

Water reuse systems, guidance and advice

given by **WATER UK**
and supported by



Water reuse systems
guidance and advice

Contents

Introduction	3
What do we mean by water reuse?	3
Rainwater harvesting	3
What is meant by rainwater harvesting?	3
Greywater	3
How is greywater different?	3
Standards and regulation	3
Are there any standards?	3
What regulations apply?	4
Notification	4
Do I need to inform the water supplier about my installation?	4
Why?	4
System designs	4
Direct systems	4
Indirect systems	4
Back-up water supply	5
What happens when there's no rain?	5
What would happen if there was no mains water back-up supply?	5
Backflow protection	5
What sort of risk is rainwater and greywater?	5
What backflow protection is required for the mains water back-up supply?	5
Examples of backflow protection	6
Dead legs	8
Wholesite protection	8
Do I need additional protection?	8
What is wholesite protection?	8
Pipework	8
Do I need special pipework?	8
Belowground pipework what should I use?	8
Aboveground pipework what should I use?	9
Labelling and marking	9
Why do I need labels?	9
Colour coding pipework	9
Why must you colour code all water reuse pipework?	9
The following methods are recommended:	9
Commercial/Industrial pipes	9
Domestic pipes	9
Labelling	9
Examples of labels	10
Examples of installation	10
Maintenance	11
Summary	11
Other references	11

Water reuse systems, a brief guide

Introduction

Many water suppliers support the use of water reuse systems and encourage their customers to be Waterwise. In the past there have been a number of examples where water reuse systems, particularly rainwater harvesting units, have been incorrectly installed or maintained leading to serious public health risks at the properties involved.

Legally, water reuse systems must be designed and installed to ensure there is no risk to the end users and, in particular, 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 for consideration for anyone designing installing and using these systems.**

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 drinking water for appliances that do not need such high quality water. This 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 during recent years, this has seen an increase in the use of these technologies. Couple this with the tightening of Building Regulations, this trend will only increase as new house designs are incorporating these 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. Combine this with the nature of the source of the raw water used, the potential for harm will only increase, should these systems not be correctly installed.

Rainwater harvesting

What is meant by rainwater harvesting?

In simple terms it means diverting the rainwater that falls on roofs, or other collection surfaces, of a property to store it usually in an underground tank for later reuse. The captured rainwater is then pumped to flush toilets, to outside taps for garden use and in some cases it can be used for the washing machine with a little additional treatment.

Collecting rainwater will contain traces of atmospheric and environmental pollutants, and is likely to contain some animal and bird faecal matter. The extent of such contamination will vary from site to site but some degree of contamination must always be assumed and this needs to be catered for in the design of the system.

Greywater

How is greywater different?

Greywater is the wastewater from our kitchen sinks, washing machines, wash hand basins, showers and baths but not from toilets, this 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 and regulation

Are there any standards?

Yes, 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.

What regulations apply?

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. The purpose is to protect public health not only for current users but for users in the future. These regulations are referred to in this document as the Water Fittings Regulations.

Notification

Do I need to tell the water supplier about my installation?

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 the water supplier under Regulation 5 of the Water Fittings Regulations. All water reuse systems will usually be inspected recorded and registered by the water supplier.

Why?

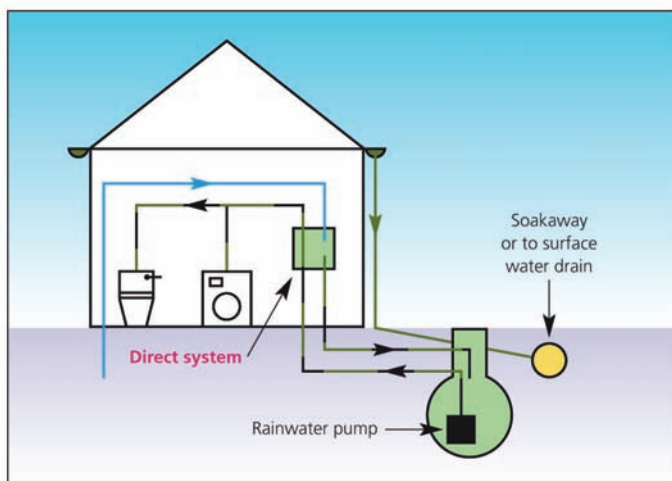
Because the water supplier has a duty to ensure these Regulations are complied with therefore ensuring public health is protected. The water supplier must be satisfied that these new types of high risk domestic systems cannot contaminate the water mains network supply. The minimum information required is a plan of the site, a schematic diagram of the plumbing layout and details of what is proposed.

System designs

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

Direct systems

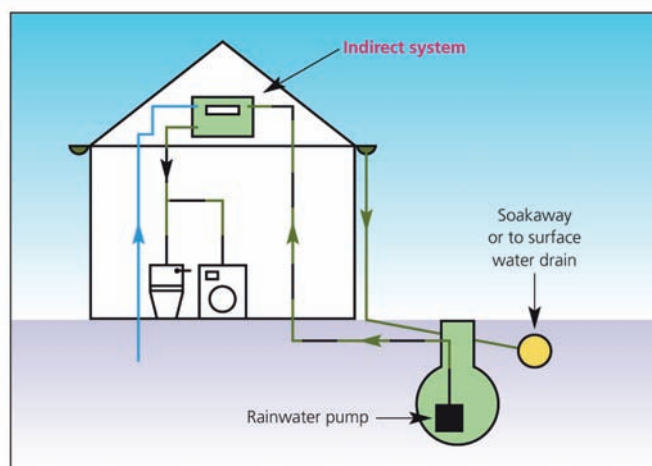
This is where water is pumped directly from storage such as the underground tank direct to the points of use for example, toilets and outside taps.



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 needed to operate them. Even a mains water back-up would be of no help, as this normally fills either into a low level storage tank or greywater treatment system and needs further pumping. **Therefore all the appliances connected for example, toilets, outside taps etc would not work, 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 high level cisterns etc.

Indirect systems

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



This type of system can be made to seamlessly change over in a no 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 a 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 fittings and taps etc.

It is necessary that the type of system selected can deliver the end use water quality parameters detailed in the British Standards to ensure the users are not exposed to undue risks. **It may be that a hybrid of the two designs 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, fed direct from the pumped water reuse supply that services the indirect storage cistern.**

Back-up water supply

What happens when there's no rain?

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.**

Greywater systems do not rely on rain but occupiers using baths, showers etc to provide it with untreated greywater, 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. **Again it will be essential for this to be provided for by a mains water back-up supply.**

What would happen if there was no mains water back-up supply?

If a water reuse system failed or there was no water to supply, the appliances connected to the system would stop working. Users would not be able to flush their toilets or use other appliances, which could potentially lead to public health issues. **So it is important that whatever design is chosen at least one toilet must be able to operate normally.** It is recommended in larger premises this 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 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 belowground storage, consideration should be given to the potential for smells to vent back in to the property. A waterless trap may be used to prevent this occurring.

Backflow protection

The Water Fittings Regulations require that the drinking water system is adequately protected from any potential contamination in the event of backflow or backsiphonage 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.**

What sort of risk is rainwater and greywater?

Atmospheric pollution and the surfaces from which rainwater will be collected from, means it is likely to contain faecal, biological and pathogenic contamination and this places it in fluid category 5, that is to say it poses a **serious health hazard**. 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.

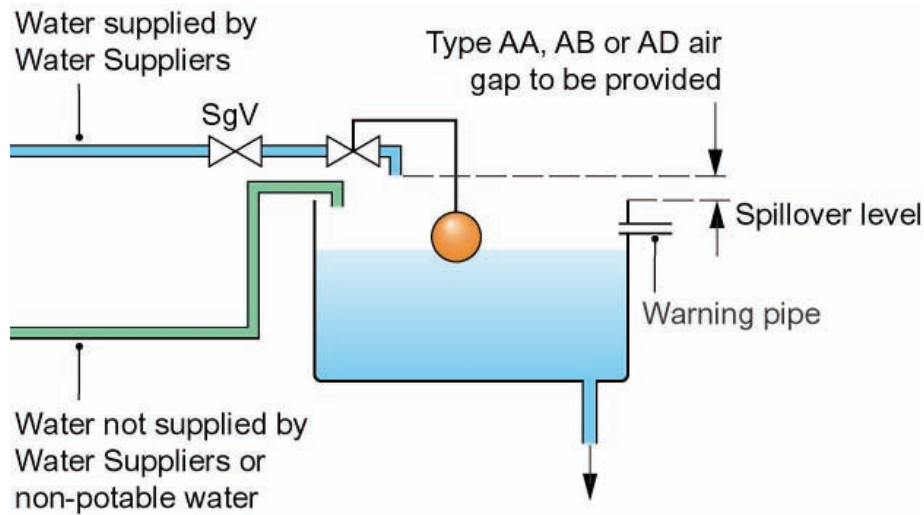
What backflow protection is required for the mains water back-up supply?

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

Examples of backflow protection

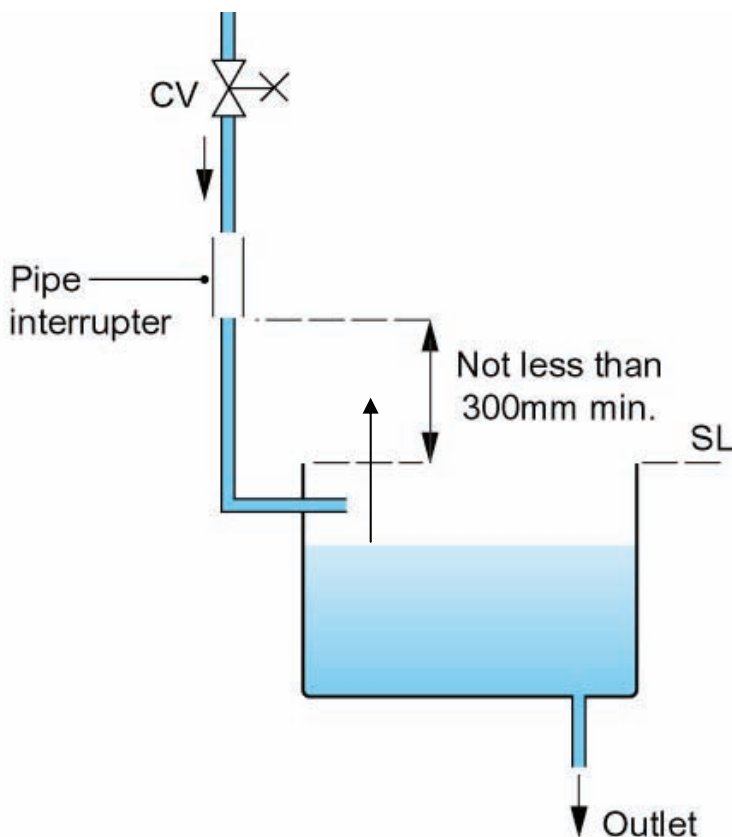
Example of air gap arrangements

Separation of the mains water supply from a water reuse system for example greywater or rainwater.



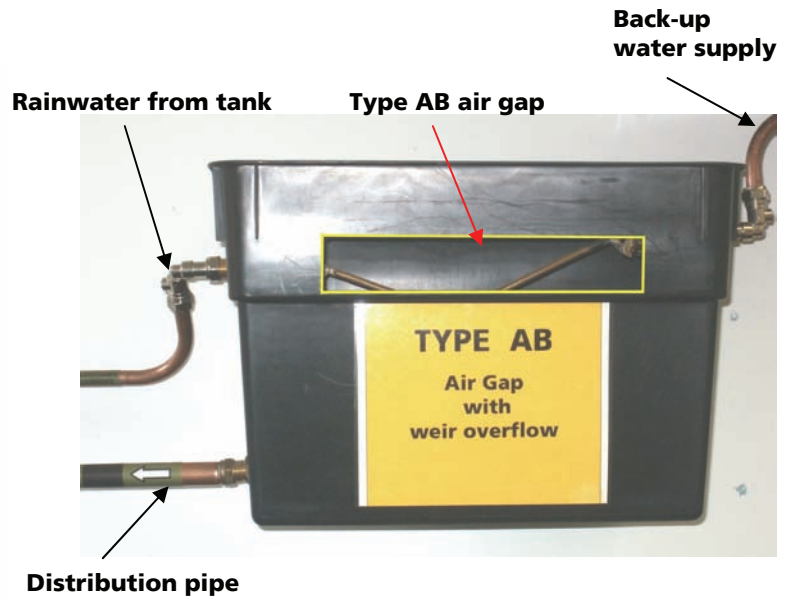
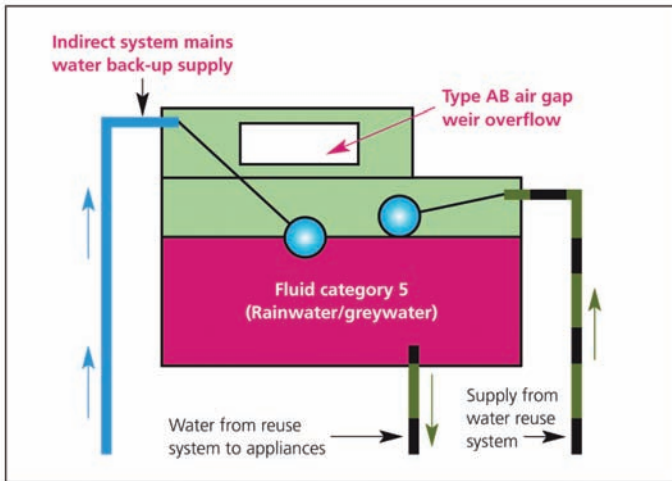
Type DC pipe interrupter

This type of device must be fitted with the lowest point of air aperture at not less than 300mm above the spillover level (SL) of the receiving appliance, and have no valve or restriction on the outlet.

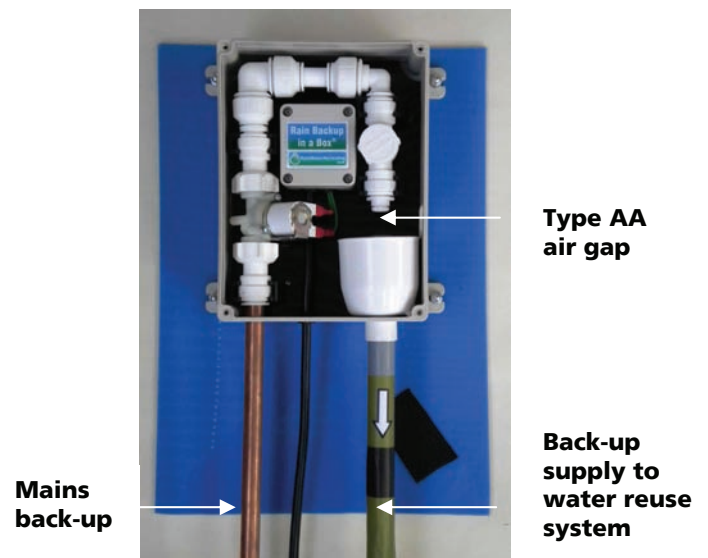
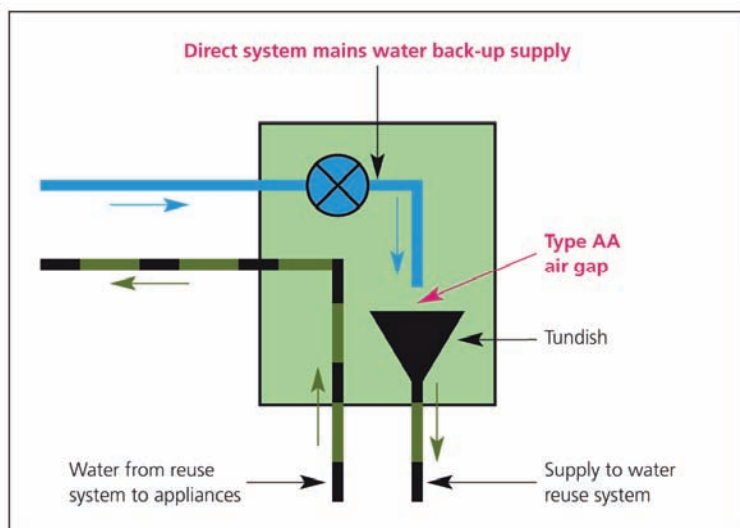


Examples of backflow protection (continued)

Indirect systems with Type AB air gap



Direct systems with Type AA air gap



Dead legs

In normal operation the back-up supply should not be needed on a regular basis, and so dead legs that offer the opportunity for water to stagnate should be avoided. Where this is unavoidable, additional backflow protection, such as a single check valve, must be installed at the branch supplying the back-up supply system to protect the drinking water supply.

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.

Wholesite protection

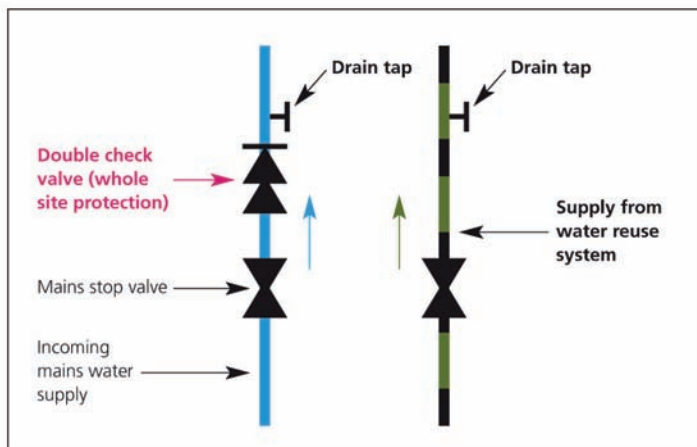
Do I need additional protection?

Most water suppliers now insist that wholesite protection is fitted to any property where a water reuse system is installed.

What is wholesite protection?

Wholesite protection is a way to provide an extra level of protection to other water users, should problems occur. A **double check valve** is normally sufficient for this purpose and would normally be required on the rising main immediately above the incoming stop valve at the point of entry.

Double check valves should have no adverse effect on the way water is supplied into the property, however in areas where the mains pressure is slightly lower for example 1.5 bar. Devices should be of the type that use low spring tensions to ensure there are no supply problems. If in doubt check with the manufacturer.



Pipework

Do I need special pipework?

No, but the Water Fittings Regulations require that pipes containing water not supplied by the local water company, or a fluid that is not wholesome, for example potable/drinking water quality, must be suitably marked so that it can be readily distinguished from any water supply providing wholesome water.

Pipes must be made from materials that are suitable for 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.**

Belowground pipework

What should I use?

For pipework belowground 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, this is detailed in the WRAS Information and Guidance Note N° 9-02-05 to meet these requirements.

Most water suppliers subscribe 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.

Example of belowground 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.

Aboveground pipework What should I use?

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.

Labelling and marking

Why do I need labels?

Fitting labels and marking pipes will ensure users are fully aware what quality of water is being supplied to their appliances. This will help users take the appropriate precautions for them and their family for example 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 pipework

Why must you colour code all water reuse pipework?

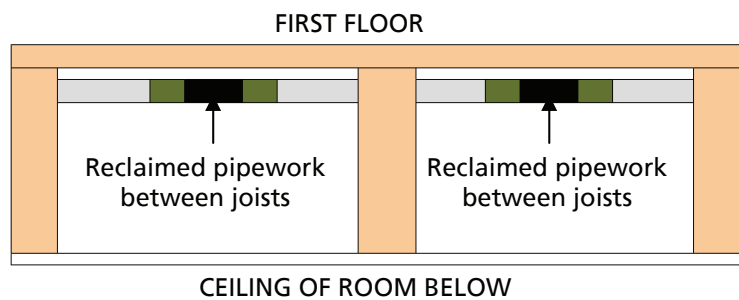
Colour coding of pipework is essential to help prevent any possibility of misconnecting onto a water reuse system during the replacement of fittings or renovation for example bathroom refits. It will also help prevent **cross-connections** that could lead to contamination of the drinking water supply.

The following methods are recommended:

Insulated pipes should be labelled on the outer surface of the insulation, regardless of whether the pipe has been identified prior to insulation, and marking should be designed for the life of the system. Marking can be made at the time of manufacture or labelling attached during installation.

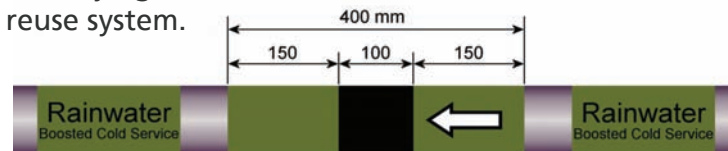
Marking should be located along the length of the pipe at not greater than 0.5 metre intervals and at key connection points, but consideration should be given to pipes running through joist to ensure they can be readily identified.

Reclaimed pipework MUST be made clearly identifiable between EVERY joist space.



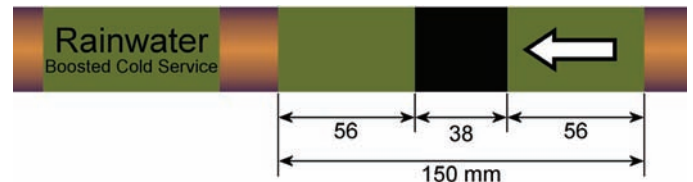
Commercial/Industrial pipes

For large scale water pipelines, for example in commercial premises, or water reuse pipelines that are insulated should be marked using the principles set out in BS1710 Identification of pipelines. The identification colour should be green and black as shown below, identifying it as carrying non-wholesome water from a water reuse system.



Domestic pipes

In premises that only have smaller pipes, such as in houses should use these same principles to ensure common recognisable marking but scaled down to 150mm long.



Colours to BS 4800:1989; Green - 12 D 45; Black - 00 E 53

Labelling

By labelling with tags all taps and valves that supply rainwater or greywater, ensures the users are made aware a water reuse system is present. Point of use appliances such as toilet cisterns, outside taps and washing machine connections should have point of use labels indicating not drinking water as shown overleaf. The minimum recommended sizing for outside taps is 80mm high and for internal use 40mm.

Labels should be fitted to isolation valves and key points that indicate supplies of different pressures, qualities and designate uses. The lettering on these labels should be black on green as above and not less than 5mm in height.

Examples of labels

Mains Water Stop Tap

Caution Greywater system installed in this property supplying:-
Toilet - Garden/Outside Tap
Washing Machine



Garden Tap
Cold Boosted Rainwater

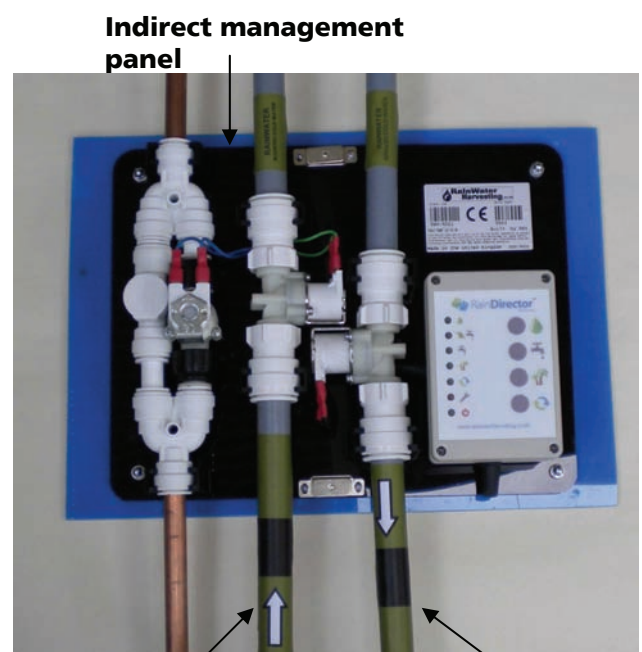
Point of use



Examples of installation



Rainwater pipework



Supply from rainwater system

Return to rainwater tank

Maintenance

Do I need 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 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 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 the water supplier 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.
- Use the correct pipe belowground.
- Make sure there are no cross-connections.
- Ensuring the backflow protection is of the correct type.
- Follow proper labelling and marking requirements.
- Follow the British Standard's Codes of Practice.
- Make sure users are fully conversant with the systems, particularly operation and maintenance requirements.

Water suppliers want to make sure that customers have a good healthy wholesome drinking water supply so by having a well designed system installed that meets the regulatory requirements all helps to serve this purpose.

Other references

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

Water Supply (Water Fittings) Regulations -
www.defra.gov.uk/environment/quality/water/industry/wsregs99/index.htm.

BS8515:2009 Rainwater Harvesting Systems code of practice.

BS8525-1:2010 Greywater Systems code of practice.

BS1710:1984 Identification of pipelines and services.

BS4800:1989 Colours for buildings
National Joint Utilities Group www.njug.co.uk.

Acknowledgements

- Regulation compliance images reproduced by kind permission of Water Regulations Advisory Scheme (WRAS).
- Cover image courtesy of RainWaterHarvesting.co.uk

