

How water is treated and distributed

Water quality

By the time it reaches rivers, reservoirs or aquifers, water already contains a wide variety of substances which determine its quality. It absorbs dirt, dust and gases from the air, debris and bacteria from the ground, and soluble minerals from rocks.

At a water treatment works the main objective is to destroy the bacteria and remove as many unwanted substances as possible. Although water treatment techniques vary widely depending on local factors, the end result will always be water that complies with the current drinking water directives. However, its character will vary greatly from one area to another.

In Britain today people take access to a regular, reliable and safe supply of 'pure' water very much for granted. Water from our taps is expected to be safe, clean and pleasant to drink. Water is a natural resource, but it has to be purified before you can drink it. The water you see in the reservoirs is raw water – in its natural state. The water needs to be cleaned and treated at the treatment works to a high quality, and delivered 24 hours a day, 365 days a year. This requires a high degree of engineering and scientific skill.

Clean water

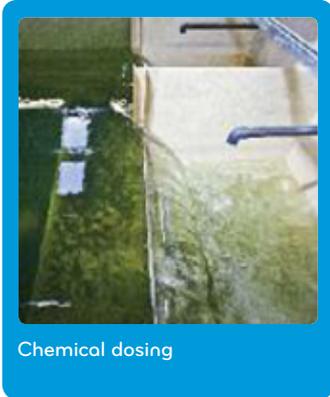
The natural water we see around us almost everywhere often appears to be clean but this is rarely the case. Water has the ability to accommodate a huge range of substances which can make the water unsafe to drink without any change in its appearance. Natural waters are a mixture of chemicals, micro-organisms, and suspended material. The exact composition of water varies from one area to another and even from day to day. Water sources throughout Wales can vary in their make up dependent on their source and the surrounding geography and land use.



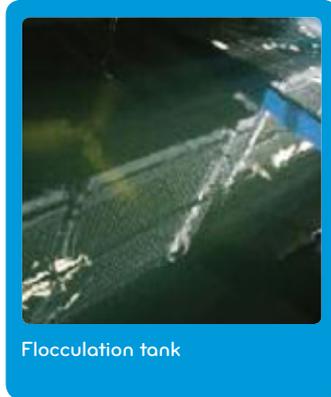
Cleaning water

As the quality of water received by water treatment works varies according to where it has come from, the amount of treatment it receives must also vary.

- Water from underground is usually the purest form of natural water having been filtered through rocks and soil. Often, all it needs is disinfection to kill harmful bacteria.
- Water from lakes and reservoirs requires additional treatment and often a series of processes to remove or destroy any unwanted substance.
- The water abstracted from rivers can be the most variable in quality and usually needs the most treatment. This includes screening, clarification, filtration and disinfection.
- Many of our water treatment works are located in environmentally sensitive areas including national Parks. Where possible Dwr Cymru Welsh Water strive to work with Planning authorities to make treatment works blend into the environment through use of local materials.



Chemical dosing



Flocculation tank



Filtration sand bed



Clarification via dissolved air flotation tanks

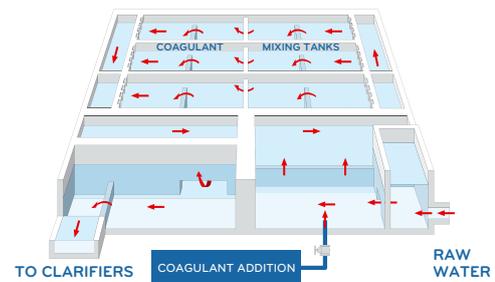
Methods of treatment

Water quality – this is the first step in the treatment process where mechanical screens remove some of the larger debris that can be found in rivers and reservoirs i.e. floating material such as branches, twigs, leaves etc.

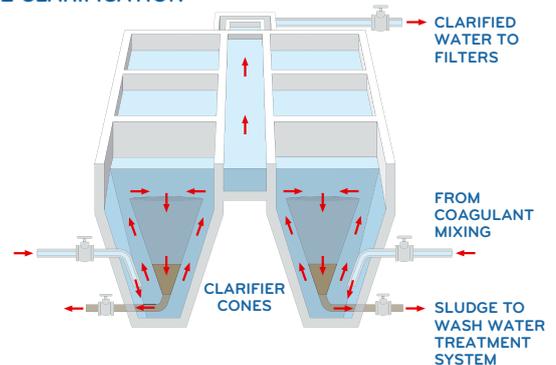
Coagulation and flocculation – a treatment chemical (coagulant) is added to the water which causes smaller particles that remain from the screening process to cling together. This process is called coagulation. These particles build into larger clumps which are then easier to remove. This process is called flocculation and usually takes place in large open tanks with stirrers.

Clarification – is the treatment process that separates these particles from the water and concentrates them into a sludge either by allowing them to settle and fall to the bottom of the tank (Gravity settlement) or by floating them to the top of a tank using small air bubbles (Dissolved air Flotation). The sludge is removed from the process for disposal.

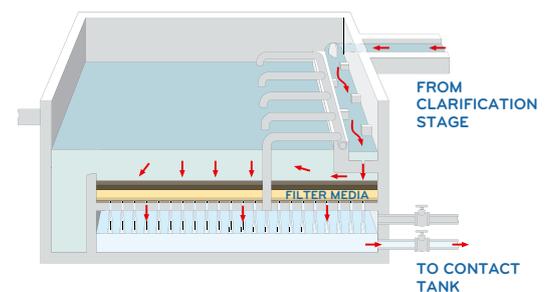
1 COAGULATION AND FLOCCULATION

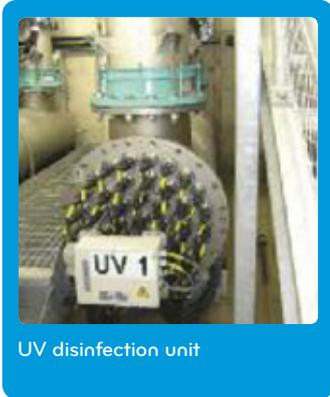


2 CLARIFICATION



3 FILTRATION





Methods of treatment cont.

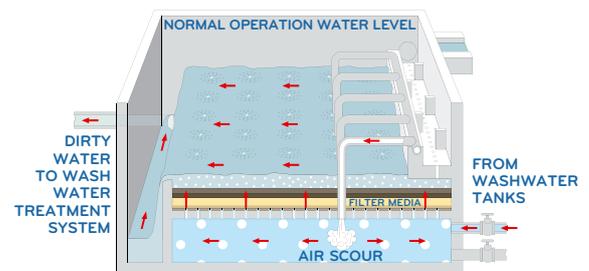
Filtration – this process replicates nature's own purification process. The water is percolated down through a layer of fine sand that traps any particles remaining from the clarification process. Clean filtered water collects at the bottom of the filter and passes forward to the next process. as the filter gradually becomes blocked with particles it is washed by passing water backwards through the filter at a high rate.

pH adjustment – sometimes it may be necessary to add chemicals to adjust the pH of the water. Chemicals are added to correct the pH value and maintain consistent quality.

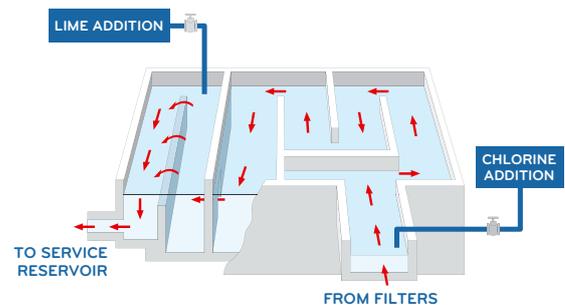
Disinfection – finally, the water must be disinfected to kill any remaining bacteria. This is usually done by adding chlorine or sodium hypochlorite. at some sites ultraviolet light is used as an additional disinfection stage to kill more resistant micro-organisms.

Automatic control and telemetry – Typically all of these processes are controlled automatically on site. Data is also exported from all sites to a central control room from where an alarm can be raised if a process begins to fail.

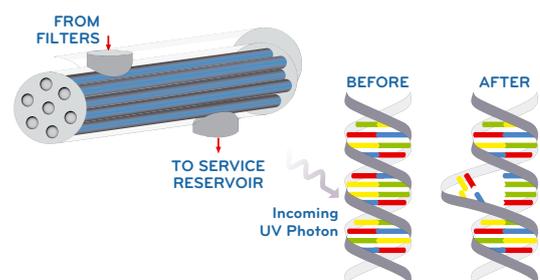
4 FILTER WASHING



5 DISINFECTION



6 UV DISINFECTION



Quality control

Before drinking water reaches the tap, every drop is cleaned and purified. To make sure it is wholesome and fit to drink, detailed laboratory tests are carried out at different points in the water supply system, including customer's taps.

Water obtained from upland sources contains naturally occurring iron and manganese which may cause 'discoloured' water. Old water pipes, often made of iron, can add to the problem. All of these are measured prior and during the treatment process to ensure their removal.

The quality of treated water is constantly monitored – Welsh Water analyses more than 60,000 samples every year.

Service reservoirs

The cleaned water is then stored in totally enclosed tanks made of concrete, metal or fibreglass called service reservoirs, before being piped to customers. These reservoirs also ensure a supply to the customer taps during different peak use times and maintain pressure within the system.

Water distribution systems

Delivering great volumes of water to virtually every domestic, agricultural and industrial premise in the land requires a vast network of pipes and mains. Much of the network in Welsh Water's region covers rural areas with small populations where it is much more costly to supply each resident than in high density urban areas.

Maintaining a water supply network presents many problems. As the mains are underground, detecting fractures or cracks is not easy and even when minor leaks are detected it is very expensive to dig up the ground to repair them.

Water from the service reservoir (where treated water is stored) passes through pipes, usually by gravity flow, until it reaches the customer. In some areas it is necessary to build tall water towers to maintain pressure. It is this pressure that makes water pour out of the tap when it is turned on. Water mains have to be designed and constructed to withstand this pressure. Many different materials have been used in the past, but today mains tend to be made of ductile iron or PVC, depending on the nature of the ground. Ductile iron is very strong and can resist ground movement, but plastic is more resistant to corrosion.

