



Governance framework for non-drinking water from rainwater harvesting and greywater reuse systems: Expert Group recommendations

March 2026



Regulation of rainwater and greywater reuse systems

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Executive Summary

England and Wales are increasingly facing an acute water scarcity challenge. The Environment Agency has predicted a demand gap of five billion litres per day by 2055 unless urgent action is taken. In response, the Government is taking steps to develop new water resources, and to reduce water consumption through water efficiency measures (Consultation [Review of Water Efficiency Standards in the Building Regulations 2010 - Defra - Citizen Space](#)).

One element of the solution involves making better use of non-drinking water (rainwater and greywater) for applications which do not require a supply of water of drinking water quality.

The arrangements for supplying collected rainwater and greywater reuse systems require a dual pipe supply system within a property. One supply is the normal wholesome drinking water supply, used for all domestic purposes such as for drinking, food preparation and washing. The second supply is labelled as non-drinking water, intended for a limited number of specific domestic purposes which do not require water treated to drinking water standards, mainly toilet flushing, some garden uses and sometimes laundry.

There are two main public health risks with supplies of non-drinking water:

1. Contamination of the wider drinking water supply network through inadequate backflow protection, cross connections and poor plumbing
2. Potentially harmful to health exposure to non-drinking water by the end user.

Safeguards must be in place to ensure that non-drinking water systems work effectively and safely, at the time of installation, whilst being maintained and during the whole operational life of the system. Failure to control risks can result in serious illness in the community, and there is sufficient evidence that incidents of cross connection to the drinking water supply are likely to occur, if the system is badly maintained. Risks from exposure to pathogens or other harmful hazards therefore must be controlled for rainwater harvesting and greywater reuse to be practiced safely, and without risk to the drinking water supply.

In July 2025 an Expert Group was convened by the Drinking Water Inspectorate (the Inspectorate) on behalf of the Defra Secretary of State to consider water quality standards and the regulatory framework for dual supplies.



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The Expert Group supported a risk-based approach with standards for system design, operation and maintenance. They made recommendations, which consider the existing legislation and guidance, and set a direction for further regulatory control supporting the Government's growth agenda while protecting consumers and users. It was not possible within the timeframe to recommend with confidence which water quality standards should apply to non-drinking water, and there were differences of opinion as to whether standards are necessary, with some views that it is for Government to decide on an acceptable risk. The report identifies some next steps to implement the recommendations. It sets out further work to develop an Approved Code of Practice for rainwater harvesting and greywater reuse, and to inform options for a single set of water quality standards for non-drinking water.



Terminology used in this report

‘Water reuse’/‘reused water’: the collection of greywater and rainwater for an application such as toilet flushing.

‘Water recycling’/‘recycled water’: Water recycling uses treated wastewater as a source of public drinking water supply. Advanced treatment processes ensure safety and quality.

Blackwater: Any domestic water source which contains faeces or urine. Wastewater from toilets which contains pathogens from human/animal waste and therefore unsuitable for reuse without treatment. Blackwater is not covered in the report.

Drinking Water: Water provided for all domestic purposes which is wholesome and complies with the Water Supply (Water Quality) Regulations.

Dual Supply: A separate water distribution system that runs parallel to the drinking-water distribution system.

Greywater: Domestic wastewater excluding wastewater from toilets (BS EN 16941 2:2021) [Glossary of wastewater engineering terms \(BS EN 16323:2014\)](#).

Rainwater harvesting: direct collection of rainwater before run-off to the environment or discharged to the sewerage system (BS EN 16941).

User: refers to the user of a water reuse system and care has been taken in this report to not refer to them as a ‘consumer’ as this might cause confusions with drinking water.

Hazard: anything that has the potential to cause harm, such as harmful water quality.

Risk: the severity of a hazard, combined with the likelihood of it happening.

Water Agnostic: an industrial process technology or operation designed to function effectively irrespective of the quality or source of water input.

Flow Loop – shower that enables water reuse by recycling, cleaning and disinfecting the personal shower water in a closed loop while showering



List of Abbreviations

BS EN – British Standard European Norm

CIBSE – Chartered Institute of Building Service Engineers

CIPHE – Chartered Institute of Plumbing and Heating Engineering

EWSC – Enabling Water Smart Communities

HACCP – Hazard Analysis and Critical Control Points

HSE – Health and Safety Executive

MTP – Market Transformation Programme

NSF – National Sanitation Foundation/NSF International

PWS – Private Water Supplies

SoPHE – Society of Public Health Engineers

UKWRA – UK Water Reuse Association

WHO – World Health Organization

WRAS – Water Regulations Advisory Scheme

WRUK – Water Regs UK, formerly WRAS

WSP – Water Safety Plan

The Regulations – [The Water Supply \(Water Quality\) Regulations 2016](#) and [The Water Supply \(Water Quality\) Regulations 2018](#)

The Fittings Regulations – [The Water Supply \(Water Fittings\) Regulations 1999](#)

The PWS Regulations – [The Private Water Supplies \(England\) Regulations 2016](#) and [The Private Water Supplies \(Wales\) Regulations 2017](#)

The Building Regulations – [The Building Regulations 2010](#)



Scope

This report is restricted to water reuse in domestic settings in England and Wales, including similar uses in industrial settings, new builds and retrofits to existing properties. The report covers rainwater harvesting and greywater reuse for flushing toilets, garden irrigation, and laundry, and other uses such as cleaning and car washing which do not require drinking water. The recommendations provide a framework of governance principles which underpin safe water reuse. These will allow the use of rainwater and greywater for specific applications where drinking water quality is not needed, whilst ensuring the drinking water supply is protected from cross contamination or backflow.

Industry requires significant water resources, and water supply should form part of any strategy for location of processes. There are many situations in England and Wales where water companies supply water for industrial uses. Examples include operation of a raw (untreated) water main, provision of a supply to a paper mill; and operating an industrial main which has a lower disinfectant residual than the domestic main. Each industrial usage has its own water quality requirements. In some cases, the process itself includes water treatment to specific quality standards, which may be different to drinking water quality standards. The principles recommended in this report could apply equally to industrial water usage. Any legal framework focussed on water scarcity and sufficiency must consider industrial uses as well as domestic use.

Nothing in this report should be interpreted as a reduction in standards or relaxation of regulation with respect to drinking water quality in England and Wales.

Methodology

The Chief Inspector of Drinking Water convened a group of experts to examine the governance framework of policy and regulatory enforcement required to prevent public health risks from adopting dual supplies of greywater and harvested rainwater, and to set quality standards for non-drinking water.

The objectives were to recommend health-protective standards for safe water reuse in England and Wales, to support the development of water reuse systems. This should consider different domestic uses and a flexible regulatory framework.

The Inspectorate convened a group of technical specialists and invited other key industry specialists to contribute. A series of meetings were held to discuss relevant



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topics including selection of source waters, suitable domestic uses, international approaches, current guidance and gaps in the legislation and enforcement, and key public health risks. The Inspectorate provided the chair and secretariat functions. The Expert Group met during July to November 2025 inclusive. Consultation with practitioners was undertaken through site visits to Stormsaver offices (Newark, Nottinghamshire), and Kings Cross Development (London) which informed the work. See Annex 1 for a summary of these site visits.

Background

The market for water reuse systems is comparatively undeveloped in England and Wales. Although safely practiced around the world, reuse systems can pose a risk to public health if not properly managed. Therefore, legislation and guidance are needed to provide the necessary assurances of clarity, consistency and safety to permit development in this sector.

Background to the legislation and associated guidance in England and Wales

Primary legislation

The Water Industry Act 1991 (the Act) is the primary legislation for water supply. Section 218 of the Act defines domestic purposes to include: drinking, washing, cooking, central heating and sanitary purposes including outside the house (for example washing of vehicles and the watering of gardens) for which water supplied to those premises may be used.

Secondary legislation

1. The Water Supply (Water Quality) Regulations 2016 in England and 2018 in Wales

The Water Supply (Water Quality) Regulations 2016 in England and 2018 in Wales (the Regulations) set out the requirements for wholesome drinking water in public supplies. The Inspectorate is the regulator. Water companies are required to carry out risk assessments from source to tap to ensure protection of public health. Wholesome drinking water, is defined in regulation 4 as: *'water supplied to premises that is intended for human consumption including — (a) for such domestic purposes as consist in or include, cooking, drinking, food preparation or washing, or (b) for food production purposes.'*



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Wholesomeness is defined by a set of proscribed concentrations and values and encompasses any parameter or substance at a concentration or value which can cause a risk to health. Any changes to the quality of water used for any purpose within the home must be carefully managed to ensure that the wholesome drinking water supply is not put at risk of contamination.

2. The Water Supply (Water Fittings) Regulations 1999 (the Fittings Regulations)

The Fittings Regulations set legal requirements for the design, installation, operation and maintenance of plumbing systems, water fittings and water-using appliances. They are designed to prevent misuse, waste, undue consumption or erroneous measurement of water and, most importantly, to prevent contamination of the wider drinking water supply.

Water undertakers are the enforcing body for the Fittings Regulations for public supplies within their appointed water supply areas, and local authorities in respect of private supplies. They undertake inspections of new and existing installations to check that these regulations are being met. Across the UK, each year around 70,000 inspections are carried out by water companies.

The installation of reuse systems connected with a public water supply back up must be notified to the local water company.

If contamination or illness in the community arises from the water supply, the water undertaker must notify the Drinking Water Inspectorate. There have been notified events due to cross connections between a drinking water supply and a water reuse system due to inadequate backflow protection.

3. The Private Water Supplies Regulations 2016 in England and 2017 in Wales (PWS Regulations)

The PWS Regulations cover the quality of private water supplies, i.e. those supplies are not provided by a licenced water undertaker. Similar to the public supplies regulations, they set out the need for risk assessment and standards in the schedules. Local authorities are the regulator for private water supplies. The PWS Regulations allow for water intended for human consumption to be unwholesome, provided it is not a danger to human health. Notably this includes the uses of drinking, washing and cooking. This contrasts with public supplies, where all domestic uses must be wholesome under regulation 4. Regulation 6 of the PWS Regulations exempts single properties from a risk assessment.



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The Inspectorate has published [risk assessment tools](#) to assist local authorities in their regulatory role for private water supplies. These include user-friendly checklists and recording templates, suitable for selecting and assessing alternative sources for domestic uses including toilet flushing. This is an example of how a water safety planning approach can be made user friendly to non-specialists, whilst adhering to the risk assessment principles.

4. The Building Regulations 2010 (the Building Regulations)

Under the Building Regulations 2010, sanitation, hot water safety and water efficiency Approved Document G, sets out guidance and standards for water supply to buildings. A developer will be considered to have complied with the Building Regulations if they follow practice specified in Approved Document G. The Health and Safety Executive (HSE) regulates the Building Regulations.

[The Building Regulations Approved Document G on sanitation, hot water safety and water efficiency](#) states the design standards for water supply and aligns with principles of risk assessment. The designer, builder, or installer is responsible for ensuring work complies with the Building Regulations requirements and can be served with an enforcement notice in cases of non-compliance. *Document G1 (1.6)* allows for the use of alternative sources of water for sanitary conveniences, washing machines and irrigation, provided the appropriate risk assessment has been carried out. The risk assessment must be carried out by a competent person and should ensure that the supply is appropriate to the situation in respect of the quality of the source water and receives appropriate treatment, and is unlikely to cause waste, misuse, undue consumption or contamination of wholesome water. It should also include consideration of the effect on water quality of system failure and failure to carry out necessary maintenance.

Water Regs UK has updated its *Pipework identification* and [Alternative water systems](#) leaflets, which supersede the Building Regulations.

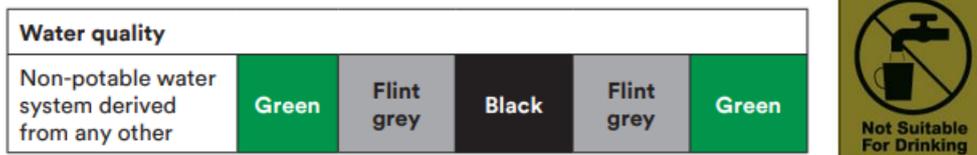
5. British Standards (BS EN)

The BS EN include standards for design, fittings, materials, and installation. BS EN are available from Bsi and developed over time by expert committees and are available by subscription. Compliance is not mandatory but is often written as a condition into building contracts. British Standards produced a suite of guidance documents covering:

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- BS 1710:2014 Specification for the identification of pipelines and services. It includes colour coding requirements, guidance on labels and signs, and the contents of pipework. The purpose of this requirement is to prevent accidental cross-connections that could lead to contamination of drinking water in supply pipes or distributing pipes.

Examples of colour coding and sign from United Utilities website:



- BS EN 16941-1:2024 On-site non-potable water systems - Systems for the use of rainwater. BSEN 16941 has been revised to align with the risk-based approach embedded in L8 and its associated guidance documents.
- BS EN 16941-2:2021 On-site non-potable water systems - Systems for the use of treated greywater
- BS EN 16941-3 (in development) specifies requirements and recommendations for the testing of treatment procedures for on-site water reuse systems.

In addition, these are of relevance:

- BS 8595:2013 Code of Practice for the selection of water reuse systems
- BS EN 805:2000 Water supply. Requirements for systems and components outside buildings
- BS EN 806 Specification for installations inside buildings conveying water for human consumption. Operation and maintenance (Parts 1-5).
- BS 8558:2015 complementary to BS EN 806, detailed guidance on the design, installation, testing, operation and maintenance of services supplying water for domestic use within buildings and their curtilages.

6. Legionella risk assessment

Managing *Legionella* in buildings is regulated by HSE, under Approved Code of Practice [Legionnaires' disease: the control of *Legionella* bacteria in water systems \(L8\)](#). The Code of Practice applies to risk assessments undertaken on premises, plant and systems and where control measures may have been implemented. This follows a risk assessment and control methodology.



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7. Other guidance documents

The [*Enabling Water Smart Communities \(EWSC\)*](#) OFWAT Innovation project has published summaries and guidance on matters relating to communities that are “water smart” including guidance on water reuse and risk assessment.

8. Sustainable Urban Drainage Systems (Including newly published SuDS guidance for Wales)

There are [national sustainable urban drainage standards](#) which apply in England. They provide information for designers, property developers, local authorities and other interested parties. Defra SuDS standards are relevant as they prioritise non-potable use over discharge to the environment, groundwater or sewer.

Research commissioned by the Inspectorate

In February 2024, the Inspectorate published research into the risks associated with dual supply systems ([Dual Pipe Water Recycling Systems and Risks to Water Quality - Drinking Water Inspectorate](#)). The report cited examples of contamination of drinking water from cross connections with a secondary supply, including a case study of serious illness from norovirus in the Netherlands which resulted in a government policy change to reduce the uptake of dual pipe systems for communal systems. The report also identified a suite of international regulations and standards to alleviate the risks of cross-connections to dual pipe supplies at household scale during installation, but highlighted risks of cross-connection post-installation. It identified opportunities to improve risk reduction and improve public understanding of the health risks associated with dual pipe systems, to deter the inappropriate uses of this lower standard water.

In 2024, the Inspectorate also published research into the [Impact and future of the regulatory model and legislative framework surrounding private water supplies in England and Wales](#). This is of relevance to dual pipe supplies as under current legislation alternative supply systems would fall under the PWS Regulations. This research highlighted significant issues with the current governance structure for private water supplies. This includes limited enforcement powers by the Inspectorate and the availability and funding of sufficiently trained practitioners in local authorities which has resulted in uneven implementation of the PWS Regulations across England and Wales. The report recommended that:

- i. An overseeing body is needed with the people and funds to provide guidance, training and supervision. Powers to audit and enforce the legislation should be

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- harmonised, and with data systems to collect and report on data and standards.
- ii. Legislation should ensure mandatory registration of all private supplies and to include relevant requirements within conveyancing policy.
 - iii. The economic burden of regulating private supplies should be assessed with appropriate cost recovery and funding mechanisms should be in place.

World Health Organization guidance relevant to reuse systems

The World Health Organization (WHO) [Guidelines for Drinking Water Quality](#) (the Guidelines) and WHO [Water safety in buildings](#) recognise the increased use of dual piped water supply systems in domestic settings, particularly in developed countries. The Guidelines warn of the health risks such systems can introduce, most commonly due to accidental cross-connections. WHO guidance notes that consideration of the following control measures is recommended:

- Good design practices to prevent cross-connections,
- Clear labelling of each system,
- Installation of the non-drinking supply only by qualified plumbers,
- Regulation of the non-drinking supply by the authority responsible for drinking water surveillance,
- Public communication regarding potential health risks from exposure to the non-drinking supply through cross-connections and the dangers of modifying systems by inexperienced or non-credited plumbers.

[Water safety in buildings](#) notes that installation of dual supplies may lead to a reduction in water use in drinking water systems. Therefore, knock-on impacts to drinking water supplies, such as stagnation risks, must be considered.

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The WHO [Health aspects of plumbing](#) notes the risk of contamination through cross-connections during the installation or repair of such supplies. The WHO recommends:

- Clear labelling and identification of non-drinking water, with a system of colour coding, labels and tags that conform to a national standard. All non-drinking water outlets must be clearly labelled and physically separated from drinking water outlets. Where possible, non-drinking water outlets should be

Box 1: The UKWRA position is outlined as follows:

1. Rainwater systems are the most popular solution currently in the UK. Typically, they are small-scale, self-build residential projects. They are promoted as simple to clean and generate less limescale for laundry use and vehicle-washing. Typically collected from the roof, but hard-standing areas can be included with additional filtration. More solutions for collecting rainwater from a variety of different areas are coming onto the market. Domestic solutions can be installed in the UK, but they are at the moment self-built projects and small community systems. Sometimes installed in houses of multiple occupancy (HMOs), but a small roof area can mean not as much can be collected.
2. Greywater systems are increasing in popularity, and can be suitable for multiple-occupant buildings like student accommodation, hotels and leisure centres. These buildings may not have a large roof collection area, but they create a lot of water internally from showers, and swimming pool backwash water etc. (in which case they would be combined rainwater and greywater). They commonly require a lot of space (in the basement or elsewhere), additional filtration and treatment, commonly using membranes or disinfection, depending on the use. The maintenance regimes for greywater are more regular and more costly than rainwater - but can be achieved with a good regime in place.
3. Smart SuDs tank systems both prevent flood risk and allow for rainwater harvesting as weather monitoring technology (for storm duration and intensity) is becoming more commonplace and can ensure there is the correct amount of capacity for the incoming storm.



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locked off to prevent unauthorized use. In a domestic environment, non-drinking water is best restricted to uses such as toilet flushing or garden irrigation. A closed distribution system will prevent casual use of the water for other uses.

- The role of plumbers in risk assessment and risk management, including guidance on codes of practice, training and registration for plumbers.

The WHO endorses a risk assessment and risk management approach to managing all water supplies.

Standards and approaches adopted in other countries

The [Dual Pipe Water Recycling Systems and Risks to Water Quality](#) research provides a good overview of standards and approaches in other countries, with a focus on Australia and USA. Regulations focus on measures to control the risk of recycled water consumption and to ensure that water is not deliberately being used in a manner other than that intended. Rainwater harvesting has been widely practiced in Belgium and Germany for over 20 years.



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Australia

In Australia, Hazard Analysis and Critical Control Point (HACCP) methodology is developed based on key principles including intended use of the water, development of a process flow diagram, identification of hazards and associated preventive measures, identification of critical control points, development of critical limits, monitoring procedures, corrective action procedures, and validation.

- Domestic rainwater tanks are not subject to the Australian recycled water guideline risk-management/HACCP requirements.
- Larger or engineered rainwater/stormwater reuse systems may fall under the Australian Guidelines for Water Recycling, with application and level of control determined by state/territory regulators and local authorities.
- Greywater reuse: a risk-based management approach (HACCP-style) is recommended and often required by state regulators for approval, especially for treated or non-domestic systems.
- Recycled water for potable use: a formal risk-based framework (including HACCP principles) is mandatory.

The Australian National Guidelines on Water Reuse provides an authoritative reference for the supply, use and regulation of recycled water schemes. It encourages commissioning and operational audits that are proportional to public health risk and argues that an understanding of recycled water quality management is essential for empowering and motivating operators and associated contractors to make effective decisions. Such understandings include the principles of risk management, the characteristics of the recycled water supply system and preventive strategies in place, regulatory and legislative requirements, roles and responsibilities of employees and departments, and how individual actions can affect water quality, and public and environmental health.

United States

In the United States, the State of California requires that dual pipe systems are tested at least once every four years for cross-connections. Their regulations allow health officers to conduct inspections within water users' premises to identify cross-connections and determine appropriate backflow protection measures. Only accredited recycled water agencies can deliver recycled water to a dual-plumbed facility, enforcing pre-commissioning and thereafter four yearly inspections for possible cross-connections, and obliging reporting of backflow incidents. The



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NSF/ANSI are the American water treatment safety standards. The acronym denotes any standard set by the *National Sanitation Foundation* (now more typically referred to as *NSF International*) and approved by the *American National Standards Institute*.

In both Australia and US, much of the practical risk mitigation requirements are laid out in the relevant guidance, and plumbing codes. Risk control is primarily through effective system design principles, examples include backflow protection through use of air gaps, differential pipe colouring, differential pressure, avoiding oversized systems which could develop stagnant water. Inspection and testing regimes are mandated and signage is required.

France

In France, Decree 2024-796 of July 2024 sets legal requirements for the use of water unfit for human consumption. It restricts which domestic uses can receive unfit water, and this varies with the source. Raw water (rainwater, freshwater, wells and boreholes) can legally be used for a wider range of domestic uses than greywater. Responsibility is placed with the owner of the distribution system.

Recommendations

Recommendation 1: Define the domestic uses suitable for non-drinking water.

Justification: Under the Act all water supplied for domestic purposes must be wholesome. Therefore, there has been no need to date to make distinctions between domestic uses which require wholesome water and those which could use water of non-drinking water quality. Understanding the transmission pathways of water used in a domestic setting, including consumption, absorption and inhalation, and the associated risks is the first step to understanding and mitigating the risks to public health.

The Expert Group considered which domestic purposes would be suitable for a non-drinking water supply by assessing common routes of exposure and risks to health.

1.1 The following domestic uses were considered as **unsuitable** for non-drinking water based on risk to health:

- Ingestion - drinking, food preparation,
- Personal hygiene including washing, showering, bathing and teeth brushing
- Washing dishes
- Outdoor hot tubs and paddling pools

1.2 The following domestic uses were identified as **potentials for use of non-drinking water** based on their relatively low risk to the user and relatively large water consumption:

- Toilet flushing
- Garden irrigation (lawn and non-edible plants) and car washing, pressure washing patios and drives and all other external uses.
- Laundry for non-vulnerable persons

A study by the Energy Saving Trust observed typical domestic water usage as 33% for showers and baths, 31% by taps, 22% for toilet flushing, 10% by washing machines, and 2% by dishwashers (ref - [Energy saving trust report](#)). The Expert Group identified toilet flushing and certain outdoor uses as activities which are high water uses but which could use non-drinking water due to their relatively low health risk to the user.

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Garden irrigation (lawn and non-edible plants), car washing, pressure washing patios and drives and all other external uses were agreed to be a potential low-risk opportunity for water of non-drinking water standard to be used. The risks identified were skin contact, inhalation of aerosols from hoses or sprinklers and inappropriate uses such as consumption from a garden tap. Many of these hazards however are already present in toilet flushing. Although some research exists (for example [Inhalation of fine droplets and touching contaminated surfaces \(Pitchers and Stanfield, 2005\). Pitchers et al., 1995\).](#)), further research to understand the risk of chemical exposure via aerosols would be useful.

- 1.3 The use of non-drinking water could be considered for washing machines used by non-vulnerable people. Washing clothes with rainwater is popular due to softness of rainwater. This use is listed in the Building Regulations as suitable for alternative supplies. An assessment of the special circumstances for vulnerable users, including defining who those users are and safeguards to those users, is required including considering transient vulnerabilities.

Using non-drinking water was considered for closed loop central heating systems however these were identified as low water uses and therefore low impact. Risks identified were sprays during bleeding radiators, mechanical failure of backflow protections which could cause disproportionate risks to health based in comparison to the water savings.

- 1.4 The Expert Group raised concern about the use of recirculating showers which are currently on the market in the UK, and the associated risk to public health. Further work is recommended to help define the risks, set out on page 33.

Recommendation 2: Establish a risk-based framework to underpin all water reuse systems, by adopting a water safety planning approach, comprising risk identification and risk management, with accompanying standards for design, installation, and operation.

Justification: Drinking water legislation and enforcement is underpinned by the proactive risk assessment and risk management approach to prevent risks to health being realised. Water Safety Plans (WSP) are recommended by the WHO and have subsequently been further developed by the Enabling Water Smart Communities project. The Building Regulations (Controlled Document G2) recommends a risk-based approach to water reuse. This is also the approach adopted by HSE for *Legionella* control.

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The Water Safety Plan approach involves considering each aspect of a water supply system, from source to point of use, and identifying the risks, implementing control measures to mitigate the risk and putting measures in place to verify the effectiveness of such control measures. This framework has been demonstrated to have significant benefits to public health and therefore adopting a similar approach aids consistency in water management.

2.1 The Expert Group supported adopting the Water Safety Plan approach for water reuse systems. Specific benefits to water reuse systems of adopting this approach include:

- All risks and mitigation steps are considered up front at the design stage.
- It allows flexibility and adaptability to new source types, risks and technologies.
- Mitigations can be embedded by use of an approved technician, in conjunction with source water type selection, system design, reducing routes of exposure, treatment credits, competency and accreditation, testing, maintenance and verification sampling.
- The approach can be underpinned by impactful water quality standards.
- This encourages understanding of the system but needs to be made accessible for non-specialists to use, through appropriate guidance. There are challenges with how burdensome and specific this approach can become, which the group acknowledged and further work is recommended to make the approach practical and accessible.

2.2 Identifying the risks presented in the source water and during storage is a key step in the risk assessment process. This enables the required treatment and maintenance steps to be defined to ensure effective and safe use. For instance:

- Locally sourced raw water (boreholes and springs) can contain *Cryptosporidium* and pathogenic microorganisms and chemical hazards.
- Sustainable urban drainage systems can contain microbial and chemical contaminants from road and surface run-off;
- Rainwater harvesting can contain microbial and chemical contaminants, including faecal matter from birds, and lead from roofs;
- Greywater can contain pathogens, personal care products, fats, oils and greases and detergents.

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- 2.3 Effective control measures can be grouped into compliance with guidance, accreditation, labelling, good system design, installation and commissioning, ongoing maintenance. Inspection frequencies should be considered against best practice and set out in guidance.
- 2.4 The group discussed the need for a flexible regulatory framework which could be extended over time, as further technologies are developed which allow for more sophisticated treatment and control methods.
- 2.5 Standards should be set for system design, installation and commissioning, incorporating the water safety planning approach. A key stage of safety relies of compliance with system design best practice at the outset. However, the integrity of the design needs to be maintained throughout the life of the system through both maintenance and validating any changes as appropriate. Standards for system design, installation, commissioning, maintenance, accreditation and verification were discussed in detail. These are well established and outlined below and in Annex 1.
- 2.6 The Expert Group supported the need for some water quality standards alongside risk assessments, design standards and control systems.
- 2.7 Develop a single set of regulations for non-drinking water. One set of regulations covering all dual pipework systems would make it much easier in combined rainwater and greywater systems. This should be sensible and not impose the more rigorous treatment that is needed for greywater onto rainwater. However, if this is not possible, and would make it overly onerous for rainwater, then a "dual pipework part A - rainwater and part B - greywater" would be better. The expert view is that combined regulations will be easier to implement and manage in the long term.
- 2.8 The guidance and standards for system design and maintenance must be accessible to all users.
- 2.9 One of the disadvantages of the water safety plan approach is its potential to be time consuming and resource intensive to do properly, which can be a severe disadvantage for smaller system operators. Some of the expense of applying the risk-based approach to each individual system, could be alleviated by developing pre-defined sets of model requirements and risk reports for specific system sizes, sources of water and users (including vulnerable users for example), similar to approach taken in the private water risk assessment tools. A pre-validated fixed design template with prescribed installation instructions could additionally be a helpful area for further development.

Recommendation 3: *Provide standards for the maintenance of reuse systems, that safeguard performance over the operational lifetime, including performance verification and testing frequencies.*

Justification: Assuming the water is adequately treated, the main risks to develop are post installation, from unauthorised cross connections and inadequate maintenance. Cross connections risk applies to all domestic uses. Therefore, system ownership, liability and lifetime performance are important safeguards, post commissioning.

- 3.1 System adoption over the operational lifespan should be mandatory, with provision for a Responsible Person identified in statute. Private water supplies regulation refers to a Relevant Person, which has been identified as an inadequate regulatory control mechanism. In England and Wales, legal responsibility would usually lie with the landowner, or the business owner, examples would be a university campus, the system would be owned by the university, an airport, the dual pipe system would be owned by the airport.

The EWSC project reported a broad range of adoption and management options [Report: Insights into community-led stewardship models — EWSC.](#)

Various options for system adoption are listed below, and clarity about the legal liability for every reuse systems is required:

1. Remains with the system installer.
2. The land or property owner, for example, large commercial systems, airports, university campuses, and other privately owned sites.
3. Adoption by water company or NAV (or their approved sub-contractors): Water companies have the technical skills to adopt dual pipe systems, and they have an interest as there are significant risks to the drinking water supply from backflow due to poor system design or maintenance. Some NAVs may have the capacity and in-house competency, although for both water companies and NAVs, capacity is likely to be an issue. This might be a logical solution for community-based housing systems.
4. Adoption by estate Facilities Management Company (FCM): The FCM could take on this responsibility for shared community systems, alongside its other maintenance duties. An assessment of the practicality of such an arrangement, including skills, coverage and standards of service is needed.



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5. Adoption by a third party for example technical commercial interest for the purpose of maintaining dual pipe systems
 6. Arguably, if stormwater harvesting systems are part of SuDS, there could be an option for the local authorities (or their approved sub-contractors) to adopt them. There may be a government consultation on orphan SuDS later in 2026 and water reuse systems could be included in scope of that.
- 3.2 Maintenance frequencies, operational monitoring requirements and other appropriate and proportional verification should be mandated, to ensure the system remains working within its design criteria and does not pose a risk to health.
 - 3.3 Design lockdowns of systems, with no unapproved changes to functionality, should be considered, to prevent DIY approach to altering the system operation to facilitate changes over time that may denude safety and function.
 - 3.4 Systems should self-monitor treatment efficacy (for example pressure for ultrafiltration, fluence for UV) and prevent supply of water if treatment was likely to be inadequate. These should cover appropriate operational parameters (for example turbidity, UV light intensity, pressure). There should be regular dye tests for cross connections, and microbiological tests for *Legionella* and coliforms at the point of service. Minimum frequencies should be set out, such as annual servicing. Common standards would be better for adherence simplicity and checking compliance, and are therefore the preferred approach.
 - 3.5 Different manufacturers, developers and installers may currently have different timescales and requirements for checking equipment in place/installed. Both BS EN 16941-1:2018 (for rainwater) and BS 8525-1:2010 (for greywater) contain information on desirable maintenance frequencies for different system elements. BS EN 16941-2:2021 (Greywater) does not.
 - 3.6 BS EN 16941:1 – Rainwater for systems control and monitoring, requirement appears to be continuous monitoring with audible and/or visible alarms. There are no requirements for commissioning tests or ongoing verification of water quality or verification that there are no cross connections in this standard.

BS EN 16941:2 – Greywater: system control and monitoring appear to specify continuous monitoring with operator being made aware of malfunctions.

Commissioning includes cross-connection test by dye or pressure (section 9) and there is no frequency set for testing of water quality which is decided based on a risk assessment.

***Recommendation 4:** Review and update primary and secondary legislation to enable adoption and effective regulation of dual pipe systems.*

Justification: There is no definition or allowance for the supply of non-drinking water in primary legislation. Therefore, a legal definition of non-drinking water is needed. The group agreed that water undertakers should be legally able to adopt dual pipe systems, but that any changes to primary or secondary legislation **must only be made alongside safeguards set out in Recommendations 1, 2, 3, 5, 6, 7 and 8 to protect users of non-drinking water and to protect the drinking water supply network.** The definition for non-drinking water is important, and further work is needed to establish this critically important point. The definition should ideally not be done by reference to prescribed limits or values for chemicals and micro-organisms. An alternative approach might be to have a definition based on comparable risk. For example, for each specific end-use application the non-drinking water supply must not pose an increased risk compared with that from drinking water, but this could be difficult to make practical, and would need to be legally enforceable. Alternatively, it could be defined in words such as non-drinking water or water unfit for human consumption. Potable is not a legal term and should be avoided. Legal advice is needed on how best to define non-drinking water. The wholesomeness definition is very useful and comprehensive, but could be clarified.

- 4.1 The definition of 'domestic purpose' should be redefined across the primary and secondary legislation to provide consistency and clarity and considering the outputs of recommendation 1 (define the domestic uses suitable for non-drinking water). Domestic uses need to be rationalised and consistent across different regulatory frameworks; currently the definitions of 'domestic uses' are inconsistent between drinking water regulations and building regulations.
- 4.2 A legal review of existing secondary legislation, to identify inconsistencies and duplications, should be conducted. The private water supply regulations allow for alternate standards of wholesomeness for different uses, whereas in contrast, the Water Supply (Water Quality) Regulations do not make the same distinction for public supplies, where all domestic uses must be wholesome under regulation 4.
- 4.3 It is recommended that provision and safeguards for non-drinking water reuse systems is given statutory footing through new secondary legislation. This should follow a legal review to inform the best place for the legislation, and

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whether it's better to make a bespoke new secondary legislation for non-drinking water systems or to align and update existing regulations. A new statutory instrument would bring the requirements (from five separate areas) into one place, providing clarity and focus. The BS EN could be revised and incorporated into such a set of regulations, making the standards accessible. The Research project [Dual Pipe Water Recycling Systems and Risks to Water Quality](#), made a strong case for streamlining the regulations and standards for dual pipe systems, ideally into a single measure.

- 4.4 It is recommended to review conveyancing law with a view to including water supply in home buyers' information. This should identify whether the property is fed by a public or private supply, whether it receives a dual pipe supply of non-drinking water, and should additionally include a search requirement to detect the presence of lead plumbing and solder.
- 4.5 The experts supported a proportional regulatory approach and discussed the possible exemption of single property schemes from regulation, as is the case under regulation 6 of the Private Water Supply Regulations. Many argued for an exemption for small systems, which could be a single-property exemption or a volumetric exemption. However, it was noted that there must be some proportionality to prevent suppressing the uptake of small-scale systems. It was concluded that a single property exemption may not be appropriate, because single property schemes with mains back up have the potential to impact the wider drinking water supply network if incorrectly installed. A proportional regulatory approach is needed to prevent some very simple systems becoming unfeasible.
- 4.6 A common-sense approach is recommended. For example, the safe installation, use, and maintenance of water butts can be very adequately covered through product design, correct installation, and instructions for use in a leaflet.
- 4.7 Under the Building Regulations 2010, Approved Document G contains different definitions of wholesomeness, and guidelines for the use of non-drinking water (for example in commercial or industrial buildings). This document potentially conflicts with the Water Industry Act and Water Supply (Water Quality) Regulations, which contain no allowance for different or lesser quality standards for wholesomeness.



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It is recommended that a review of these regulations is carried out by legal services, in conjunction with the Inspectorate, with a view to bringing clarity and consistency in the definitions of domestic uses, and where wholesomeness is required, across the different statutory instruments.

Recommendation 5: Deliver effective implementation and enforcement of legislation governing dual pipe systems

5.1 Clarify regulatory responsibilities. Clear duties and enforcement powers, capability and capacity are needed to regulate effectively. An assessment should be carried out as to the effectiveness of the current systems. The role of HSE and the Inspectorate should also form part of this review.

The Health and Safety Executive (HSE) is the lead regulator for The Building Regulations 2010 Approved Document G, covering Sanitation, hot water safety and water efficiency. HSE already has a water safety remit for *Legionella*, and it might be appropriate for HSE to take on that role purely for commercial settings.

Local Authorities are the regulator for private water supplies, and the local authority is usually the local Building Control Body, responsible for the enforcement of building regulation Approved Document G.

Water undertakers (water companies and NAVs) are the enforcer under the Water Fittings Regulations. Regulation 2 refers to situations with a mains supply back up and is enforceable by water companies. The regulatory effectiveness of water companies regarding water fittings should be evaluated to understand whether additional resources, enforcement powers, or regulatory oversight is required to ensure effective compliance, especially with regard to cross connections and backflow protections.

The Inspectorate is the regulator for public water supplies. It provides technical advice to local authorities regarding private water supplies but has no regulatory role. The Inspectorate's role with regard to dual supplies is limited to contamination of the public drinking water supply. If contamination occurs due to inadequate backflow protection or cross connections with a dual supply system, the water undertaker must notify the Inspectorate as an event, and the Inspectorate will take regulatory action under the Water Supply (Water Quality) Regulations.

The Secretary of State for Defra is the regulator for the Water Fittings Regulations. Defra does not hold capacity or technical competence, and it may be possible under

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current legislation for this to be delegated to the Drinking Water Inspectorate or another regulator.

- 5.2 An analysis of the effectiveness of the current regulatory regime together with an evaluation of compliance with the existing standards and guidance is needed to inform decision making. Capacity among local authorities to carry out their duties should be assessed.
- 5.3 An options assessment is recommended to assess what is the most appropriate model for a regulator or regulators working together, to provide proportional and risk-based regulation of dual pipe supplies, which will protect public health whilst not putting a prohibitive burden on the industry.
- 5.4 Duties, powers and enforcement tools should be assessed, plus offences and due diligence protections. It must be clear who is legally liable if a community system fails, with risks to health, water supply or property value.
- 5.5 Encourage responsible behaviour by industry and self-regulation. Water Regs UK rainwater case study recommends a holistic policy to encourage water re-use and also needs to consider how notification of water re-use systems can be encouraged, ensure only competent installers are used and that they use compliant products that conform to an appropriate quality and standard, and how information on operation and maintenance of re-use systems is provided to everyone with a rainwater harvesting system installed in their home.

Recommendation 6: Improve competency within the industry through training and mandatory accreditation of designers, installers, operators and maintainers of dual pipe water reuse systems.

- 6.1 The Expert Group strongly recommends the extension of the WaterSafe scheme to make registration compulsory for contractors and plumbers working on water supply systems. The WaterSafe scheme for approved water contractors and plumbers is well established and adopted by water companies and plumbing associations, but unlike the gas system, registration is not mandatory. This should be implemented in tandem with a public information campaign to raise awareness of the requirement for 'WaterSafe' plumbers to carry out dual use (and other) work (see Recommendation 8 below).
- 6.2 Owners, operators, maintainers, and enforcers require formal training with periodic reassessment for competence. (This could be like the Unvented Hot Water Systems and Safety (HWSS) certificate as an example, with a five-year

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training renewal period to maintain competence). Accredited installation and maintenance schemes should include regular audits of competence and compliance.

- 6.3 Standards for accreditation (and training) specific to water reuse need to be written with regulatory approval in view of existing industry guidance. Trade associations have a key in devising training and accreditation schemes, with sign-off by a central regulator.

Recommendation 7: Revise and update the guidance to the industry into a single Approved Code of Practice on an official government website.

Justification: A comprehensive review is needed of existing guidance with the aim of updating and bringing together into a set of national guidance, which incorporates the risk-based approach and the BS EN. The BS EN is available by subscription only, and therefore not fully accessible to all system developers and users. This is an unnecessary barrier and not appropriate for water reuse systems.

- 7.1 Defra and the Inspectorate should commission an independent consultant working with UKWSA, WRUK, EWCS, and other reputable trade bodies (CIBSE, CIPHE) to consolidate and revise the guidance to industry. The guidance should comprise legislative requirements and standards for design, installation, commissioning, maintenance and testing, and could form the basis of secondary legislation.

Water Regs UK (WRUK) in conjunction with UKWRA are well placed to advise, and an independent consultant would be well placed to revise and update the guidance available to industry, developers and householders on dual supplies. The revision should bring together the best of existing guidance, including BS EN, NSF, Approved Document G, and risk assessment methodology developed by the Inspectorate and Enabling Water Smart Communities project, into a coherent Code of Practice or guidance.

- 7.2 The Expert Group recommended that the guidance is signed off by the Inspectorate.
- 7.3 The updated guidance should be published on a suitable free government website.
- 7.4 As part of the guidance, a national system of pipe colour coding should be established. Purple pipes are used in many countries for dual pipes, but in UK

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these are used for electrical cabling under highways, and in UK green/grey/black is specified by the BS EN. UKWRA has informed the group that compliance with labelling in between joists and in properties is poor, and there are technical difficulties with producing the green/grey/black pipes. A cost, safety, and benefit evaluation is needed to decide whether to align with the purple pipe, ahead of the expansion of reuse systems. This would retain similarity with other countries and be easily recognised by the public.

- 7.5 Guidance to the public should be made freely available as a follow-on part of this work to ensure products are safe for the end user. A common-sense approach is recommended. For example, the safe installation, use, and maintenance of water butts can be very adequately covered through product design, correct installation and instructions for use in a leaflet.

Recommendation 8: Require and facilitate mandatory registration of installed systems

Justification: Regulation 5 of the Water Fittings Regulations requires a person who proposes to install a water fitting in connection with their supply to notify the water undertaker. Any system with a mains back up should be notified. According to the industry compliance is very low, with no process to identify when a notification should have been made.

The requirement to notify must be enforced.

- 8.1 A centralised register of dual pipe systems is needed for regulation and conveyancing searches. The EWCS has created a GIS mapping system for reuse schemes, which could form the basis of a register.

A similar parallel system is administered by HSE, which is responsible for enforcing gas safety laws and keeping the register of gas installations and Gas Safe Installers.

Recommendation 9: Raise public awareness of the dual pipe systems including water saving advantages and risks to public health

- 9.1 Water companies and professional organisations have been encouraging consumers to save water (for example SES Water, Water reuse – guidance and advice factsheet, CIWEM – “Water quality issues for household water reuse”, Briefing Note). However, awareness amongst the public of dual pipe systems is likely to be fairly low due to the small number of schemes in operation. As the technology spreads it is important that public awareness increases, so that

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householders have the information and awareness to correctly use and protect water in the home. Inappropriate use is a risk for all applications where the water is accessible. This must be timed for when the appropriate guidance and standards have been established, in tandem with availability of professional plumbing capabilities to advise, install and maintain.

- 9.2 Guidance should be provided for the public on dual pipe schemes and single property schemes such as water butts, to raise awareness of the presence, benefits and where relevant, the risks associated with the system, provide information, and encourage correct installation and use.
- 9.3 The Water Efficiency Campaign will launch a public awareness campaign in May 2026 with the purpose of changing public attitudes to water, to increase the value placed on water supply, increase conservation and reduce wastage in commercial and domestic settings. The Expert Group recommended that public awareness of dual pipe supplies needs to be raised in conjunction with information about the safe use of such systems. There may be an opportunity to link with the Water Efficiency Campaign for joined up messaging, or branding and materials.
- 9.4 Raise public awareness of the WaterSafe Plumbers scheme.

Recommendation 10 Carry out further work to establish water quality standards for non-drinking water

Justification: The need for specific water quality standards that go beyond (in terms of legal status and detail) those available through existing British Standards was identified.

Drinking Water Quality Standards

There is a well-established mechanism to derive health-protective standards for drinking water quality. Using scientifically established toxicity data, tolerable daily intake over a lifetime of exposure, and taking into account vulnerability and uncertainty factors, a standard is derived that is health protective over the long term. This approach is adopted by the WHO, in relation to the guideline values for chemical parameters.

Indicator organisms are used extensively in water supply regulation to detect the likely presence of faecal contamination. The absence of faecal indicator organisms is a preventative measure, although the situation could exist where no indicator organisms are detected but the water may still be microbiologically unsafe.

Water Quality Standards for alternative domestic uses

The derivation of non-drinking water quality standards for alternative domestic uses is not as well developed or consistent as drinking water standards, and this is evidenced by the variety of approaches adopted worldwide. The World Health Organization does not publish guideline values for non-drinking water. For uses such as toilet flushing, irrigation and laundry, the risks vary depending on route and levels of exposure and cannot easily be derived from toxicity data or microbiological indicators alone. The need for specific water quality standards that go beyond (in terms of legal status and detail) those available through existing British Standards was identified. Therefore, the Expert Group discussed and agreed the following recommendations:

- 10.1 Develop guideline water quality values applicable to non-drinking water from reuse systems, in consultation with Defra, health regulators and DWI, such that the adoption of reuse systems for non-drinking water should not increase the risk of illness to the end user, compared with drinking water. This will involve a limited number of areas outlined below and could involve further research to better understand the source water quality and the end quality in typical UK systems, using real water quality data, derived either from a literature search or a sampling programme. As with any water quality standards, there should be a duty to review their effectiveness on a regular basis.
- 10.2 Further assess the relevance, risk and protection offered by the BSEN examples. The microbiological parameters for non-spray applications were, we understand, derived from the bathing water standards. Schedule 5 of the Bathing Water Regulations 2013 classifies 'Excellent' coastal waters as <250 *E.coli*/100 mls, which is the same as the guideline value for toilet flushing. The BS EN example for non-spray application is 250 *E. coli*/100 mls, 100 intestinal enterococci/100 mls and 1,000 coliform/100 mls, with a tighter standard of 10/100 ml coliforms for laundry.

The microbiological standard for spray application is more stringent, 0/100 ml for *E. coli* and intestinal enterococci, 10/100 ml *Legionella* and 10/100 ml total coliforms.

Physicochemical example standards include pH, turbidity, residual disinfection (chlorine and bromine) where used. The water should also be free from suspended solids, colour and odour.

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- 10.3 Consideration of the risks from campylobacter (and other relevant pathogens) should be included (see case study in Annex 4).
- 10.4 Consider deriving log removal standards for bacteria, virus and protozoa, based on acceptable end quality. Treatment standards based on log removal values for bacteria, virus and protozoa, as used in US and Australia, should be included in the preparation of options for ministers.
- 10.5 Gap analysis of the L8 *Legionella* risk assessment should be carried out to ensure the requirements cover all reuse systems where there is a risk of *Legionella*. The HSE does not set numerical standards for *Legionella*, which is entirely a risk-based control system. *Legionella* bacteria are widespread in natural water systems. Outbreaks of the illness occur from exposure to *Legionella* growing in engineered water systems in buildings. Legionnaires' disease is normally contracted by inhaling small droplets of water (aerosols), suspended in the air, containing the bacteria. Certain conditions increase the risk from *Legionella* if: (a) the water temperature may be between 20–45°C, which is suitable for growth; (b) it is possible for water droplets to be produced and if so, they can be dispersed; (c) water is stored and/or re-circulated; (d) there are deposits that can support bacterial growth, such as rust, sludge, scale, organic matter and biofilms.
- 10.6 Research gap: Assessment of laundry risks for vulnerable users. Evaluation of low temperature washes and laundry sanitisers, description and definition of vulnerable users is required.
- 10.7 There should be a duty to review the effectiveness of any standards set.

Future recommended work to deliver required outcomes

1. Develop options for ministers for a single set of water quality standards for non-drinking water, working with health regulators and academia. The Drinking Water Inspectorate could lead such a twelve month follow up research project as needed, if resourced appropriately.
2. Appoint an independent consultant, under direction from the Inspectorate, to produce an Approved Code of Practice or similar guidance document, for non-drinking water supplies. This should bring together all the best parts of the existing disparate guidance into a single document, updating where necessary to reflect best practice and ensure all risks are managed. The output should be freely available for industry, housing developers, and homeowners in England and Wales.
3. A review of the relevant legislation should be carried out by Defra legal teams, to ensure the framework is consistent and allows for the legal development of dual pipe systems.
4. Consideration of a new statutory instrument for dual pipe supplies, or, if more appropriate, aligning existing statute to provide clarity and safeguards for dual pipe systems.
5. Policy analysis to determine the most appropriate effective regulatory structure, which will protect public health, and allow the industry to expand whilst maintaining drinking water quality and public confidence in the sector. Roles of the main regulators, the Inspectorate, HSE, local authorities and water companies must be clarified and the regulators provided with the necessary duties and powers to effectively regulate dual pipe systems. Assessment of capacity, capability and costs of regulation, recharge and effectiveness drawing on experience of private water supply regulation and incorporating lessons learned and better regulation principles.
6. Although the group ruled out showers as a suitable use for non-drinking water, we are aware that there are recirculating showers available on the market in the UK, and that these are being actively promoted. The safety of such devices should be established and proven, including for vulnerable users and over the lifetime of the device, before these are allowed to be proliferated. IKEA with Flow Loop (a Danish company) have developed a water recycling shower, which saves both water and energy, by recycling, cleaning and disinfecting the personal shower water in a closed loop while showering. The Bathroom Association noted that IKEA is willing to share their water quality testing data of 'Flow Loop', which



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would provide evidence of the water quality they achieved with UV and filters which may help to define the risks.

7. Investigate areas where innovation which improves the safety of reuse systems could be supported. For example (i) real time monitoring and control systems which can identify contaminant breakthrough and either isolate the supply or switch to potable backup. (ii) novel forms of treatment which can be deployed at small scale. (iii) more reliable and cheaper treatment and control technologies including status/alarm systems.

Annex 1: Case studies from Expert Group site visits

Case study 1 of 2. Aquality installation serving the development at Kings Cross, London, UK

The Inspectorate arranged a site visit to the *Aquality* installation at the London Kings Cross development on Wednesday 29 October 2025 (the second of two site visits arranged for the Inspectorate's 2025 Expert Group on Water Reuse, the first being a smaller trip on Wednesday 15 October, to the Stormsaver company's offices and design space in Newark). This site visit was attended by the Inspectorate and its Expert Group, and was hosted by Lutz Johnen from *Aquality*. Lutz is also Chair of *UK Water Reuse Association* (UKWRA), the UK's trade association for water reuse, and in that capacity Lutz advises multiple EU and British Standards committees, pertaining to water design and product and water quality testing specifications.



Figure 1 The group tour of the tank room

At the visit, the group were shown the tank room that supplies the Kings Cross development via water reuse, 47% of which is supplied by reused water, before switching to mains supply due to demand. This consisted of (pictured below, respectively) rainwater and greywater storage/treatment and supply pipes, a mains water top-up tank with a safety air gap 'break tank', connected to both the rainwater and greywater supplies), rainwater diverter valves, and variable speed pumps.

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Figure 2 Rainwater tanks



Figure 3-4 Greywater storage and treatment



Figure 5 Reclaimed water supply pipes



Figure 6 Backflow protection with type AA air gap

The mains water is protected with a Type AA air gap, which is a recognised backflow prevention arrangement suitable for protection for up to fluid category 5 risk.



Figure 7 Rainwater blockage detection flaps Including variable speed pumps below tank

In this design there is also Cat 5 UV disinfectors for the mains water. This was part of this developer's request for the system (as a belt-and-braces safety measure, even though the system already has the bio-mechanical filtration (Ultra-filtration membrane) to clean the reused water and the air gap break tank to protect the mains water).

Aquality designed and installed this system. 60% of water reuse system designers install their own systems but there is no obligation to. *Aquality* designed and installed this system. *Aquality* performs three minor and one major inspections on this project, which are performed by fully qualified service engineers.

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Rainwater is stored in the black tanks. The group learned that the rainwater filters for this installation have a calmed inlet into the tank to enable sedimentation and flotation. The group learned that in general (not for this installation), complaints about grit/dirt in a rainwater-fed toilet means tanks either have the pipes installed too high or too low in the tank or they don't have a calmed inlet. Installation has diverter valves installed that have bi-weekly automatic blockage checks. The water is kept at 18°C, although in general rainwater tends to be much less than this, especially when stored underground.



Figures 8-9 Rainwater tanks and diverter valves

Greywater is stored in the grey tanks. The group learned that this installation uses MBR (membrane bioreactor)-type filtration for its greywater treatment, based on the specification to opt for a biofiltration-treatment method rather than a chemical-treatment method. MBR filters the biological matter, including filtering out key harmful microbes (bacteria) such as coliforms and *Legionella*. The treated (filtered) water averages 18°C. Here they use flat sheet MBR; the other type being hollow fibre membranes. Filters also differ by whether they gather the water on a membrane and/or use backwash filtration. The water in the tank is continuously aerated because this helps lift dirt from the membrane. This installation was designed so the filters needed to be cleaned at most once a year, and there is no cost for new membrane, only a cost for cleaning. The group also learned there were no issues with surfactants (soaps) being present in the filtered greywater – due to a sedimentation and flotation effect in the tank.

The collected rainwater and greywater at this installation also receive UV treatment post-filtration. For the post-treatment water quality test before it enters the reclaimed water supply for the development, it must achieve the water quality standards specified in the British Standards for rainwater and greywater, which, currently, are compared with EU Bathing Water Directive water quality standards.



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The high-throughput for this development (due to the high demand) also helps reduce the presence of microbes that may build up in standing water, pre-treatment. Monitoring of microbial quality is optional for *Aquality's* clients, however, the developers for this site requested it so *Aquality* monitors it via an alarm system, so they get alerted.

London Kings Cross – Case Study

In 2001 Argent was selected as a development partner. The development plan was prepared by Allies and Morrison, Porphyrios Associates and Townshend Landscape Architects.

In 2006 outline planning was granted permission which allowed for:

- 2,000 new homes*
- 20 new streets*
- 10 new public squares*
- 26 acres of open space*
- Accommodating 30,000 people*
- An overall mixed development on 67 acre site.*



In 2008 the developer King's Cross Central Limited, which included Argent LLP, DHL and London & Continental Railways was formed.

Transformed into a new part of the city with homes, shops, offices, galleries, bars, restaurants, schools and a university.

A new postcode was created - N1C.



AQUALITY Trading & Consulting Ltd.
www.aqua-lity.co.uk

Cont. London Kings Cross – Case Study

High level sustainability was part of the planning permission from Camden Council.

This included high level BREEAM requirements for all commercial buildings. Aquality was involved from the start. Initially presenting water reuse options to Argent Group and then supporting several consulting engineering firms including SWECO in the design to meet the requirements. In the next stage Aquality supplied and installed 6 greywater recycling systems and 4 rainwater harvesting systems.



Today Aquality maintains these systems and more including remote monitoring.

All systems have a potential of saving ~19,000m³ of mains water per year. When saving the mains water, the same amount of water will not hit the sewer system. This is an often forgotten advantage of using non-potable water.

Approx. 2500m³ of rainwater are being flushed in the WCs per year and therefore will not enter the sewer system in a rainfall event.

Approx. 16,500m³ of greywater per year can be recycle which is also used to flush the WCs and will not enter the sewer system as foul water



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Figure 10-31 Aquality's own case study slides of their installation for the Kings Cross development

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Case study 2 of 2. Stormsaver company offices and design space, Newark, UK

This site visit was attended by the Inspectorate and its Expert Group, and was hosted by Lisa Craven and Michael Farnsworth, *Stormsaver's* co-founders and Professor Rob Morris of Nottingham Trent University.

The group was taken through some presentations and learned about the rainwater and greywater-collection (water reuse) systems; fittings used in the industry and products designed and manufactured at *Stormsaver.*, whilst learning about the scale at which they are typically installed. The group also had the opportunity to seek views from *Stormsaver* staff in its capacity as a member of the *UK Water Reuse Association (UKWRA)*.

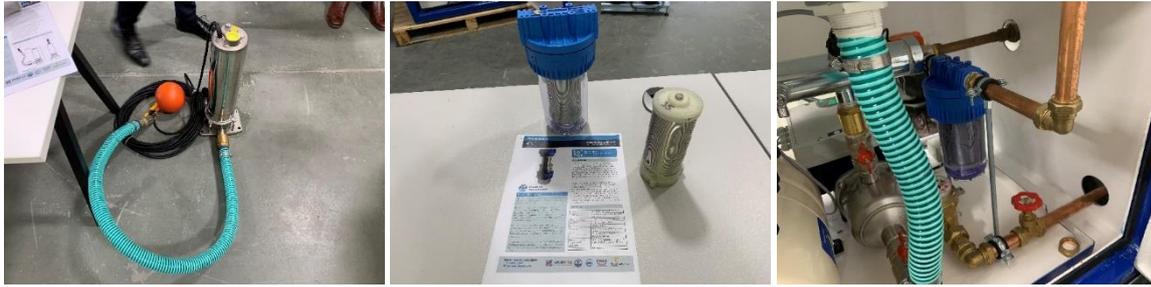
The group was then taken on a tour to meet some of the teams, which included the marketing, sales, operations and design teams who manage the industry outreach, design and installations. The group learned that *Stormsaver's* Design Team is primarily made up of Design Engineers, which include Post PhD Chartered Engineers and Engineering graduates., The team innovate improvements in new technology as well as considering response to customer and market feedback. In doing so, *Stormsaver* adds to wider industry knowhow thanks to the company's links with *UKWRA*. The group had learned previously about the innovation project *Stormsaver* was awarded, to develop an AI system that detects system operation for condition-based maintenance and can detect temperature for *Legionella* control and other water quality conditions. The group was shown this now completed piece of technology.

The group was then taken to look at some of the equipment.

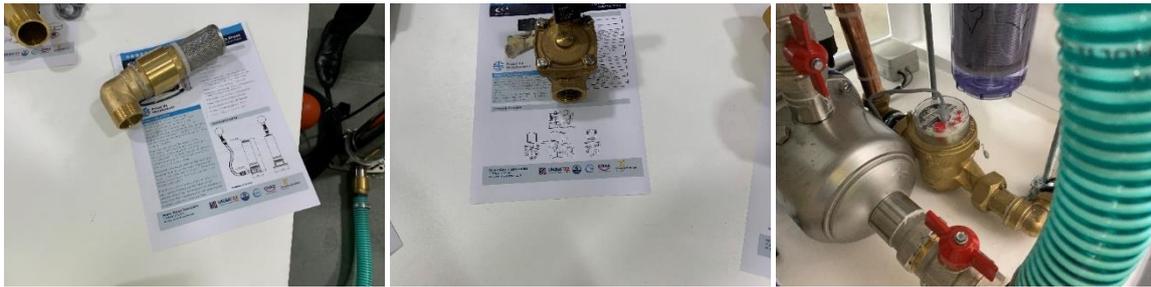


Figure 4-2 The group tour of the warehouse and workshops

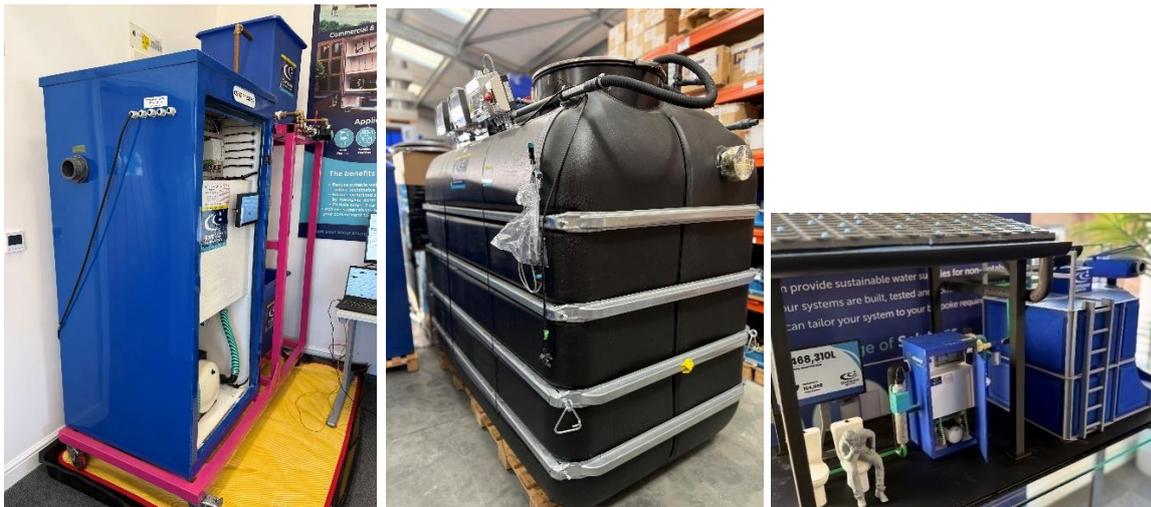
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Figures 3-5 Pumps and examples of filtration



Figures 6-8 Pipe connectors and valves



Figures 9-11 Smart Control system with AI and condition based monitoring



Figures 12-14 Black and green pipework, safety labelling and maintenance instructions



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On the site visit, the group discussed with the *Stormsaver* hosts what currently works well about existing systems for water reuse (rainwater- and greywater-collection), including that:

- The safety of these systems is in the design phase.
- Monitoring includes for turbidity, UVI, flowrate, free chlorine, and ozone residuals.
- These systems are relatively straightforward to install.
- Other countries who successfully have these systems up and running include Germany, where over 60,000 new systems are installed each year, using water for toilet flushing, garden use and water reuse for washing machines, and Australia, which has over 3 million properties using rainwater for similar applications to Germany and with washing machines for reuse on an entirely separate plumbing line with an air gap for safety.
- Rainwater-collection systems...
 - (In new-build homes) are indicated via pipe colour labels.
 - Require several filtration layers in the tank. The tank needs to overflow for the floating sediment on top to clear. Heavy sediment then sinks to bottom. A calmed inlet oxygenates incoming water and aerates the tank, allowing aerobic bacterial digestion of the sediment layer. (A non-aerated tank would cause anaerobic digestion, and anaerobic bacteria are unsafe.)
 - Are more effectively treated by UV when turbidity and biofilms are properly pre-cleared by filtration and the filter is properly maintained. Typically no other filters are deemed as necessary for rainwater-collection systems (other than, potentially, carbon capture filters).
 - Are designed to detect a flow to switch systems on/off when flushed toilets refill.
 - Are designed so that empty tanks (partially) refill from the mains to ensure a consistent supply via an approved airgap
- Greywater-collection systems...
 - Draw from handbasins, baths and showers. Sludge, sediment and foam build-ups must be cleared. Water is treated with aerobic bacterial digestion and then passed through ultra filtration (0.02 micron). The cleared greywater is then passed to the next tank where it is recirculated using UV-treatment. As with rainwater-collection systems, the water is more effectively treated by UV when properly pre-cleared by filtration and the filter maintained.



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The group discussed with the *Stormsaver* hosts (in their capacity as a *UKWRA* member as well), their views on,

What would work best for industry risk ownership and accountability, including that:

- Plumber Competency would be best applied if the supplier of the system had also commissioned the system (“Supplier-Commissioner-only” water reuse systems).
- A WaterSafe Plumber Accreditation scheme, adapted for water reuse systems, would simply need to be about connecting up the correct pipes. Accreditation could be made equivalent to the Gas Safe Register (Similar to the G3 HWSS Unvented Hot Water Qualification), including mandating that every five years a WaterSafe-Accredited water reuse professional must retake their accreditation.
- For further water safety (for example, for instances where the British Standard doesn’t state clearly enough what the water quality standards should be), guidance should be sought from Water Regulations Advisory Scheme (WRAS) Approvals.
- Community-Residential systems would be safest, because they would not be placing the safety duties (and therefore the risks) upon individual occupants, but rather would centralise that risk and accountability for the installation to the (authorised) supplier-commissioner and the (accredited) plumber. Ongoing responsibility would then be passed to the Facilities Management company, NAV or water utility responsible for maintaining the site.
- Water companies have cost-benefit drivers to create accountability in their checks, so regulation around water reuse should ensure that those cost-benefit drivers can be properly leveraged to ensure water company safety (Water Safety Planning).
- That the industry requires minimum water quality standards and through innovation can achieve these standards using a range of techniques and processes and that the technologies themselves shouldn’t be prescribed which could stifle innovation.

And current gaps in the water reuse industry, including that:

- More research on pollutants (toxicology) is needed.
- Underground Storage tank temperatures are typically not beneficial for the growth of *Legionella* (6-11 degrees), however, in the internal pipes and water tanks it can be. This is where UV filtration-treatment comes in. UV treatment can

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be built into risk assessments and can tackle *Legionella* onsite with immediate results. Individual site risk assessments should be carried out in the normal way.

- The British Standard needs to include more filtration stages (so that the UV disinfection can work better on *Legionella*, as explained above).
- The *Water Supply Water Quality Regulations* erroneously specify reclaimed water pipe colours as black/green/grey, but this colour combination of materials cannot be manufactured. Currently black/green pipes are manufactured (not with the grey) and black/green/grey stripe stickers are used instead, to make it more obvious in case the pipe is the wrong colour. This relies on the installer fitting the labels during installation.
- It is currently not a UK requirement to carry out any water quality testing in any water reuse system. Currently the NSF formula is strictest for accreditation is probably best to draft UK standards based on these, if we are not creating our own. NSF is Europe/USA NSF/ANSI 350-2011. UK systems designers are currently basing things on either NSF, or Aus (AS 1546.4:2016 Part 4), but are resistant to include more without legislation to look to. However, regarding the basis for the NSF *E. coli* parameter, there's not really any suggestion as to why it's this.



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Annex 2: Standard setting via control measures

Control measures to adopt (i.e., standards on water reuse) for reducing risk of exposure to harmful water quality

Guidance (User and Industry)

- Standards for Guidance (User and Industry) specific to water reuse need to be written with regulatory approval **in view of existing industry guidance**.

Regulated guidance packs need to be produced that are accessible for the user, and for the industry. The guidance must clearly encompass the control measures as applicable.

Accreditation (and Training)

- Standards for Accreditation (and Training) specific to water reuse need to be written with regulatory approval **in view of existing industry guidance**.

Owners, operators, maintainers, and enforcers need to receive formal training, ideally with periodic reassessment (for example, similar to hygiene certification schemes). Accredited installation and maintenance schemes should include regular audits of competence and compliance.

Labelling (of Pipework and Fittings)

- Standards for Labelling (of Pipework and Fittings) specific to water reuse need to be written with regulatory approval **in view of existing legislation and industry standards**.

To minimise the risk of cross-connection, [The Water Supply \(Water Fittings\) Regulations \(Schedule 2, 14\(1\)\(b\)\)](#) require reused-water plumbing systems to be clearly identified and distinguishable from those conveying drinking water; compliance with the British Standard [BS1710 \(Pipe-marking\)](#) meets this requirement.



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The British Standards [BS\(EN\)16941-1:2024 \(Rainwater systems\)](#) and [BS\(EN\)16941-2:2021 \(Greywater systems\)](#) require all pipework and fittings to be marked in accordance with the British Standard [BS1710 \(Pipe-marking\)](#).

Design (Materials and Water Treatment)

- Standards for Design (Materials and Water Treatment) specific to water reuse need to be written with regulatory approval **in view of existing legislation and industry standards**.

The British Standards [BS\(EN\)16941-1:2024 \(Rainwater systems\)](#) and [BS\(EN\)16941-2:2021 \(Greywater systems\)](#) specify that materials must not adversely affect the quality of the reused water, must be resistant to corrosion, and should comply with the material properties described in the British Standard [BSEN12566-3:2016 \(Small wastewater treatment systems\)](#).

Installation

- Standards for Installation specific to water reuse need to be written with regulatory approval **in view of existing legislation and industry standards**.

The British Standards [BS\(EN\)16941-1:2024 \(Rainwater systems\)](#) and [BS\(EN\)16941-2:2021 \(Greywater systems\)](#) require dye or pressure tests at pre-commissioning, to confirm there are no cross-connections. Dye testing is generally more effective at identifying cross-connections.

(Operation and) Maintenance

- Standards for Operation and Maintenance specific to water reuse need to be written with regulatory approval **in view of existing legislation and industry standards**.

A water system schematic, and operation and maintenance (O and M) plan must be provided to the person accountable for the water system within the premises. Plans must be carried out, and records kept.

Compliance

- Standards for Compliance specific to water reuse need to be written with regulatory approval **in view of existing legislation and industry standards.**
- **Compliance is the fundamental control measure for the regulator to adopt, and needs to involve:**

Enforcement and regulatory oversight

Effective enforcement requires: A register of installed systems (linked to notification processes); Clear assignment of enforcement responsibilities (for example, is it the water companies, local authorities), with powers to inspect and compel those responsible to put things right; Adequate funding and regulatory oversight to ensure enforcement bodies can act effectively; Defined escalation processes where enforcement is ineffective.

Verification and monitoring

Verification measures should be implemented to confirm that systems is safe and effective. These may include: Commissioning tests; Monitoring of treatment performance; Routine maintenance inspections; Annual (or appropriate frequency) water quality sampling; Periodic dye or pressure testing for cross-connections (for example, annually for registered sites); Smart meter monitoring by water retailers to detect abnormal flow (possible backflow); Risk-based enforcement inspections, focusing on higher-risk or higher-impact sites.

Requirements to notify

For premises connected to the public water supply, installation of a water reuse system must be notified to the relevant water company before work begins, as required under the Water Fittings Regulations. The company has 10 working days to consent, which may be issued with conditions. There may be a notification gap for sites not connected to a public supply. Considerations may cover: whether legislation should be amended to require notification; whether registration should apply only to commercial, tenanted, social housing, and community premises; where such a register should be held (for example, by the relevant water company); whether the register should include the name and contact details of the responsible person on site. Incentives could encourage compliance — for example, offering discounted water bills for registered systems.



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Site/system/risk owner

When ownership of a property changes: System schematics and plans must be transferred to the new owner; accountability for system management must be formally handed over; if the site is registered this should be updated, and water supply details must be included in conveyancing reports. Clear ownership and accountability are essential. Who owns the risk and is responsible for corrective actions? What mechanisms exist to ensure compliance if the responsible party fails to act? *Example: A study by Anglian Water found that among 1,200 homes with rainwater harvesting systems, many had changed ownership within five years, and new occupants were often unaware that such systems existed.*

Annex 3: Further detail on the Water Safety Planning approach

Water Safety Planning covers all aspects of water resources, treatment, delivery to end-use and aftercare of a water supply system, from initial installation to the training and competency of the people operating and maintaining it. When risk assessment methods are robustly designed to capture supply system data, and multidisciplinary teams of people are engaged in a Water Safety Planning process, risks are controlled to achieve the greatest reduction in impact to the end-user. A robust Water Safety Plan maintains protection of public health and user confidence through validation and verification.

Figure 1 shows a Water Safety Planning cycle using the dual-stage approach, typical for drinking water supply systems, which are typically larger in their complexity and coverage. A dual-stage approach means risks are assessed both before and after control measures are implemented, to see how effective the control was.

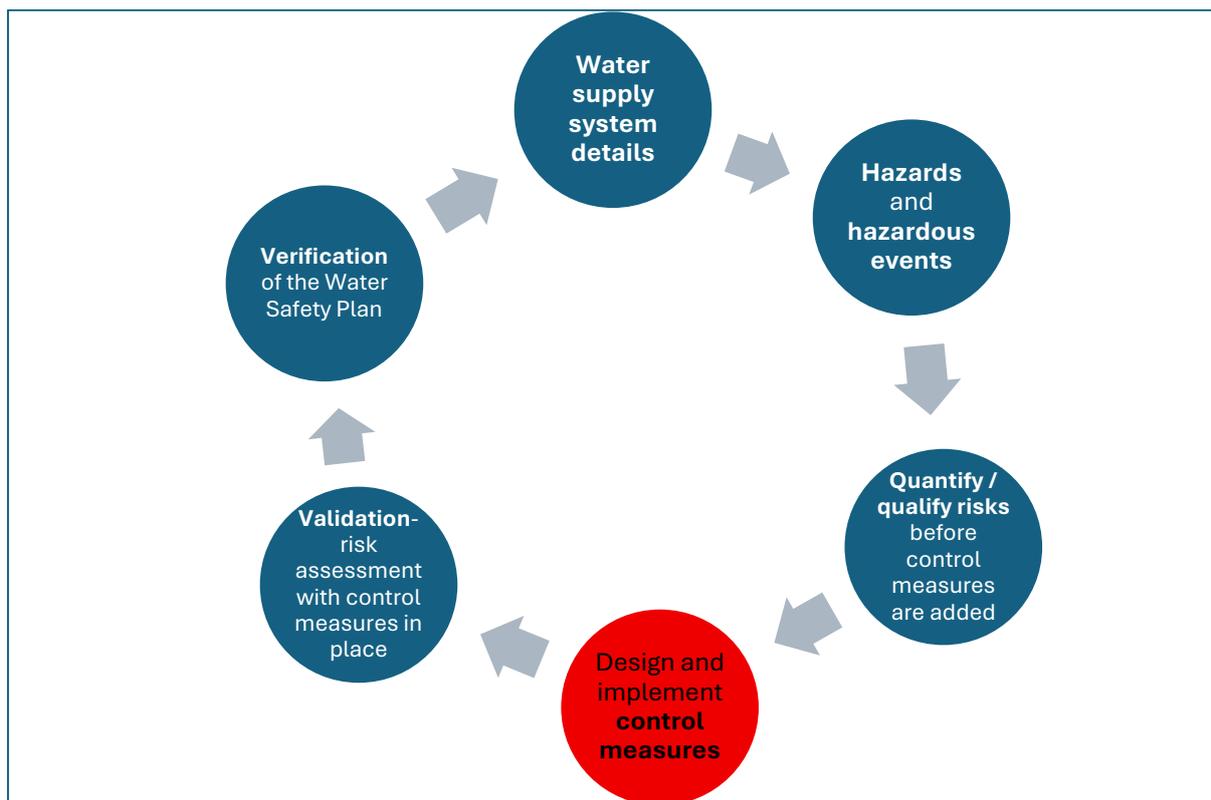


Figure 1 Water Safety Planning cycle: dual-stage approach.

Figure 2 shows a Water Safety Planning cycle using the single-stage approach, typical for private supply systems, which are typically smaller in their complexity and

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coverage. A single-stage approach means risks are assessed considering control measures already in place. The process is less time consuming and easier to follow for stakeholders without prior experience in Water Safety Planning. **This smaller approach is suitable for water reuse systems.**

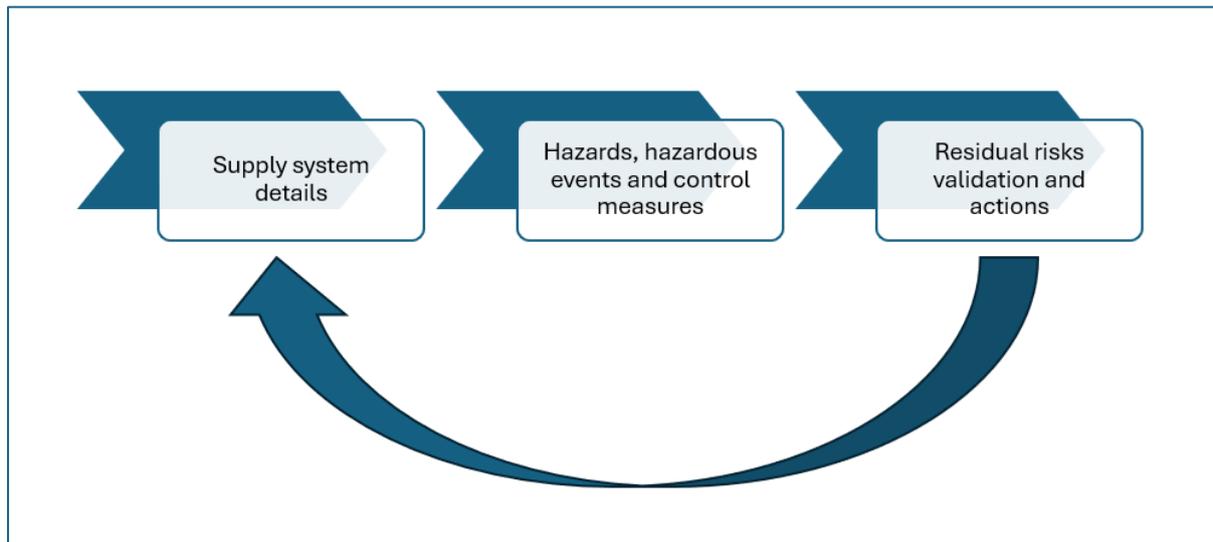


Figure 2 Water Safety Planning cycle: single-stage approach.

Annex 4 Risks from campylobacters in harvested rainwater – assessment

Scenario

Rainwater is collected from roof surfaces that are accessible to wild birds (for example crows, pigeons, gulls) that may deposit faecal contamination containing various pathogens, including campylobacters (prevalence around 33% and 10^4 to 10^5 cells per g, depending on the species). These bacteria have a low infectious dose and may pose a risk to individuals exposed to harvested rainwater.

Available knowledge

A few studies have been published regarding the risks posed by campylobacters to roof-harvested rainwater quality. A single study from the UK examined the microbial risks associated with *Campylobacter* infection from toilet flushing with rainwater in the UK (Quantitative microbial risk assessment with respect to *Campylobacter* spp. in toilets flushed with harvested rainwater, Lorna Fewtrell and David Kay. The authors used previously published data on *Campylobacter* spp. prevalence in rainwater. Monte Carlo analysis was conducted to estimate human health risk, which was quantified in terms of disability adjusted life years (DALYs). The authors assumed that overall, 30% of *Campylobacter* infections result in illness, while the severity of infections and the duration of illness were also considered. The results indicated that the risk of acquiring campylobacteriosis from using untreated harvested rainwater for toilet flushing was below a risk benchmark of 10^{-6} DALYs pppy.

No suitable epidemiological studies were identified that would provide evidence of a health risk on this specific issue.

Conclusions

The evidence available indicates that the potential for *Campylobacter* contamination of harvested rainwater does not pose a risk to public health when used for toilet flushing.

An unacceptable risk may exist in the harvested rainwater was inadvertently supplied as drinking water (i.e. in the event of a cross-connection). Under the principle of the multi-barrier approach to protecting public health, supplying untreated rainwater removes a major barrier to minimise the risk.



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Limitations

- It would be advisable to review the system set-up for comparability with typical rainwater harvesting systems (is there a likelihood for short-circuiting in the tank), the number of bacteria being representative of harvested rainwater and the validity of the modelling assumptions.

Other considerations

- This brief review considered a single bacterial pathogen with a faecal-oral route of transmission. Whilst this organism can be taken as model for other bacterial pathogens, risks from parasitic protozoa or free-living amoebae have not been considered.
- Exposure to opportunistic pathogens (for example legionellae, pseudomonads and related bacteria, non-tuberculous mycobacteria) in harvested rainwater (and greywater) has the potential to infect through breathing aerosols containing these bacteria or contaminating broken skin.
- It would be worth being satisfied that this risk is acceptable as these sources of water can be nutrient rich and are encouraged to develop biofilms within the collection tanks. Data from the industry on monitoring for legionellae and HPC bacteria (in and out of collection systems and over time) would be helpful, if available. Also, higher nutrients could lead to greater biofilm development that could increase exposure to these bacteria.
- Particular activities, such as use of Neti pots and cleaning contact lenses should be prohibited from using this type of water.

Brief note prepared by Robert Pitchers on 6 November 2025.

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