

Water treatment – Glencorse water treatment works

Background information for educators

This is a new water treatment works to supply a substantial proportion of Edinburgh's population with drinking water. It replaces a much older and under-capacity treatment works, providing a facility of 21st century standard. The project incorporates the latest technology, and is designed to discreetly fit in to the surrounding landscape. It incorporates environmental features such as microgeneration of power using turbines fitted to the incoming water mains. Full details can be found on the website.

The technical skills and knowledge required for water treatment and supply involve maths, physics, biology and chemistry skills. It is necessary to calculate quantities, understand raw water quality, design the appropriate chemical and biological treatment process and calculate the correct sizes for pipes, pumps etc. It is also necessary to work out the costs for chemical supply, pipe maintenance and many other things

Overview of the process – UK practice

There are a wide range of treatment processes available depending on the quality of the raw water and the size of the facility. This is a very brief overview.

Raw water generally has suspended solids causing colour and turbidity; these are removed by coagulation, adding a chemical such as alum (Aluminium Sulphate) or Polyelectrolyte to cause smaller particles to coagulate into bigger ones that settle more easily. Clarification then takes place, removing coagulated material which settles or which floats to the surface. This is typically followed by filtration, either through sand filters or rapid gravity filters. These have both a physical and a biological action, removing remaining impurities and pathogens from the water. pH balancing may then be necessary (depending on the chemicals added earlier in the process.) Finally the treated water is disinfected, either with Chlorine gas, (liquid) Sodium Hypochlorite, or Ozone. This is to protect it when it is travelling through the distribution system to customers' taps.

The distribution process usually requires a service reservoir with some capacity for storing water to cover breakdowns in treatment (between six hours and two days is typical in practice), and is then generally driven by gravity flow through pipes, though pumping may be necessary in places where the local topography does not support this.

Some of Scotland's water comes from the ground, via boreholes. This tends to be purer and may only need disinfection. Ultra-Violet (UV) purification may also be used.

Smaller works in Scotland and elsewhere in the world are increasingly using membrane filtration - proprietary membrane systems filter out the impurities and pathogens. Membrane filtration may need to be preceded by clarification to stop the membrane clogging with suspended solids. Membranes are more economical for smaller works, which is the case in many of Scotland's more isolated communities.

Leakage is often in the news as an issue with UK water supply, but it must be remembered that the water is supplied under pressure so that it comes out of the tap. This means that leakage is very difficult to stop, especially when mains are very old and often inaccessible under buildings etc.

Overview of the process – The developing world

The process in the developing world may technically be the same as in the UK. The issues are more to do with the lack of, or lack of funding for, major infrastructure projects. Piped water supply is expensive, and beyond the range of most developing countries to install or maintain. Thus water supply, particularly in rural areas is often local, and is typically a borehole with a hand pump. There may be no treatment, which is perhaps acceptable as groundwater is often quite clean and there is no extended distribution network in which the water can become contaminated. However, there may be issues with contamination, eg heavy metals such as Arsenic. This can be removed with membrane treatment, which can be powered by local, small-scale means including solar panels.

Surface water, where used, is often contaminated with pathogens (due to inadequate sanitation and animal contamination, etc). It can be treated using simple, easy to construct sand filters if the required knowledge is available. UV purification can be used by allowing water to stand in the sun - but warm water is not pleasant to drink.

Access to water is often a problem, with much of it having to be carried long distances. This duty usually falls to women and girls, who often miss out on education because of it.

Rainwater harvesting is also an option where there is sufficient rainfall to warrant it.

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