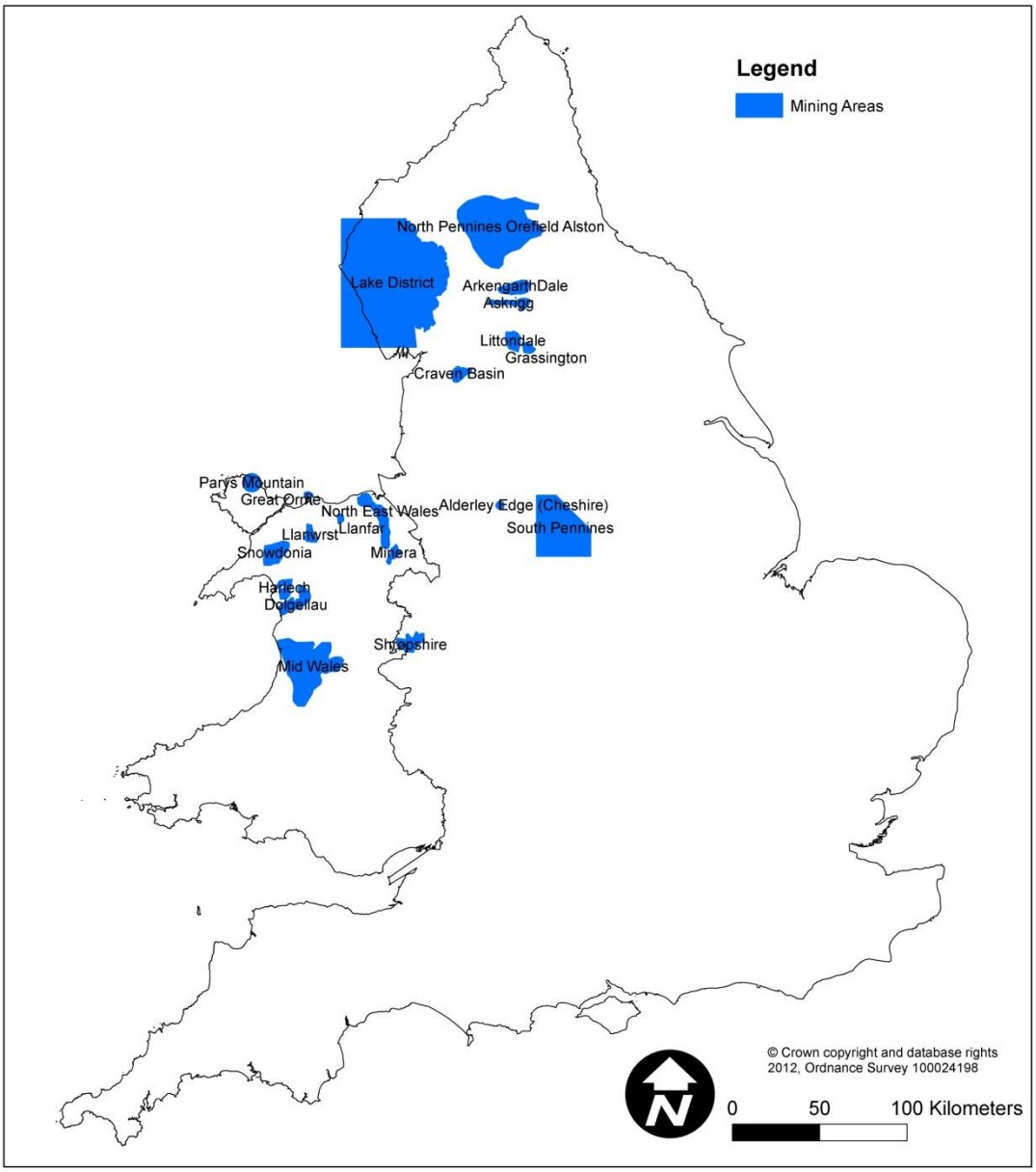

Figure 3. BGS GIS screening - study areas shown in blue.

3.2.2 Plymouth University screening

In Devon and Cornwall (south west England), the BGS did not have adequate geochemical data on stream water or sediment quality to allow their screening to be applied. Plymouth University have developed a GIS prioritisation tool to assess the risk of rivers being impacted by diffuse mine water sources, primarily mining wastes (Turner, 2011; Environment Agency, 2012d). The probability that a particular mining waste site will cause pollution is a function of the volume of waste, proximity to watercourses and various environmental factors including topography, rainfall, vegetation cover, soil type and underlying geology. Weighted scores were derived for each factor and the GIS tool was used to calculate an overall risk score.

Risk scores were calculated for more than three hundred individual mining waste sites in the Tamar catchment and the results assigned to categories from “Low” to “Extreme” risk. Although the score does not consider the level of contamination in the waste materials, it identified the sites which pose the greatest threat to water quality. Limited

monitoring of water quality at selected sites ranked as “Extreme” confirmed the potential of the GIS tool to prioritise sites for further investigation.

The original GIS tool requires a considerable number of datasets which were not readily available for mining areas across England and Wales. Analysis of the results from the Tamar catchment highlighted that the most significant risk factors were:

- Waste area
- Proximity to nearest surface water course/body (stream, river, estuary or lake)
- Topographical slope of the drainage pathway

The South West Region of the Environment Agency held data for most of these factors for Devon and Cornwall. A simplified GIS tool was applied by Plymouth University to calculate a risk score (Turner, 2010). Nearly one thousand nine hundred sites were ranked. Sites with an “Extreme” score that were larger than 10,000 m^2 (1 hectare) were reviewed by reference to historic water quality data, aerial photographs and discussions with local Environment Agency experts. The highest risk sites were nominated for further field investigation. The results of the simplified GIS tool are summarised in Table 5.

Table 5. Plymouth University screening results

Catchment	Number of mining waste sites	Number of sites after risk screening	Number of sites to be investigated
West Cornwall	1249	92	24
North Cornwall	185	15	4
North Devon	24	2	1
South Devon	131	17	2
Tamar	310	36	39
Total	**1899**	**162**	**70**

3.2.3 Water quality investigations at potential MWD inventory sites

Following collation of all available data, and application of the GIS screening described above, further investigations were carried out at more than 200 potential MWD inventory sites through site visits and collection of water quality data. The regional distribution of these potential sites is indicated in Table 6.

Table 6. Number of potential inventory sites for water quality investigations

Location	Number of sites investigated
North East	50
Yorkshire	29
Shropshire	7
North West	38
South West	59
Wales	37
Total	**220**

The strategy for the investigations was to carry out a visual inspection of the waste facility to confirm:

- Presence of mining wastes
- Proximity to streams
- Potential to impact water quality
- Observation of potential instability and/or erosion of wastes
- Sample water quality upstream and downstream of wastes (including 500 metres downstream where possible)
- Sample any mine water discharges to allow assessment of contribution from mine water versus mining wastes
- Short written record of site visit including photographs.

3.2.4 Investigations at potential MWD inventory sites since May 2012

The Environment Agency has gathered further data on water quality around abandoned mine sites since the inventory was published in May 2012. Local authorities have considered new information to review sites on the inventory.

3.3 Decision on potential inventory sites

The data on potential inventory sites were compared with the criteria set out in Section 2.4 to determine whether serious environmental impacts are being caused. The results are summarised in Section 4.

4 Summary of inventory

The updated inventory contains 150 mining waste facilities with 111 in England and 39 in Wales. Water pollution is the most common type of serious environmental impact with 148 sites. At one of the 148 sites, impacts on human health have also been confirmed (determined as Part 2A contaminated land). At one of the 148 sites, a Part 2A assessment has concluded there are no unacceptable impacts on human health. One site is on fire (coal spoil heap) and the local authority has advised there is risk to human health or property. At one site the local authority has advised that the spoil (quarry wastes) are unstable and adjacent to a footpath.

The results of the inventory have been made available to the public through the Environment Agency's "What's in your backyard" website. The list of sites on the inventory is shown in Table 7 and in Figure 4.

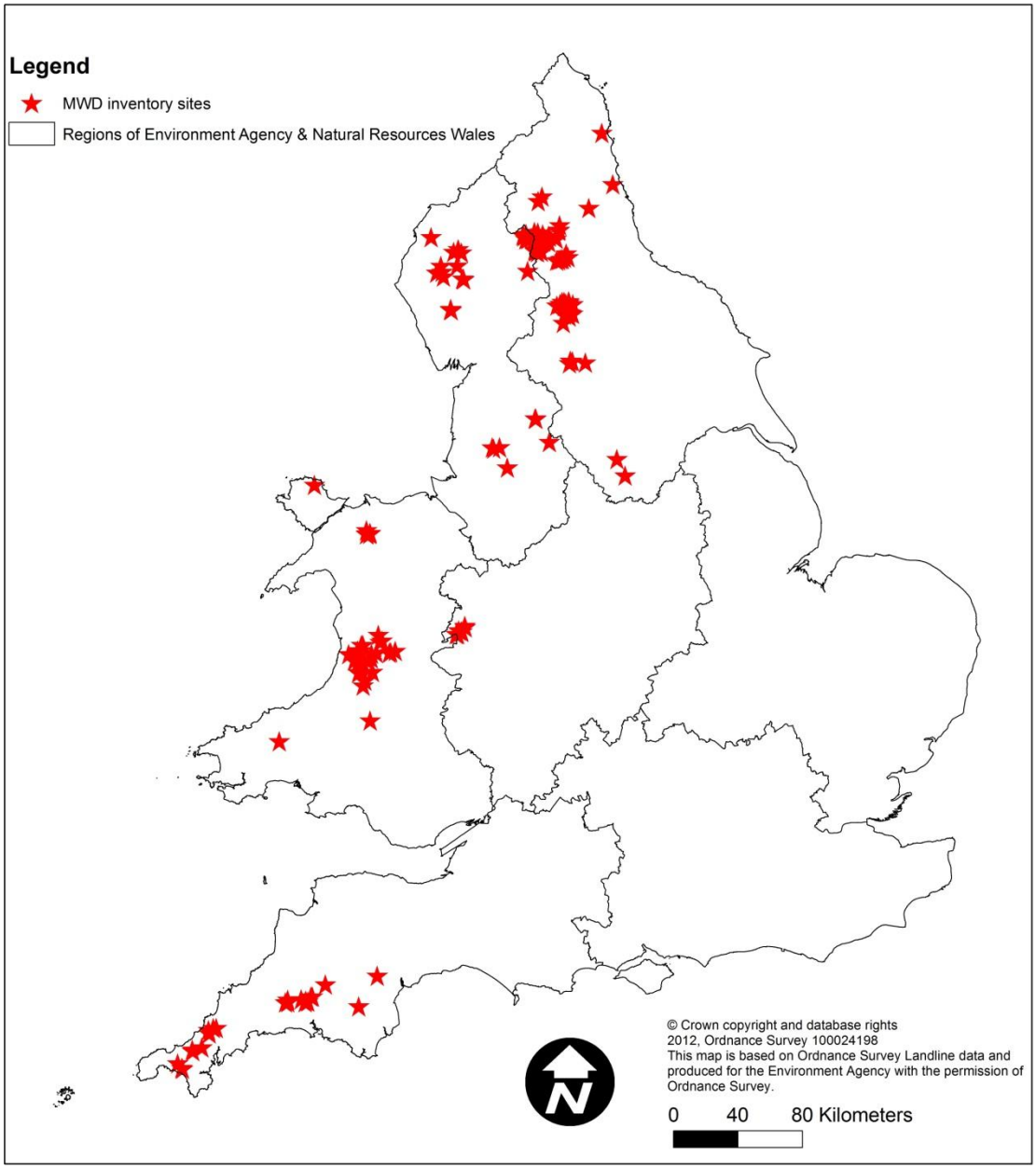

Figure 4. Distribution of inventory sites.

Table 7. MWD Article 20 inventory for England and Wales (updated January 2014)

URN	Facility_name	Mine_type	Reason	Country	Local_authority	Easting	Northing
1206	Barrow and Uzzicar	Metalliferous	Water pollution	England	Allerdale District	323213	522155
1207	Carrock End Mine	Metalliferous	Water pollution	England	Allerdale District	335180	534112
1208	Carr Wood	Coal	Water pollution	England	Allerdale District	316430	543700
1210	Force Crag	Metalliferous	Water pollution	England	Allerdale District	319872	521587
1212	Yewthwaite	Metalliferous	Water pollution	England	Allerdale District	324065	519267
1243	Roughton Gill Mine	Metalliferous	Water pollution	England	Allerdale District	330349	534443
1244	Sandbeds	Metalliferous	Water pollution	England	Allerdale District	333284	536241
1267	Thornthwaite Mines	Metalliferous	Water pollution	England	Allerdale District	322439	525907
1020	Dodworth Colliery Tip	Coal	Water pollution	England	Barnsley District	431290	406250
1003	Hapton Clough	Coal	Water pollution	England	Burnley District	380840	431460
1014	Habergham Clough	Coal	Water pollution	England	Burnley District	381170	431300
1009	Welch Whittle	Coal	Water pollution	England	Chorley District	354300	413500
1019	Chisnal Hall	Coal	Water pollution	England	Chorley District	355124	412736
1325	Eller Brook	Coal	Water pollution	England	Chorley District	358740	413566
1166	Wheal Maid	Metalliferous	Water pollution, Human health	England	Cornwall	174722	42229
1173	East Caradon	Metalliferous	Water pollution	England	Cornwall	227820	70130
1177	Holmbush	Metalliferous	Water pollution	England	Cornwall	236116	71970
1193	Silver Valley	Metalliferous	Water pollution	England	Cornwall	238480	70130
1196	Prince of Wales	Metalliferous	Water pollution	England	Cornwall	240160	70590
1197	Marke Valley	Metalliferous	Water pollution	England	Cornwall	227730	71730
1198	East Kithill	Metalliferous	Water pollution	England	Cornwall	238900	71100

URN	Facility_name	Mine_type	Reason	Country	Local_authority	Easting	Northing
1277	West Caradon Mine	Metalliferous	Water pollution	England	Cornwall	226342	69956
1280	Cargol Mine	Metalliferous	Water pollution	England	Cornwall	183540	54130
1292	Shepherds Mine	Metalliferous	Water pollution	England	Cornwall	181710	54170
1294	West Chiverton Mine	Metalliferous	Water pollution	England	Cornwall	179250	50850
1295	Great Fortune Mine	Metalliferous	Water pollution	England	Cornwall	162740	28950
1296	Metal Mine	Metalliferous	Water pollution	England	Cornwall	162200	29543
1297	Godolphin Bridge Mine	Metalliferous	Water pollution	England	Cornwall	159670	32370
1300	Anna Mine	Metalliferous	Water pollution	England	Cornwall	178750	52950
1309	South Carn Brea Mine	Metalliferous	Water pollution	England	Cornwall	168820	40720
1310	Basset Mine	Metalliferous	Water pollution	England	Cornwall	169010	39930
1024	Boltsburn Mine	Metalliferous	Water pollution	England	County Durham	393771	542692
1026	Burtree Pasture	Industrial minerals	Water pollution	England	County Durham	385990	541215
1027	California	Metalliferous	Water pollution	England	County Durham	398919	530896
1030	Deborah Level	Metalliferous	Water pollution	England	County Durham	395658	548216
1031	Derwent Mines	Metalliferous	Water pollution	England	County Durham	395250	547558
1033	Frazers Hush	Industrial minerals	Water pollution	England	County Durham	388944	544429
1034	Grove Rake	Industrial minerals	Water pollution	England	County Durham	389550	544102
1036	Kilhope Head	Metalliferous	Water pollution	England	County Durham	381036	543210
1039	Sedling Mine	Metalliferous	Water pollution	England	County Durham	385857	541039
1041	Wiregill	Metalliferous	Water pollution	England	County Durham	397629	530082
1042	Lodge Sike	Metalliferous	Water pollution	England	County Durham	395412	529420
1044	Coldberry	Metalliferous	Water pollution	England	County Durham	394036	529058

URN	Facility_name	Mine_type	Reason	Country	Local_authority	Easting	Northing
1045	Cornish Hush	Metalliferous	Water pollution	England	County Durham	399957	533547
1049	Grass Hill Mine	Metalliferous	Water pollution	England	County Durham	381154	534801
1052	Ashgill Head	Metalliferous	Water pollution	England	County Durham	380743	535373
1053	Manor Gill	Metalliferous	Water pollution	England	County Durham	396589	529958
1055	Trough Mine	Metalliferous	Water pollution	England	County Durham	382254	534311
1252	Tallen Hush Mine	Metalliferous	Water pollution	England	County Durham	380639	536028
1254	Langdon Head Shop Mine	Metalliferous	Water pollution	England	County Durham	384567	534648
1261	Middlehope Old Mine	Metalliferous	Water pollution	England	County Durham	389140	540559
1326	Sharnberry High Level Tips	Metalliferous	Water pollution	England	County Durham	401181	531297
1211	Grassington Moor mines	Metalliferous	Water pollution	England	Craven District	402589	467143
1213	Yarnbury Mine	Metalliferous	Water pollution	England	Craven District	402007	465620
1214	Blea Beck Mines	Metalliferous	Water pollution	England	Craven District	403848	466918
1005	Nenthead Mines	Metalliferous	Water pollution	England	Eden District	378420	543300
1038	Holyfield Mine	Metalliferous	Water pollution	England	Eden District	373128	544849
1043	Bentyfield Mine	Metalliferous	Water pollution	England	Eden District	375415	542544
1059	White Sikes	Metalliferous	Water pollution	England	Eden District	375012	542433
1060	Flow Edge	Coal	Water pollution	England	Eden District	373775	544083
1072	Brown Gill, Garrigill	Metalliferous	Water pollution	England	Eden District	376246	542372
1137	Hudgill Burn	Metalliferous	Water pollution	England	Eden District	375180	545660
1257	Greenside Mine upper wastes	Metalliferous	Water pollution	England	Eden District	335864	518005
1258	Greenside Mine lower wastes	Metalliferous	Water pollution	England	Eden District	336391	517712

URN	Facility_name	Mine_type	Reason	Country	Local_authority	Easting	Northing
1259	Greenside Mine Tailings Dams	Metalliferous	Water pollution	England	Eden District	336574	517517
1265	Hilton/Scordale	Industrial minerals	Water pollution	England	Eden District	376225	522712
1316	Gategill Mine	Metalliferous	Water pollution	England	Eden District	332577	526031
1010	Spen Lane	Coal	Fire Hazard	England	Gateshead District	413926	561733
1327	Providence Lead Mine	Metalliferous	Water pollution	England	Harrogate	411904	466058
1001	Barney Crag / Scraithole mines	Metalliferous	Water pollution, Instability Hazard	England	Northumberland	380348	546963
1004	Shilbottle Pyrites Tip	Coal	Water pollution	England	Northumberland	422060	608160
1029	Coalcleugh	Metalliferous	Water pollution	England	Northumberland	380091	545093
1037	Mills Vein Level	Metalliferous	Water pollution	England	Northumberland	385473	545368
1040	Shildon	Metalliferous	Water pollution	England	Northumberland	395955	551050
1047	East Cramlington	Coal	Water pollution	England	Northumberland	428771	576436
1051	Langly Barony	Metalliferous	Water pollution	England	Northumberland	382588	566025
1054	Settlingstones	Metalliferous	Water pollution	England	Northumberland	384992	568842
1062	Swinhope Head Mine	Metalliferous	Water pollution	England	Northumberland	382491	546553
1217	Wet Grooves Mine	Metalliferous	Water pollution	England	Richmondshire District	398209	490540
1218	Apedale Mine	Metalliferous	Water pollution	England	Richmondshire District	401889	494574
1220	Whitaside Mine	Metalliferous	Water pollution	England	Richmondshire District	398942	495631
1221	Grovebeck Mine	Metalliferous	Water pollution	England	Richmondshire District	402771	496749
1222	Harker Lead Mine	Metalliferous	Water pollution	England	Richmondshire District	401607	497284
1223	Grinton Howe Lead Mine	Metalliferous	Water pollution	England	Richmondshire District	404024	496252
1227	Friarfold Rake	Metalliferous	Water pollution	England	Richmondshire District	396170	502281
1228	Barras End Mine	Metalliferous	Water pollution	England	Richmondshire District	398711	501038

URN	Facility_name	Mine_type	Reason	Country	Local_authority	Easting	Northing
1229	Bunton Lead Mine	Metalliferous	Water pollution	England	Richmondshire District	394258	501303
1230	Windegg South Mine	Metalliferous	Water pollution	England	Richmondshire District	401547	504033
1232	Sleigill Lead Mine	Metalliferous	Water pollution	England	Richmondshire District	401639	503086
1233	Black Mine	Metalliferous	Water pollution	England	Richmondshire District	398801	503611
1235	Dodgson Hush Mine	Metalliferous	Water pollution	England	Richmondshire District	399747	502540
1236	Danby Lead Level Mine	Metalliferous	Water pollution	England	Richmondshire District	397533	503629
1238	Hurst Mines	Metalliferous	Water pollution	England	Richmondshire District	404085	502087
1007	Ring Lows Quarry Tips	Building minerals	Instability Hazard,	England	Rochdale District	389543	416859
1076	Hesley Wood	Coal	Water pollution	England	Sheffield District	436391	396189
1149	Roman Gravels	Metalliferous	Water pollution	England	Shropshire	333587	300313
1151	Tankerville Mine	Metalliferous	Water pollution	England	Shropshire	335456	299597
1155	Snailbeach	Metalliferous	Water pollution	England	Shropshire	337435	302292
1158	Whitegrit Mine	Metalliferous	Water pollution	England	Shropshire	331949	298015
1159	Oldgrit Mine	Metalliferous	Water pollution	England	Shropshire	332745	298017
1161	Roundhill Mine	Metalliferous	Water pollution	England	Shropshire	335050	299602
1164	Snailbeach Smelter	Metalliferous	Water pollution	England	Shropshire	337343	303049
1283	Brookwood Mine	Metalliferous	Water pollution	England	South Hams District	271710	67560
1069	Paddy End Works	Metalliferous	Water pollution	England	South Lakeland District	328427	498737
1070	Red Dell Copper Mine	Metalliferous	Water pollution	England	South Lakeland District	328587	499203
1071	Bonsor Dressing Floor Spoil	Metalliferous	Water pollution	England	South Lakeland District	328911	498540
1284	Bridford Mine	Metalliferous	Water pollution	England	Teignbridge District	283094	86454
1167	Betsy	Metalliferous	Water pollution	England	West Devon District	251000	81200
1181	Devon Great Consols	Metalliferous	Water pollution	England	West Devon District	243030	73660

URN	Facility_name	Mine_type	Reason	Country	Local_authority	Easting	Northing
1182	Wheal Fanny	Metalliferous	Water pollution	England	West Devon District	242120	73700
1002	Bickershaw Colliery	Coal	Water pollution	England	Wigan District	363585	401117
1086	Cwmbrwyno	Metalliferous	Water pollution	Wales	Ceredigion	271300	280500
1087	Abbey Consols	Metalliferous	Water pollution	Wales	Ceredigion	274326	266137
1088	Bog	Metalliferous	Water pollution	Wales	Ceredigion	273900	281400
1092	Bwlch	Metalliferous	Water pollution	Wales	Ceredigion	270123	282519
1095	Cwm Rheidol	Metalliferous	Water pollution	Wales	Ceredigion	273000	278300
1097	Cwmerfin	Metalliferous	Water pollution	Wales	Ceredigion	269600	282900
1098	Cwmystwyth	Metalliferous	Water pollution	Wales	Ceredigion	280200	274600
1099	Cwmsymlog	Metalliferous	Water pollution	Wales	Ceredigion	269800	283700
1102	Esgairfrith	Metalliferous	Water pollution	Wales	Ceredigion	274200	291200
1103	Esgairhir	Metalliferous	Water pollution	Wales	Ceredigion	273400	291300
1104	Esgairlle	Metalliferous	Water pollution	Wales	Ceredigion	279495	282867
1105	Esgairmwyn	Metalliferous	Water pollution	Wales	Ceredigion	275500	269200
1106	Frongoch	Metalliferous	Water pollution	Wales	Ceredigion	272200	274400
1107	Goginan	Metalliferous	Water pollution	Wales	Ceredigion	269000	281700
1113	Penycefn	Metalliferous	Water pollution	Wales	Ceredigion	265500	285600
1115	Wemyss	Metalliferous	Water pollution	Wales	Ceredigion	271600	274200
1117	Ystumtuen	Metalliferous	Water pollution	Wales	Ceredigion	273200	278800
1120	Llywernog	Metalliferous	Water pollution	Wales	Ceredigion	273184	280964
1123	Bwlchglas	Metalliferous	Water pollution	Wales	Ceredigion	271002	287819
1124	Castell	Metalliferous	Water pollution	Wales	Ceredigion	277392	281242
1125	Hafan	Metalliferous	Water pollution	Wales	Ceredigion	273000	288000

URN	Facility_name	Mine_type	Reason	Country	Local_authority	Easting	Northing
1126	Llwynteify	Metalliferous	Water pollution	Wales	Ceredigion	274100	278900
1127	Plynlimon	Metalliferous	Water pollution	Wales	Ceredigion	279600	285800
1011	Parc	Metalliferous	Water pollution	Wales	Conwy	278765	360581
1012	Pandora	Metalliferous	Water pollution	Wales	Conwy	276475	359878
1013	Hafna	Metalliferous	Water pollution	Wales	Conwy	278398	359949
1077	New Pandora, Tyn-y-groes	Metalliferous	Water pollution	Wales	Conwy	276702	360266
1078	Pandora North	Metalliferous	Water pollution	Wales	Conwy	276717	360031
1079	Klondyke Mill and Tips	Metalliferous	Water pollution	Wales	Conwy	276449	362199
1016	Dylife	Metalliferous	Water pollution	Wales	Powys	286108	293980
1101	Dfyngwym	Metalliferous	Water pollution	Wales	Powys	284934	293100
1109	Nantiago	Metalliferous	Water pollution	Wales	Powys	282600	286300
1114	Van	Metalliferous	Water pollution	Wales	Powys	294216	287607
1119	Rhoswydol	Metalliferous	Water pollution	Wales	Powys	283800	297500
1121	Aberdaunant	Metalliferous	Water pollution	Wales	Powys	290600	286500
1122	Bryntail	Metalliferous	Water pollution	Wales	Powys	291500	286900
1065	Llanfyrnach	Metalliferous	Water pollution	Wales	Sir Benfro - Pembrokeshire	222500	231700
1111	Nantymwyn	Metalliferous	Water pollution	Wales	Sir Gaerfyrddin - Carmarthenshire	278746	244463
1006	Parys Mountain	Metalliferous	Water pollution	Wales	Ynys Mon - Isle of Anglesey	244221	390397

Table 8. Facilities removed from the MWD Article 20 inventory for England and Wales (updated January 2014)

URN	Facility_name	Mine_type	Reason	Country	Local_authority	Reason removed from inventory
1021	Cortonwood Colliery	Coal	Fire Hazard,	England	Rotherham District	Following further monitoring and review, the site is no longer perceived as a short to medium term fire hazard.

5 Managing pollution from abandoned mines

Other than the general provisions in Article 4, to take the necessary measures to "*ensure that extractive waste is managed without endangering human health and without using processes or methods which could harm the environment*" (European Commission, 2006), the Mining Waste Directive does not specifically require action to deal with sites on the Article 20 inventory. The inventory identifies sites that are causing serious environmental impacts or have the potential to do so in the short to medium term. Work is under way to address these impacts subject to available resources.

5.1 Water pollution

Abandoned mines contribute to 7% of failures to achieve good ecological and chemical status in surface and groundwater bodies for the Water Framework Directive. As a result, programmes to manage this pollution have been set up in England and in Wales. All water bodies must achieve good status by 2027. The data gathered to create the inventory is being used to support this work, particularly for metal (non-coal) mines.

In England, Defra have provided funds in 2011-2015 for the Environment Agency to work in partnership with the Coal Authority to begin to deal with more than seventy surface water bodies identified in River Basin Management Plans as requiring intervention to mitigate pollution from abandoned metal mines (Defra, 2011). The Welsh Government is funding similar work as part of the long-running Metal Mines Strategy for Wales to address around fifty impacted surface water bodies. The majority of Article 20 inventory sites are causing significant water pollution. Unfortunately in most cases, no-one can be held liable for water pollution arising from mines that closed before 1999. Consequently the Government has recently, through the Water White Paper (Defra, 2011), reaffirmed its commitment to tackling pollution from abandoned metal mines in England. Limited financial and technical resources mean that it is not possible to deal with all rivers impacted by abandoned mines immediately and the presence of inventory sites will be taken into account when prioritising these work programmes.

5.2 Human health

Local authorities have a duty under the Part 2A contaminated land regime (Defra, 2012) to inspect their area for land that may cause significant harm to human health amongst other receptors. The inventory will be shared with local authorities and they will be asked to notify the Environment Agency if in future they identify any closed or abandoned mining waste facilities that meet the inventory criteria.

5.3 Other impacts

Local authorities will be asked to inform the Environment Agency if they identify any additional closed or abandoned mining waste facilities that are causing or have the potential to cause harm due to stability, fire or other impacts. These will then be considered for inclusion when the inventory is being periodically updated.

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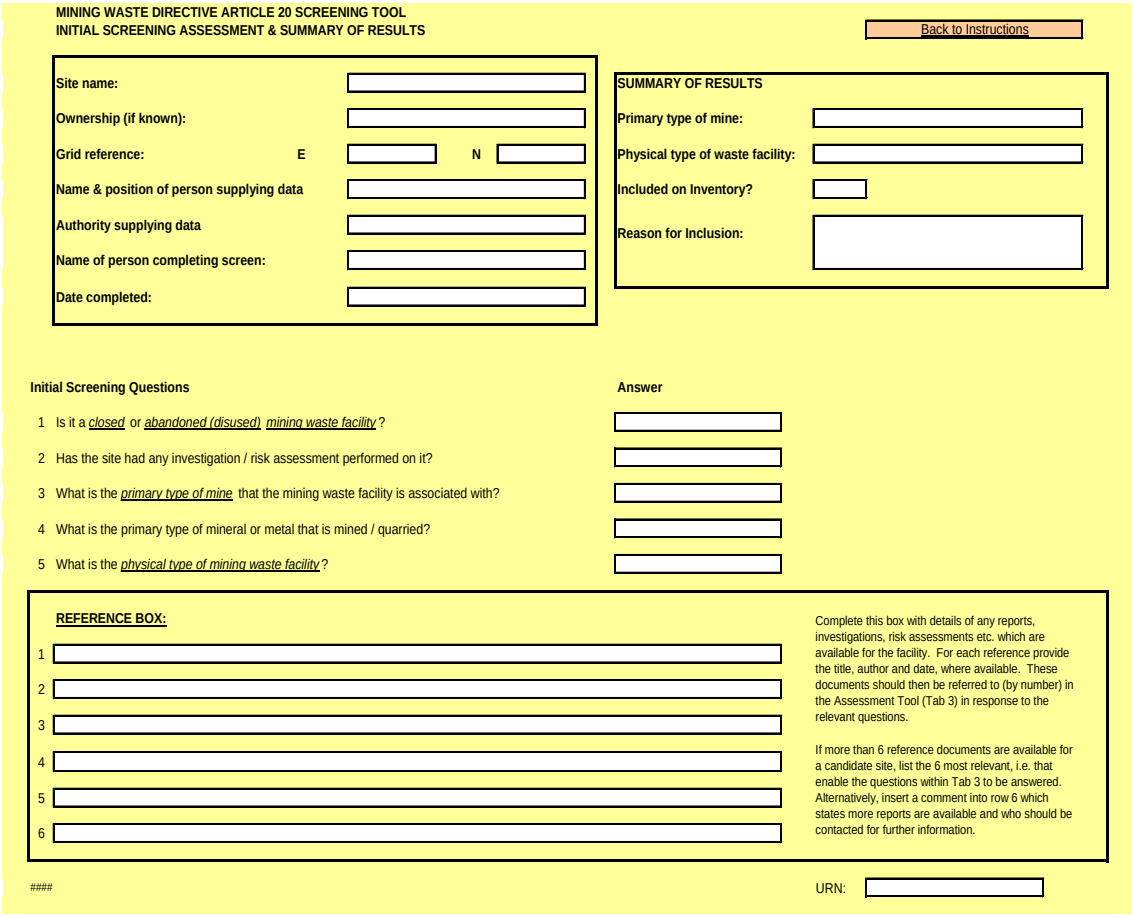
Appendix 1.

Figure 5. Proforma for recording Mining Waste Directive inventory candidate sites



MINING WASTE DIRECTIVE ARTICLE 20 SCREENING TOOL
INITIAL SCREENING ASSESSMENT & SUMMARY OF RESULTS

Back to Instructions

Site name:	
Ownership (if known):	
Grid reference: E	N
Name & position of person supplying data	
Authority supplying data	
Name of person completing screen:	
Date completed:	

SUMMARY OF RESULTS

Primary type of mine:	
Physical type of waste facility:	
Included on Inventory?	
Reason for Inclusion:	

Initial Screening Questions	Answer
1 Is it a *closed* or *abandoned (disused)* *mining waste facility*?	
2 Has the site had any investigation / risk assessment performed on it?	
3 What is the *primary type of mine* that the mining waste facility is associated with?	
4 What is the primary type of mineral or metal that is mined / quarried?	
5 What is the *physical type of mining waste facility*?	

REFERENCE BOX:

1
2
3
4
5
6

Complete this box with details of any reports, investigations, risk assessments etc. which are available for the facility. For each reference provide the title, author and date, where available. These documents should then be referred to (by number) in the Assessment Tool (Tab 3) in response to the relevant questions.

If more than 6 reference documents are available for a candidate site, list the 6 most relevant, i.e. that enable the questions within Tab 3 to be answered. Alternatively, insert a comment into row 6 which states more reports are available and who should be contacted for further information.

####

URN:

MINING WASTE DIRECTIVE ARTICLE 20 SCREENING TOOL
ASSESSMENT TOOL

Back to Instructions

	A Assessment for Instability Hazard	Yes / No	Reference No.
1	Is the mining waste facility a *"closed" tip* located at an **operational** mine as defined under the Mines and Quarries (Tips) Act 1969?		
2	Is the mining waste facility a *"disused" tip* as defined under the Mines and Quarries (Tips) Act 1969?		
3	Has the facility been inspected / had a stability risk assessment undertaken?		
4	Does the assessment indicate that there is a risk of instability?		

	B Assessment for Particulates Hazard	Yes / No	Reference No.
1	Has an air quality assessment which considers particulates been undertaken?		
2	Does the local air quality fail to meet to meet the *Air Quality Objective* (AQO) for $PM_{2.5}$ as a result of emissions from the site?		
3	Does the local air quality fail to meet to meet the AQO for PM_{10} as a result of emissions from the site?		
4	Does the local air quality fail to meet to meet the *best practice standard* for *nuisance dust* deposition as a result of emissions from the site?		

	C Assessment for Suspended Solids Hazard	Yes / No	Reference No.
1	Has any investigation been undertaken in relation to suspended solids?		
2	If yes, does surface water quality, as monitored at the nearest appropriate surface water monitoring point, fail to achieve a *"good ecological quality" status* as a result of suspended solids from the site?		

	D Assessment for Contaminants Hazard	Yes / No	Reference No.
1	Has the site been determined as *Contaminated Land*?		
2	Has the site been investigated / had a *contaminated land* and / or *controlled water* risk assessment undertaken?		
3	Have any of the following receptors been identified as present?		
	a Humans		
	b Protected ecological sites		
	c Property - buildings, services		
	d Property - crops		
	e Property - livestock, pets, wild animals		
4	If yes, in respect of any of the above receptors, has *significant harm* or *significant possibility of significant harm* been identified?		
5	Have *controlled waters* (groundwater and or surface water) been identified as a receptor?		
6	If yes (to Q5), is there evidence that the site has caused exceedences of surface water *Environmental Quality Standards (EQS)* or caused visual evidence of pollution (e.g. staining) over a distance of more than 500 m?		
7	If yes (to Q5), is there evidence of groundwater contamination or a contaminated groundwater plume extending (a) more than 50 m from the site in a *principal aquifer*, or (b) more than 250 m from the site in a *secondary aquifer*?		

	E Assessment for Fire Hazard	Yes / No	Reference No.
1	Has the site been investigated / had a risk assessment undertaken that considers *combustion*?		
2	Have any of the following receptors been identified as present?		
	a Humans		
	b Protected ecological sites		
	c Property - buildings, services		
	d Property - crops		
	e Property - livestock, pets, wild animals		
3	If yes, has *combustion* of the facility been identified within the last 10 years?		
4	If yes to (to Q3), is there evidence that *combustion* / burning has not been permanently remediated?		

##

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