CIWEM Chartered Institution of Water and Environmental Management

Policy Position Statement

Water reuse for people and the environment

Purpose

This Policy Position Statement provides an overview of the significance and promotability of large scale water reuse schemes delivering more than 10Ml/d of water resource, for people and the environment. For the UK, like many other areas of the world with a need to bridge the gap between water supply and demand in the long term, large scale water reuse (or effluent reuse) is a relatively untapped way of providing water to meet the long term needs of people and the environment, in the face of future uncertainties such as climate change.

CIWEM calls for:

1. The promotion of large scale water reuse schemes to reclaim water resources, and to facilitate a dependable and a secure long term water supply, in the face of future uncertainties such as climate change.
2. A coherent government policy and the publication of guidelines on water reuse, coupled with well-founded water reuse quality standards for the protection of public health and the environment. Reducing carbon footprints and improving energy efficiency of existing schemes should underpin any water reuse policy.
3. Treatment of waste water to an appropriate standard for the permitted end use, recognising that there is a need to protect public health and the environment, and to deal with potential public concerns associated with water reuse.
4. Local planning authorities in water stressed regions to bring forward proposals in their Development Plan Documents for local requirements on sustainable buildings which reflect the need for new development to be water efficient, in accordance with the Government's recent Planning Policy Statement: Planning and Climate Change.
5. The building industry to further explore and promote innovative small scale domestic water reuse opportunities
6. Research and development into low carbon, large scale, sustainable and economic water reuse treatment methods, and the monitoring, with a view to sharing and learning from best practice, of water reuse practices in countries such as the USA, Australia, Japan, Israel, Jordan, South Africa and Spain where water reuse is taking place for a number of agricultural, industrial and leisure irrigation uses.

CIWEM is the leading independent Chartered professional body for water and environmental professionals, promoting excellence within the sector.

Context

The concept of water reuse to augment water resources is not new. Water reuse can be split into planned and unplanned, direct and indirect, large scale and small scale. Large scale water reuse to replenish river water resources has occurred ever since the introduction of community waste water treatment works. Much lowland abstraction will comprise a proportion of treated waste water discharges derived from upstream wastewater treatment works.

Considerable untapped potential exists for the promotion of water reuse schemes. The greatest potential for reuse will be in areas where discharges are currently made to the sea, or to inland waters that are not abstracted from further downstream, as they could be redirected inland to support river flows and abstractions. Mobilisation of the untapped potential requires actions and policies from the government, regulators, water undertakers and the public.

The categorisation of water reuse schemes is often confused. Large scale water reuse schemes delivering more than 10Ml/d of water resource may be split into planned and unplanned and direct and indirect (Akande and Spraggs, 1999).

Planned reuse is where waste water discharges, with additional specialised treatment, are purposely used to enhance water resources. Unplanned reuse is where waste water discharges enhance water resources, but no account is taken of their impact and no specialist treatment is involved (other than those required to satisfy normal waste water discharge permissions). Unplanned reuse can evolve into planned reuse if large amounts of waste water are discharged into large catchments; for example in the Thames Basin, where on average, one third of London's drinking water is estimated to be recycled waste water (Young, 1984). Planned and unplanned reuse may be either direct or indirect, although unplanned reuse is almost always indirect. Direct reuse is where treated waste water is transferred from a waste water treatment works to the reuse site without intervening discharge into a natural body of water or a reservoir. Such reuse is sometimes called pipe to pipe reuse, and is relatively uncommon for public water supply purposes, but more so for industrial applications. Indirect reuse is where treated waste water is discharged or transferred from a waste water treatment works to a river, a canal or reservoir prior to subsequent abstraction, and treatment to appropriate water standards (if required), and reuse.

Waste water can comprise: discharges from community sewage works or sewers, waste water from industrial processes, waste water from household properties and run-off from highways in wet weather. Water reuse opportunities may be associated with: raw water sources for potable water supplies, raw water sources for non potable water supplies, industrial process water, replenishment of water resources for ecological impact mitigation, irrigation water and wetland regeneration.

A large scale water reuse scheme is a relatively untapped way of providing water to meet long term needs of people and the environment, in the face of future uncertainties such as climate change. The development of a water reuse strategy will depend upon a number of factors including: pattern of demand, extent and type of conjunctive use, operational flexibility and cost. A water reuse scheme may be used to meet either base or peak demand, and can be operated either in isolation or in conjunction with other water sources.

Key Issues

Promotion of large scale water reuse schemes can be justified on account of a significant gap in long term water supply and demand projections. For such schemes to be cost effective they must integrate with existing and probable future water supply arrangements.

Supply Demand Balance and Climate Change: Water reuse schemes specifically engineered to enhance water resources could help bridge the gap between long term supply and demand balance projections, especially in the growth regions of the South and East of England where other more sustainable options may be more limited.

Existing Arrangements: Water reuse to replenish river water resources has occurred ever since the introduction of community waste water treatment works. As an indirect consequence of this, much lowland abstraction from rivers will comprise a proportion of treated waste water discharged from upstream treatment works.

On a catchment scale, the large scale Langford scheme (Chelmer Recycling Scheme, Essex) is an example of a successful indirect water reuse scheme, where treated waste water is mixed with the water from the River Chelmer, which is abstracted at Langford, near Maldon, for Hanningfield reservoir refill. The Langford scheme, at 40Ml/d is associated with a population of up to 100,000 and is a biofor system for phosphate and nitrate removal, with powdered activated carbon for oestrogen removal and UV for disinfection. Some of the water is stored only in 7 day bankside storage lagoons before having normal water treatment. It does not have reverse osmosis treatment. The scheme has been operating for around 5 years.

On a local scale, and more recently, direct and small scale water reuse facilities through industrial processing, for further industrial use has been practised and these include car wash water recycling for subsequent car wash and vegetable wash waste water for subsequent irrigation use. In some cases waste water discharges from community waste water treatment works has been used. There are now examples of waste water from household use, such as sink and bathrooms (grey water), being re-used as cistern flush water. However these units are still expensive at the single household scale.

Direct and indirect water reuse practice is also a feature of irrigation systems in resource stressed and semi-arid areas of Australia, the USA and Spain. In some areas treated waste water from sewage works is used to replenish groundwater resources.

Possible Future Arrangements: The greatest potential for large water reuse scheme will be in areas where waste water discharges are currently made to the sea, as they could be redirected inland to support river flows and abstractions. But, the treatment of waste water in these areas to an appropriate standard for end use, when there is a need to protect public health and the environment must be guided by a coherent government policy and guidelines on water reuse, coupled with authoritative water reuse quality standards.

For discharges to the ground, the risk to groundwater resources should considered, taking into account the source and pathway associated with each discharge, to assess the potential risk to groundwater. In this respect, the size and quality of the discharge, the discharge arrangement and the nature of any industries in the catchment should be established. The purification characteristics of the soil and sub soil and the hydrogeological conditions at each discharge location should be assessed.

The market for small scale household water reuse is growing slowly but many new build developments have potential for purpose-built water reuse facilities. Retrofit installation of greywater systems on existing individual properties has a long payback period and is not attractive using current technology.

Discussion

Considerable untapped potential exists for the promotion of water reuse schemes. The greatest potential for reuse will be in areas where discharges are currently made to the sea, or to inland waters that are not abstracted from further downstream, as they could be redirected inland to support river flows and abstractions. Mobilisation of the untapped potential requires policies from government and regulators, and positive action from water undertakers, to address public concerns on health and safety in re-using water.

CIWEM calls for the promotion of large scale water reuse schemes to reclaim water resources, and to facilitate a dependable and a secure long term water supply, in the face of future uncertainties such as climate change. Climate change scenarios suggest that the UK is likely to experience drier, warmer summers (Hulme et al, 2002) with more frequent periods of extended drought. Demand for water is also expected to rise (Downing et al, 2003). Uncertainties such as climate change may result in significant supply demand balance deficits in the long term, if at different times in different places.

In the UK, there are a number of policy drivers for water reuse including the Urban Waste Water Treatment Directive, the Water Framework Directive, the Integrated Pollution Prevention and Control Directive as well as more local Catchment Abstraction Management Strategies. Further details are given in Appendix 1. The House of Lords Science and Technology committee, in their recent Water Management report, stated that "there is scope for greater industrial use of waste water that has been treated to a sub-potable standard" and that the government needs to investigate how this can be encouraged (House of Lords Report on Water Management, 2006 p69). Defra's recent Water Strategy, Future Water, is positive towards wider industrial water reuse and the development of standards for non-potable water re-use, but does not discuss the potential for wider large-scale re-use schemes.

CIWEM calls for the promotion of a coherent government policy on water reuse, coupled with the development and publication of well-founded water reuse quality standards. The standards must be robust and protect public health and the environment. Reducing carbon footprints and improving energy efficiency of existing schemes should underpin any water reuse policy. The government guidelines must incorporate best practice and a risk management and multiple-barrier approach to managing potential health and environmental risks from water reuse. Australia and the USA both have national guidelines for water reuse, and government support for large scale water reuse schemes. Good educational programmes for raising public awareness of water reuse have been developed in Singapore and the USA. Lessons should be learnt and applied elsewhere.

Water reuse can involve high energy use in advanced waste water treatment and pumping. The impact of water reuse schemes on greenhouse gas emissions will therefore need to be compared with other water supply options, including desalination, rainwater harvesting, winter storage reservoirs, and demand side options to reduce forecast deficits in the supply-demand

balance. International experience at both the strategic and project level can help inform decisions about water quality standards, and the energy efficiency of potential water reuse schemes.

CIWEM considers that the factors that should be taken into account when identifying reuse opportunities with the greatest resource advantage include: development of an inventory of sources and sinks of waste water discharges in water bodies, quantification of the relative magnitudes of the sources and sinks and the feasibility of reuse if sinks are bigger than sources. Water bodies in this case cover river catchments, aquifer units and coastal regions.

CIWEM calls for treatment of waste water to an appropriate standard for end use when there is a need to protect public health and the environment, to deal with potential public concerns associated with large scale water reuse. Although water reuse has been practised indirectly for decades through the existing water cycle of abstractions and discharges to rivers, the reuse of water does carry potential risks that need to be addressed. For instance, pathogens and biological agents that can potentially cause disease and illness may be present in any waste water that is discharged to a water course and is subsequantly reused for water supply. There are also potential impacts on fish and the riverine environment and the probable impact of the build up of contaminants over time in a closed system.

The UK water industry considers that existing standards of water reuse consenting (to meet environmental quality standards and Directives) and conventional drinking water treatment is sufficient to protect public health. Recent anthropological studies have shown that the general public do not like experiencing other peoples waste and would possibly be concerned if they were aware of current practices of indirect recycling. As the process of consultation is now widely practised, and will be reinforced through the Water Framework Directive, then not only will new schemes be exposed but concerns may be raised over existing arrangements.

In order to address potential public concerns, the issue of whether or not additional standards are required for the control of waste water discharges, associated with future development of reuse opportunities, must be considered. There may also be a need for additional treatment reliability to reduce the risk of failure, and to incorporate barriers to possible breakthrough of contaminants. To this end, the United Kingdom Water Industry Research (UKWIR)/American water works association Research Foundation (AwwaRF) and Water Reuse Foundation (WRF) have recently completed a project titled: "A Protocol for Developing Water Re-Use Criteria with Reference to Drinking Water Supplies" (UKWIR, 2005). The project proposed a framework that deals with standards for the control of waste water discharges to address potential public concerns. The framework also provides a basis for more widespread acceptance of the existing practice of using treated and blended waste water as a raw water source, and as a replacement for other uses of conventional drinking water sources. The project identified a number of knowledge gaps that can potentially restrict the introduction and application of waste water reclamation and reuse strategies.

CIWEM calls for the building industry to promote and further explore innovative small scale domestic water reuse opportunities. The South and East of England are considered to be the economic powerhouse of the country, but there is a housing shortage. The UK government has plans for development of new housing in four key areas of: the Thames Gateway, Ashford, Milton Keynes and South Midlands, and the London-Stansted-Cambridge-

Peterborough corridor. This should provide ample opportunities for further exploration of innovative water reuse schemes in the long term.

CIWEM urges local planning authorities in water stressed regions to bring forward proposals in their Development Plan Documents for local requirements on sustainable buildings which reflect the need for new development to be water efficient. Specifying the higher levels of the Code for Sustainable Homes in such areas will encourage deployment of technologies such as rainwater harvesting or grey water recycling systems in support of housing developments.

CIWEM calls for research and development in low carbon, large scale, sustainable and economic water reuse treatment methods and the monitoring, with a view to sharing and learning from best practice, of water reuse practices in countries such as the USA, Australia, Japan, Israel, Jordan and South Africa and Spain where water reuse is taking place for a number of agricultural and industrial uses. In the UK, more research and development into the feasibility and environmental economics of large scale water reuse schemes is needed to be able to identify suitable associations between water and sewerage service providers and industries for the promotion of beneficial large scale schemes.

Research and development activities should involve water reuse demonstration plants that can be used to investigate different treatment technologies. Some work has been carried out to explore dual distribution infrastructure systems at community level for small scale water reuse and CIWEM advocates such pilot studies where the results may be helpful in developing innovative solutions for new communities.

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Appendix: Some Policy Drivers for Water Reuse in the UK

The main policy drivers that will influence the implementation of future water reuse schemes in the UK are as follows:

Urban Waste Water Treatment Directive: This European legislation aims to protect the environment from the adverse effects of urban waste water discharges. It requires municipal and certain industrial waste water deriving from areas with a population equivalent of more than 15 000 to receive secondary and tertiary treatment. Waste water from smaller settlements must also receive some form of treatment and sensitive waters must be properly protected. The Directive also asserts that sewerage undertakers must ensure treated waste water is reused 'whenever appropriate'. Although this assertion is somewhat vague, as a minimum it suggests that the potential for water reuse must be considered, to determine whether either is 'appropriate' given the circumstances

Water Framework Directive: This European Directive requires inland, estuarine and coastal waters to reach "good status" by 2015. The water environment must be managed in an integrated manner on the basis of river basin districts. To achieve good status: agriculture, water companies and industry will be required to be more stringent in preventing the discharge of pollutants into receiving waters. Only sustainable levels of abstraction from rivers will be allowed because certain minimum flows are required to support the algae, plants, fish and macro-invertebrates whose presence confers good ecological status on a water body. Reduced abstraction and more stringent discharge consents are likely to lead to more businesses considering water recycling and reuse

Where treated waste water is discharged to rivers and forms a significant component of baseline river flow in periods of low rainfall, water reuse and recycling could result in diminished river flows and resultant ecological implications. Where waste water is discharged directly to the sea, this problem is avoided (Environment Agency, 2006)

Integrated Pollution Prevention and Control Directive: The IPPC Directive requires potentially highly-polluting industry to obtain a permit which is only issued if certain environmental criteria are met and information is provided about how the company will reduce and prevent various kinds of pollution (including waste water discharges)

Catchment Abstraction Management Strategies (England and Wales only): The aim of these locally-developed documents is to help balance the demands of water abstractors and the aquatic environment and ensure that decisions are made equitably and publicly. To ensure abstraction is sustainable, those wishing to abstract significant quantities of water require a licence. This licence has certain conditions such as a maximum quantity that can be abstracted and a minimum flow requirement before any abstraction can take place. Businesses which cannot obtain sufficient licences to meet their requirements must find an alternative water supply. Catchment Abstraction Management Strategies have been developed by the Environment Agency and as such cover only England and Wales

Whilst there are currently no directly comparable strategies in Scotland or Northern Ireland, both now have an abstraction licensing system.

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Note: CIWEM Policy Position Statements (PPS) represents the Institution's views on issues at a particular point in time. It is accepted that situations change as research provides new evidence. It should be understood, therefore, that CIWEM PPS's are under constant review, that previously held views may alter and lead to revised PPS's. PPSs are produced as a consensus report and do not represent the view of individual members of CIWEM.