

Water reuse – guidance & advice factsheet

Introduction:

SES Water supports the use of water reuse systems and encourages our customers to be Waterwise. Recently, the water industry has become aware that there have been a high number of water reuse systems, particularly rainwater harvesting units, that have been incorrectly installed or maintained leading to serious public health risks at the properties involved.

Legally, it is a requirement that a water reuse systems must be designed and installed correctly so that it complies with the Water Supply (Water Fittings) Regulations 1999, to ensure that there is no risk of contamination to the end users. Water from a water reuse system is not potable water and therefore it must not be directly connected in any way to the mains drinking water supply. **The following information describes the key areas which must be adhered to and areas of consideration for anyone designing, installing, and using these systems to prevent the risk of cross contamination.**

What are the water supply regulations?

These regulations are known as: The Water Supply (Water Fittings) Regulations 1999 and they apply in England and Wales. These regulations are national requirements for the design, installation, and maintenance of plumbing systems within the boundary of a residential or commercial property. They apply to all water pipes, water fittings, appliances that use water and all other plumbing within the property. The purpose of the regulations is to prevent waste, misuse, undue consumption, erroneous measurement of water and, most importantly to prevent contamination to the water supply.

What do we mean by water reuse?

Water reuse is the new term used for what we used to know as water recycling or reclaimed water. The purpose of these systems is to provide an alternative source of water that can be used in place of potable water for appliances that do not necessarily require such a high quality of water. This also helps to reduce the reliance on public mains water. The most common systems used in the UK are **rainwater harvesting** and **greywater treatment**.

With the growing number of eco homes being built across the SES Water region during recent years, this has seen an increase in the use of these technologies. With the tightening of Building Regulations, this trend will only increase as new house designs are incorporating water reuse systems in a bid to ensure that planning permission is granted.

Whilst these systems do not need specialist installers, our experience is that there is relative lack of experience and awareness by most plumbers regarding the implications of correctly installing them and the associated risks. Due to the nature of the source being raw untreated water used, there is a high increase of risk for potential harm if these systems are not installed correctly.

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What is Rainwater Harvesting?

In simple terms it means diverting the rainwater that falls onto roofs, or other collection surfaces of a property, and storing it usually in an underground tank for reuse. The captured rainwater is then pumped from the underground tank to supply water for flushing toilets, supplying outside taps for garden use, and it can also be used for the washing machine with a little additional treatment.

Collecting rainwater will contain traces of atmospheric and environmental pollutants, and it is likely to contain some animal and bird faecal matter which results in the water containing contaminants. The extent of such contamination will vary but some degree of contamination must always be assumed and this needs to be catered for in the design of the system. That is why rainwater harvesting is prohibited from mixing with a potable water supply.

What is a greywater System?

Greywater is the wastewater from our kitchen sinks, washing machines, wash hand basins, showers, and baths. Greywater does not include wastewater from toilets, that is known as blackwater.

It is the less polluted greywater from baths, showers, and wash hand basins, which is normally collected and treated ready for reuse. This is known as bathroom greywater but the greywater from washing machines may also be used if greater volumes of water are needed.

Standards & water regulations:

British Standards have published two standards, **BS8515:2009 for rainwater harvesting systems** and **BS8525-1:2010 for greywater systems**. These recently published standards cover the design, installation and maintenance requirements for these water reuse systems and include water quality requirements for the end uses. These are some of the first formal national standards in Europe, although standardisation throughout Europe is in progress through the European and International standards committees (CEN and ISO), it will be some years before they are published.

In addition to the British Standards, there are requirements in the Water Supply (Water Fittings) Regulations 1999 that apply to systems where water from the public mains is used to top up a reclaimed water system. The purpose is to protect public health not only for current users but for users in the future when properties are owned by different people. These regulations are referred to in this document as the Water Fittings Regulations.

Notification to SES Water:

Under the Water Fittings Regulations, if a customer proposes to install a water reuse system that incorporates a back-up supply from the public mains, they must notify SES Water under Regulation 5 of the Water Fittings Regulations. All water reuse systems will be inspected recorded and registered by SES Water. SES Water has a duty to ensure that these Regulations are complied with therefore ensuring public health is protected. We must be satisfied that these new types of high-risk domestic systems cannot contaminate our mains network supply. The minimum information required is a plan of the site, a schematic diagram of the plumbing layout and details of what is proposed.

Notification should be sent by email to: waterregulation@seswater.co.uk.

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System designs:

In general, there are two basic types of design that a water reuse system uses to distribute water to the end use appliances. These designs are known as direct and indirect, and they apply equally to both rainwater and greywater systems. Both types of system have their merits and drawbacks.

A Direct system is where water is pumped directly from storage such as the underground tank direct to the points of use for example, toilets and outside taps.

In the event of a failure in any of the sensors, pumps, controls, or an electricity failure (power cut), the whole system will not operate as electricity is required to operate them. A mains water back-up supply would be of no help, as this normally fills either into a low-level storage tank or greywater treatment system and it needs further pumping. All the appliances connected to a direct system such as, toilets and outside taps etc would not work and this is the direct system's Achilles heel. On the positive side it can take up less space in a property as there is no need for any extra plumbing such as a high-level cistern etc.

An Indirect system is where the stored water is pumped to an intermediate cistern at high level, for example in the roof space, where it can be stored and feed the points of use by gravity.

This type of system can be made to seamlessly change over in a loss of electricity situation, owing to the mains water back-up supply being fed directly into the high-level cistern. To make this work it is essential to ensure the electronically operated solenoid valve on the mains water back-up is of a type that will open in a no electric situation or, that a manual valve is installed so it can be easily accessed to turn the inlet ball valve on.

Whilst this type of system can easily cope with a failure, be it electricity or other system failure, it does require some space to locate a high-level storage cistern and additional plumbing. This system typically provides low pressure water to the appliances and possibly low flow rates. However, low flow rates can be overcome by good design and selection of approved fittings and taps.

It is necessary that the type of system selected can deliver the end use water quality parameters detailed in the British Standards to ensure that the users are not exposed to undue risks. It may be that a hybrid of the two designs will offer the best solution to users, with the security of a constant supply to toilets from an indirect system and the pressure and flow for non-critical appliances, for example garden taps that could be fed direct from the pumped water reuse supply that services the indirect storage cistern.

Back-up water supply:

All **rainwater harvesting** is reliant on frequent rainfall, so when there is no rain an alternative source will be needed to keep systems operating. It is essential to have a mains water back-up supply for such periods but the top up must be compliant with the Water Regulations. It must be supplied through a type AA or AB air gap on the cistern and the mains water top up must be in a higher position to the rainwater supply pipe.

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Back-up water supply:

Greywater systems do not rely on rainfall. It requires occupiers to be using baths and showers etc to provide the greywater system with untreated water, so this should not be a problem. However, should there not be enough untreated greywater to process or, should the treatment system fail for some reason, it should be designed so that it is able to continue to operate by providing an alternative supply. It will be essential for this to be provided by a mains water back-up supply through a type AA or AB air gap on the cistern. If a water reuse system failed, or there was no main's water back up supply due to a burst water main, then the appliances connected to the system would stop working. Users would not be able to flush their toilets or use other appliances connected to the greywater system, which could potentially lead to public health issues. It is important that whatever design is chosen, **at least one toilet must be able to operate normally**. In larger premises it is recommended that the system is supplied direct from the mains water supply if the design does not incorporate a reliable alternative.

Where a back-up water supply is used, it should be controlled so that only the minimum amount of water is supplied to the system, particularly for a rainwater system. This will ensure that when it next rains the maximum amount of rainwater can be captured, or in the case of a greywater system it can utilise the incoming greywater.

If the back-up water is delivered to an underground storage cistern, then consideration should be given to the potential for smells to vent back into the property. A waterless trap may be used to prevent this potential problem occurring.

Backflow protection and fluid category 5 risk:

The Water Supply (Water Fittings) Regulations require that the drinking water system must be adequately protected from any potential contamination in the event of backflow or back siphonage occurring. In the case of water reuse systems, **the mains water back-up supply needs to have suitable backflow protection provided at the point of supply into the reuse system to prevent the risk of cross contamination into the potable water supply**.

Rainwater collected from roofs and other surfaces is likely to contain faecal, biological, and pathogenic contamination and this places it into a fluid category 5 risk, that poses a **serious health hazard** if it is consumed. Likewise, greywater being collected wastewater from washing etc is also likely to contain faecal and pathogenic organisms and therefore also poses a fluid category 5 risk.

To meet the Water Regulations compliance, a fluid category 5 risk requires protection to the main's water supply that can only be achieved through the installation of either a Type AA, AB, AD air gap, or through the use of a Type DC pipe interrupter (a device that incorporates an air gap). This is to separate the mains water supply from a water reuse system supply. The most common methods are through a Type AA or AB air gap. It must be noted that there are no **mechanical devices capable of protecting against this level of fluid category 5 risk**. Whichever protection arrangement or device selected, must be a permanent fixture in the system to ensure that users are always fully protected.

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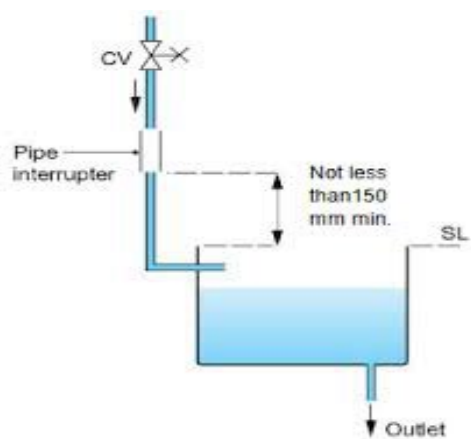
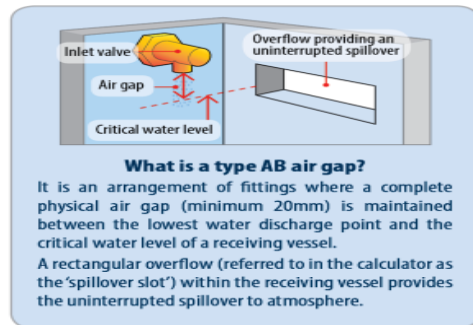
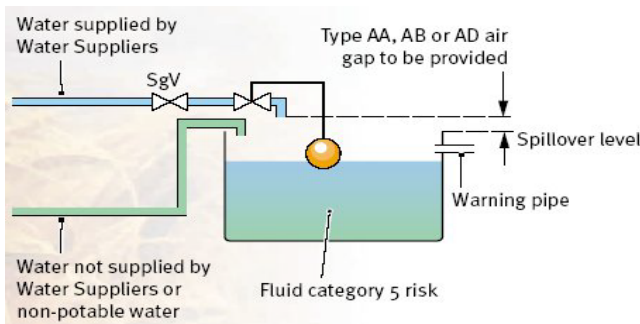
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Example of the required air gap arrangements:

Type AA air gap – This is an air gap with unrestricted discharge. It is a non-mechanical backflow prevention arrangement of water fittings where water is discharged through an air gap into a receptacle which always has an unrestricted spill over to the atmosphere.

Type AB air gap – This is an air gap with a slotted weir overflow. It is a non-mechanical backflow prevention arrangement of water fittings complying with Type AA, except that the air gap is the vertical distance from the lowest point of the discharge orifice which discharges into the receptacle, to the critical level of the rectangular weir overflow.

Type DC pipe interrupter – This is an air gap with a permanent atmospheric vent. It is a non-mechanical backflow prevention device with a permanent unrestricted air inlet. This type of device must be fitted so that the flow of water is in a downward position and the lowest point of air aperture is not less than 300mm above the spill over level (SL) of the receptacle, and it must not have any valve or restriction on the outlet.



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Required air gap arrangements on cisterns:

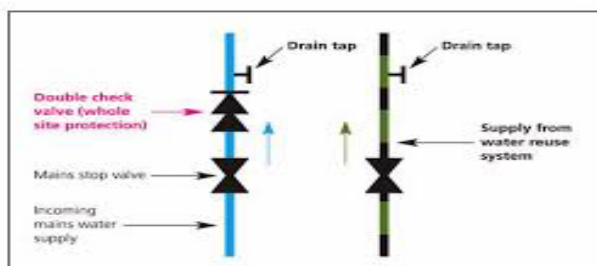


Examples of WRAS approved Fluid Category 5 break tanks incorporating AB air gaps.

Dead legs:

In normal operation the back-up supply should not be needed on a regular basis, and so it creates a dead leg situation that offers the opportunity for water to stagnate and this should be avoided where possible. Where this is unavoidable, additional backflow protection must be considered such as a fitting a single check valve on the back up supply at the branch to protect the drinking water supply from the risk of stagnant water back siphoning. Consideration should also be given to the impact of the additional demand on the plumbing system during activation and should be catered for in the design and suitably sized.

Whole site backflow protection:



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Pipework & fittings

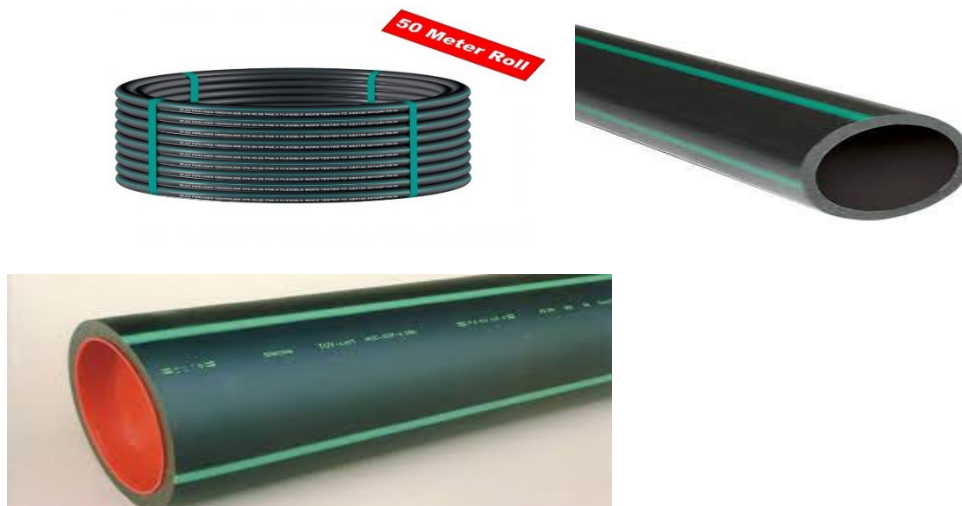
The Water Supply (Water Fittings) Regulations, require the clear identification of pipes containing water not supplied by the local water company, or containing a fluid that is not wholesome. These pipes must be suitably marked so that they can be readily distinguished from any water supply providing wholesome water.

Pipes must be made from materials that are suitable for the location, temperature range, the type and quality of the reuse water to be used. This will ensure there are no adverse effects, for example corroding pipework, due to factors such as low pH or other chemical effects. The British Standards recommend that a contrasting type or colour of pipework is used to make it easy to identify.

For any pipework used **below ground** a contrasting colour for reuse systems must be used. The Water Regulations Advisory Scheme (WRAS) and National Joint Utilities Group (NJUG) recommend that black pipe with green stripes is used for this purpose, this is detailed in the WRAS Information and Guidance Note No 9-02-05 to meet these requirements. Like other water suppliers, SES Water subscribes to these recommendations and will ensure that buried pipes can be clearly identified during any subsequent excavations. Whilst most building merchants may not hold this type of pipe in stock, there are specialist suppliers along with member companies of the UK Rainwater Harvesting Association (UKRHA) that can provide this type of pipe. Where pipework is laid in contaminated ground the pipe must also be of a type that is resilient to any potential contamination and not allow external contaminants to permeate into the reuse water.

The water reuse standards recognise that normal plumbing pipework will be used however it does recommend that a contrasting type or colour is used to prevent confusion with the normal plumbing system.

Example of approved pipework for a reclaimed water system. This pipework has the correct colour pigmentation for use above and below ground on systems like rainwater harvesting.



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Labelling, colour coding & Identification:

Fitting labels and clearly marking pipes will ensure that users are fully aware what quality of water is being supplied to their appliances through the plumbing system. This will help users take the appropriate precautions to prevent themselves, their family or anybody else not to drink from taps supplied with rainwater/greywater. This contributes to the health and wellbeing not only for current users but for future occupiers, by raising awareness that a water reuse system has been installed.

Colour coding of pipework is essential to help prevent any possibility of misconnecting onto a water reuse system during the replacement of fittings or renovation for example bathroom refits. It will also help prevent cross connections that could lead to contamination of the drinking water supply. The water supply industry deems that regulations will be met if all pipes carrying water for drinking and sanitary purposes are readily distinguishable from all other pipes. "Readily distinguishable" pipes, means any method of identification or marking. This includes colour pigmentation incorporated into plastic pipes or they should be clearly labelled in accordance with BS1710 with stickers on the pipe and lagging, indicating that the pipes are readily identifiable as pipes that contain non-potable water.

This includes reclaimed untreated water such as rainwater harvesting, greywater or water supplied from a source other than the water supplier's main. The pipes can also be colour coded in accordance with BS 1710 using tape that clearly identifies it as carrying non-wholesome water.

The colour coding or labelling should be designed for the life of the system and located along the entire length of the pipework at intervals not greater than 0.5m and be marked at every junction or key connection point to any outlet fitting. Reclaimed pipework must be made clearly identifiable between every joist space and in ceiling voids. Any point of use appliances such as toilet cisterns and washing machine valves supplied from a recycled system should have point of use labels or tags indicating not drinking water as shown. However, there must be a label stating NOT DRINKING WATER by any taps supplied from a reclaimed water system to prevent the risk of people drinking the water. The minimum recommended sizing for labelling outside taps is 80mm high and for internal use 40mm and the lettering on these labels should be black on green and not less than 5mm in height.

Below are examples of the required labelling to clearly identify pipes, taps and connection fittings that are supplied from reclaimed water using systems incorporating rainwater and greywater.

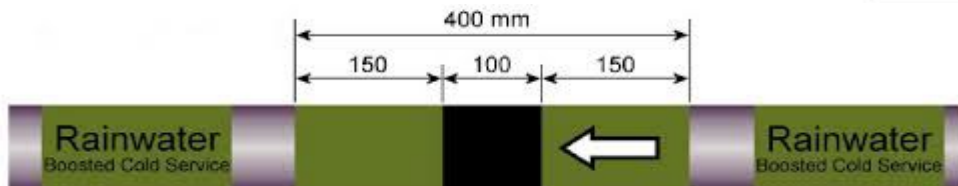
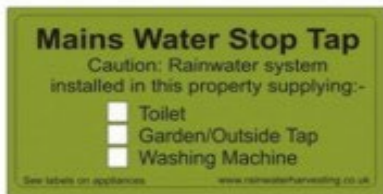
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Does the system require maintenance?

As with anything mechanical, maintenance is vital to make sure maximum benefit can be gained by users, and it is no less true for a water reuse system. A few simple frequent checks may be all that is needed to ensure a system functions at its optimum as the manufacturer intended. It is critical that users should be made aware of this and that it is in their interests to follow the maintenance requirements that the manufacturer specifies. If customers fail to get their systems serviced or maintained due to the costs involved, this could lead to either a system failure or increased levels of contamination of the water they hope to reuse. This can be critical because if a customer decides to ignore this or even worse cross-connect to their mains water supply, it can have severe consequences. It is therefore critical these factors are considered during the design stage when selecting the most suitable water reuse system.

Summary

These new types of domestic systems can offer a way in helping to save on mains water use, providing that they are installed correctly. More and more developers and builders are seeking to install these types of systems in the latest style eco homes. To ensure that we all can exercise our duties of care, please make sure you follow a few simple checks to guarantee systems are installed properly by:

- Notifying us with details of the proposed work in plenty of time to prevent delays.
- Selecting a design that can ensure a constant supply of water is available for critical appliances such as toilets.
- Using the correct pipe below ground.
- Making sure there are no cross-connections.
- Ensuring the backflow protection is of the correct type.
- Following proper the correct labelling and marking requirements for all pipes and outlet connections.

Following the British Standard's Codes of Practice.

- Making sure that users are fully conversant with the systems, particularly operation and maintenance requirements.

SES Water wants to make sure that our customers have a good healthy wholesome drinking water supply, so by having a correctly designed system installed that meets the regulatory requirements all helps to serve this purpose.

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Points of reference

Water Regulations Advisory Scheme www.wras.co.uk.

BS8515:2009 Rainwater Harvesting Systems code of practice.

BS8525-1:2010 Greywater Systems code of practice.

BS1710:2014 Identification of pipelines and services.

BS4800:2011 Colours for buildings National Joint Utilities Group www.njug.co.uk.

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