



Water Quality Issues for Household Water Reuse

Briefing Note

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Purpose

This Briefing Note considers the issues of water quality surrounding the use of alternative sources of water in the home for applications other than drinking, food preparation and personal hygiene.

It does not consider the quantitative impact of water reuse relating to conservation of potable water supplies or water reuse as a tool for demand management, (i.e. reducing per capita consumption).

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Background

Potable water provided for domestic use from a regulated supply must be wholesome for all purposes including drinking and food preparation as well as sanitary use (e.g. washing and toilet flushing) and central heating (section 218 of the Water Industry Act 1991).

Several alternative sources of water are available, however, that could be used for various applications around the house where such stringent standards are not deemed necessary. Such sources still must not, however, pose a direct risk to public health or interfere with the existing provision of potable water within a property.

There are four distinct sources of water available for use in the home depending on the type of property. Each of these sources of water has separate water quality implications that need to be discussed independently.

1. Water from a private supply that is not brought up to the required standard for drinking water but is intended to be solely for non-potable use, for example toilet flushing.
2. Rainwater collected, normally from a roof or land surface catchment, and stored in a covered container for later use.
3. Greywater¹ that is used immediately and has been derived from washing activities in the home for reuse in a different area of the household without treatment. Typical practice would involve using a bucket, watering can, or siphoning device to distribute the water.
4. Greywater that is collected and stored prior to later use and distributed through a dedicated internal plumbing system that is not connected to the potable supply. Some form of water treatment or disinfection may be required to preserve its quality and ensure it is safe to use.

¹ For the purpose of this briefing note, greywater is a term used to describe the water in the home coming from washbasins, baths, showers and clothes washing machines after use. It is not acceptable to reuse water from toilet flushing, kitchen sink, or dish-washing machine effluent. These effluents – termed blackwater – are unsuitable for the recycling applications referred to in this briefing note due to their composition.

CIWEM's position

- 1 CIWEM supports the principle of wider application of alternative sources of water for household use and welcomes the increasing debate surrounding the potential benefits of water reuse and the growth in research on the issue, in terms of both the water quality aspects and practical designs for installation, especially retrofitting.
- 2 CIWEM notes, however, that alternative sources can pose risks to public health and sources must be subject to appropriate risk assessment to provide assurance over the safety of the supply for its intended application.
- 3 Any source or supply of non-potable water should be assessed to determine if the risk to health is acceptable and establish what measures would be necessary to ensure water is safe for its intended application. Adherence to water quality standards for microbiological parameters such as indicator bacteria does not necessarily imply that the water is safe for all uses.
- 4 Water that is reused within the household will not have been tested and proved to be of as high a quality standard as potable water supplies. CIWEM considers it essential that this is thoroughly understood by householders, housebuilders, developers, lawyers and architects so that water is reused safely in the home and garden and public health is not put at risk.
- 5 Generally, the water quality from rainwater harvested on a well-maintained roof catchment is of superior quality to rainwater collected from a catchment on the ground. Rainwater is often of superior quality to domestic greywater. It is, however, a mistake to assume that greywater is relatively unpolluted. It is not recommended that untreated greywater or rainwater is used for drinking, cooking, food preparation or washing water.
- 6 When reusing water in the household it is important to consider the storage time and storage container, along with the way the water was used the first time. The water quality can vary daily even between the reused water from the same source. The table below is intended as a guide but cannot be definitive as the quality of one type of reused water can differ in each specific situation. There should be no usage other than those listed.
- 7 Where reliance is placed solely on an alternative source of water (e.g. toilet flushing), the supply should be consistently available and at the required quality to avoid a dual distribution system which could potentially lead to cross-connections.
- 8 Any work to install additional plumbing or to modify an existing installation must comply with good plumbing practice².

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

² [Water reuse systems, guidance and advice given by Water UK and supported by HBF](#)

Key Issues

The use of alternative sources of water in the home is being promoted for many reasons, including to support conservation of potable water supplies against the wider context of demand management and the supply and demand of water resources and linked to surface water management systems.

Water from alternative sources will not necessarily be of comparable water quality as potable water supplied by a regulated water supplier. When water is being collected around the home, it is most likely to have undergone a deterioration in water quality and this in turn affects the way in which it can be reused safely in the household. Whilst CIWEM supports the concept of reusing water as a means of reducing demand on the public water supply system, it is essential that the public health and water quality implications associated with this are understood and addressed.

Drivers for increased use of alternative sources of water include:

- ◆ Restricting increases in abstraction and in some cases withdrawing licences to minimise environmental impacts, to comply with the legislation such as the Habitats regulations and the Water Framework Directive.
- ◆ Growing need for water conservation – increased population, climate change, lower occupancy, increased social bathing / washing norms.
- ◆ Integrated management of water linked to surface water management systems – rainwater harvesting systems that both provide a surface water management benefit and a non-potable water supply.



Summary of household water reuse - appropriate sources and uses

Source	Use					
	Toilet flushing	Car washing	Clothes washing	Garden watering	Outside cleaning /sluicing ^a	Ornamental pond fill/ top-up
Bath water	✓	✓		✓	✓	
Shower water	✓	✓		✓	✓	
Washing machine water				✓ ^b		
Softener regen water	✓				✓	
Paddling / swimming pool		✓		✓	✓	
Rainwater ground catchment				✓	✓	
Rainwater roof catchment	✓	✓	✓	✓	✓	✓
Untreated private supply ^c	✓	✓	✓	✓	✓	✓

^a Only acceptable where water will run to an appropriate sewerage system if water is from a treated source (e.g. washing machine)

^b Washing machine water should not be used on crops that will be eaten.

^c Provided the quality of the source has been assessed and found not to pose a risk to public health

Types of alternative sources

Water may be available from a number of sources other than a potable supply. Each of these sources needs to be assessed to determine that their application does not pose a public health risk.

Storage of water can lead to the development of biological growth (biofilms) that could harbour potentially harmful microorganisms or permit the development of undesirable odours. Biological growth would be greater where with increasing amounts of nutrients, under warmer conditions and in the absence of a disinfectant.

Private Supplies solely for non-potable applications

Water may be available from a private supply that could be used for other applications (toilet flushing) but without treatment to potable quality. An inspection of the source would be necessary and measures put in place to protect it from contamination, if any deficiencies are evident.

Rainwater Harvesting and Use

Most commonly used for rainwater collection and storage are water butts, but also in attic and under-patio / drive storage tanks – rainwater may be better than tap water for many plants as it generally has lower dissolved solids and doesn't contain a disinfectant residual.

A risk to the quality of rainwater is the surface catchment from which it is collected. A reasonably common cause of contamination comes from lead roofs, animal or bird defecation and grit from tiles, or from treatments to prevent moss growth.

Greywater Reuse – without storage

This commonly consists of householders applying their bath or shower water to their gardens or to flush their toilets directly with minimal storage times. People commonly use buckets to transport the water or create a siphon using a suitable length of hose.

This method of recycling water has few water quality implications as the greywater does not have the time to turn septic before it is used. The utensil that is used to transport the greywater must be regularly cleaned to ensure that a biofilm does not develop.

Greywater Reuse – stored using greywater tank and plumbing system

Storage tanks and storage times can significantly affect the quality of grey water. Dark warm places are ideal places for microorganisms to thrive. As water flows through the same tank, biological growths inevitably build up, making treatment and disinfection necessary. Greywater can rapidly become septic and start to smell if not managed properly. Storage tanks should not be buried under driveways or in locations where they are awkward to clean.

When reusing washing machine water, it is advisable to use an “environmentally friendly” washing detergent. Even so, it is imperative that this water should not be used to irrigate plants grown to be eaten due to the risk of bacteriological contamination.



Biofilm Control in Stored Systems

There has been little research into effective disinfection of systems providing alternative sources of water. The appropriate disinfectant and its dose will be dependent on the source, the application and the anticipated storage time of the grey water. At the present time there is insufficient data available on appropriate methods for domestic-scale biofilm control. In practice, the most commonly used methods are chlorine and/or ultraviolet disinfection. Regular manual cleaning of equipment is also important. There is a need for all parties with experience of reuse to collaborate to ensure that best safe practice can be determined at the earliest possible juncture.

Planning and Installation

Correct planning, design and installation of a system is essential. During the planning stage the purpose of the system must be clear and where the reused water will come from and what it will be used for. The design stage must consider ease of maintenance and mitigate any possible hygiene risks. There must always be a clear separation between recovered and potable water systems.

Pipes and taps used for reused water must at the minimum be clearly labelled as non-potable water. It would not prevent accidental consumption by young children unable to read, for example, and it may be preferable to have a unique tap design which included safety features. Tanks should be in dark cool places where possible and should always have a siphon and overflow pipe to a suitable drain or soak away.

Maintenance

CIWEM considers it essential for household occupants, using alternative sources of water, to be fully aware of the implications and the level of maintenance necessary to keep these systems functioning safely and effectively.

Maintenance is minimised when storage, treatment and supply systems have been properly planned, installed and operated. Tank maintenance must be considered during the design of the system.

Conclusion

CIWEM supports ambition to increase the sustainability of homes and realises that this might increase the number of households incorporating systems using alternative sources of water for non-potable applications. Before implementation, it is crucial that the risks to health have been identified and appropriate safeguards are in place to ensure protection of public health.

This is a topical issue and one that is increasingly a focus of discussion and investigation. CIWEM encourages this growth in research and continued investigation.

References / Further Reading

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