

# Hydrogeology of Wales: Management and regulation of groundwater - management tools and future issues

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**This page is part of a category of pages that provides an updated review of the occurrence of groundwater throughout Wales.**

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To complement the abstraction licensing and permitting regimes that control activities which can pollute and derogate groundwater, the regulators have developed a number of assessment tools. These allow a risk based approach focussing on aquifers which are exploited for public water supply, have known problems with over-abstraction, have been identified at 'poor' status under the Water Framework Directive or where information is needed to respond to future pressures such as climate change. Some of the key tools include:

River Basin Management Plans - to identify measures to achieve Water Framework Directive requirements for all water bodies. These water bodies have been compiled into specific river basin districts (RBD), three of which cover Wales: Dee, Severn and Western Wales.



Location of the present-day groundwater level and quality monitoring networks. P859289.



Map of Principal and Secondary aquifers in Wales. P859288.

Aquifer designations - either Principal or Secondary Aquifers. These reflect the importance of the aquifer as both a resource and its role in supporting surface water flow and wetland ecosystems. Principal aquifers in Wales consist of bedrock aquifers which can supply water on a strategic scale. The principal aquifers are the Carboniferous Limestone aquifers across south Wales and area of north Wales, and the Permo-Triassic Sandstone in north east Wales (**Figure P859288**). Secondary Aquifers include a wide range of rock types or drift deposits with an equally wide range of water permeability and storage.

Source Protection Zones - to protect abstractions used for public water supply and other forms of distribution to the public, such as mineral and bottled water plants, breweries or commercial food and drink production. These zones show the areas of groundwater within which there is particular sensitivity to pollution risks due to the proximity of a potable source. There are currently 76 Source Protection Zones in Wales, ranging from small catchments around water bottling sources to large zones covering areas of heavily fractured and karstic Carboniferous Limestone used for public supply, where pollutant travel times to the source are likely to be rapid. Whereas protection zones around smaller sources can be delineated with analytical or numerical modeling techniques, in areas of karstic, non-Darcian flow they are best defined by tracer testing and field examination.

Nitrate Vulnerable Zones - delineated in areas of agricultural nitrate pollution to meet the requirement of the EU Nitrate Directive (91/676/EEC). Where groundwater quality data demonstrates increasing nitrate trends above the trigger of  $11.3 \text{ mg-N l}^{-1}$ , the drinking water standard, further investigation, for example of land management practices, is applied to refine the catchment areas. The zones are reviewed every 4 years and currently cover around 4% of the land area (cf. 70% in England) and are currently delineated only in parts of the Vale of Clwyd and Dee and Wye Valleys.

Groundwater level and quality monitoring networks - to comply with European and National legislation and meet internal and external needs from groundwater level and groundwater quality monitoring networks. Groundwater levels are monitored at 140 sites and groundwater quality at 250 sites across Wales ([Jones and Farr, 2015](#)) (**Figure P859289**).

Population growth coupled with a changing climate is likely to increase the demand for water, and water companies may have to reinstate historic groundwater abstractions or investigate new

groundwater sources which will require active management. Land uses and land management practices may also alter in response to changing climate which may impact infiltration or increase the risks of groundwater pollution.

Over the last decade the Water Framework Directive has been the driver for much positive work on groundwater, including the development of statutory monitoring networks, delineation of groundwater bodies and identifying where groundwater quality and resources are being impacted. This has built on the pollution prevention and remediation work promoted by the 1980 Groundwater Directive which was aimed largely at controlling discharges of certain (hazardous) substances to groundwater. The immediate future of groundwater management in Wales is likely to focus on addressing the impacts of diffuse pollution and abandoned metal mines.

Work is ongoing in Wales to prioritise which of the Groundwater dependant terrestrial ecosystems are most vulnerable to diffuse pollution or abstraction pressure, and to develop a programme to investigate specific impacts and develop remedial measures.

#### Industrial and commercial waste produced in Wales (tonnes x 10<sup>3</sup>) – data compiled by Environment Agency Wales

Waste type	Industry	Commerce	Total	% of total for all England and Wales
Inert	129	9	138	5.8
Paper and card	150	106	256	4.9
Food	105	18	123	4.8
General industrial and commercial	572	853	1425	5.0
Other general and biodegradable	370	80	450	5.1
Metals	393	22	415	8.7
Contaminated general	198	33	231	5.8
Mineral wastes and residues	2654	1	2655	20.7*
Chemical and other	418	19	437	7.4
Total	4989	1141	6130	8.2

\*This percentage reflects the high level of activity in the minerals sector in Wales.

#### Chemical properties of types of mine and spoil discharges (after Rees et al., 2002)

Source	pH	Net alkalinity CaCO <sub>3</sub> (mg l <sup>-1</sup> )	Type
Flooded workings	<5 - 8	0 to >500	Ca-Mg-SO <sub>4</sub> /HCO <sub>3</sub>
Spoil tip	<5	-2500 to 0	Ca-Mg-SO <sub>4</sub>
Free draining workings	5 - 7	+80 to +180	Ca-Mg-SO <sub>4</sub>
Flooded and free draining workings	>5 <8	-350 to +200	Ca-Mg-SO <sub>4</sub>
Pumped mine discharge	6.5 - 7.5	+500 to +1000	Na-HCO <sub>3</sub> /SO <sub>4</sub>

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