CPD

Rainwater harvesting

WHAT YOU'LL LEARN

- WHY RAINWATER HARVESTING IS NECESSARY
- THE REGULATORY DRIVERS FOR ITS USE
- THE MAIN SYSTEM COMPONENTS
- HOW TO GET INSTALLATIONS RIGHT

THINK TANK: *Rainwater harvesting systems begin with the installation of a water tank*

RAINWATER HARVEST TIME IS HERE

The collection of rainwater as a substitute for mains water is a key part of the Code for Sustainable Homes and increasingly important in commercial buildings, says **Steff Wright**

Surprisingly, for a country seemingly awash with water, supplies throughout the UK are under stress. In England, south of the Humber, the situation is particularly serious. With average rainfall per capita less than it is around the Mediterranean, and the population predicted to continue rising, the problem is likely to worsen in coming years if it remains unaddressed.

This is why a reduction in per capita water consumption is a mandatory requirement of each level of the Code for Sustainable Homes. At levels 1 and 2, consumption should not exceed 120 litres per person per day, a requirement that can broadly be met through measures such as smaller dual-flush toilet cisterns, aerated taps and shower heads, and water-efficient appliances.

At a maximum consumption of 105 litres per person per day, code levels 3 and 4 present more of a challenge. Smaller baths are one possible solution, but these might not be popular with many homebuyers and may be impractical for others with special needs.

The alternative, to use recycled water as a substitute for mains water, therefore becomes attractive at this level of the code – and is essential at levels 5 and 6, where a maximum daily consumption of 80 litres per person is mandatory.

The simplest and most cost-effective way of recycling water is to install a rainwater harvesting system. In domestic applications, such systems can reduce mains water consumption by up to 50%. However, in non-domestic buildings that combine a large roof with a high demand for non-potable water (ie water which is not of drinking quality), savings can exceed 80%, bringing commercial as well as environmental benefits.

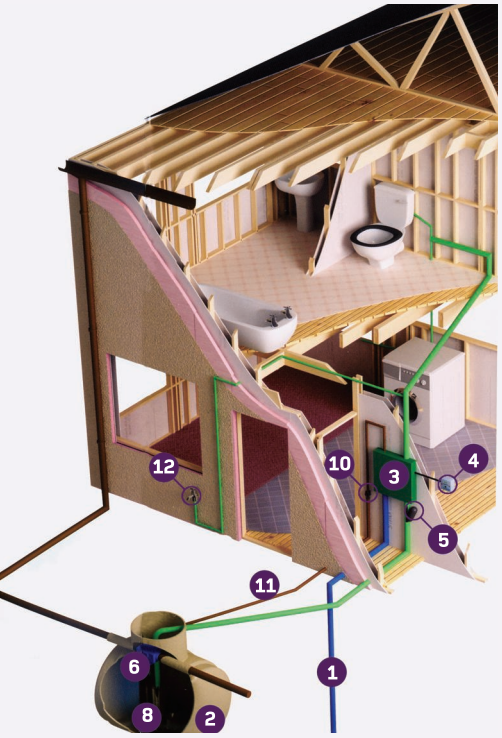
Once installed, rainwater harvesting systems also reduce the carbon footprint of the water being supplied by more than 90%, by saving the energy expended in transporting, cleansing and supplying mains water.

General concept

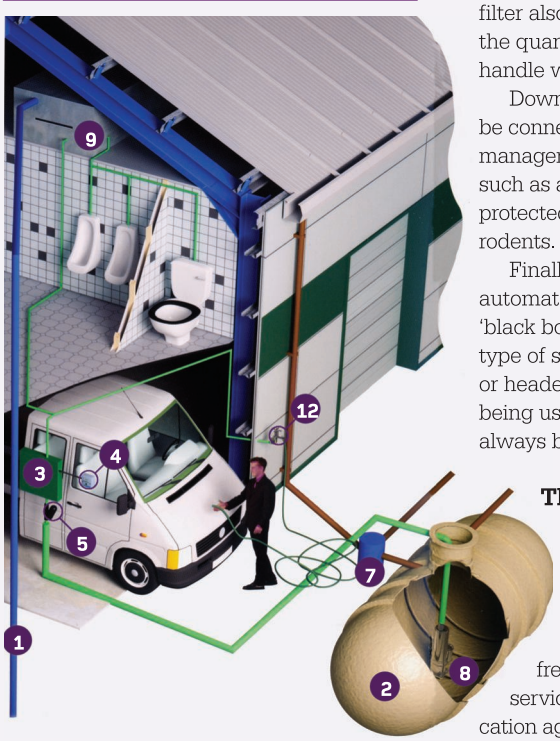
Rainwater harvesting is an old concept, which has been brought up to date by the use of today's technology. Put simply, water is channelled off a roof in the normal way before being filtered and stored pending use. Separate pipework (marked and labelled in accordance with the Water Regulations Advisory Scheme) is then used to provide the water for non-

RAINWATER HARVESTING SYSTEMS

1. Direct system



2. Gravity system



1. Mains supply
2. Storage tank
3. System management
4. Power supply
5. Pre-management filter
6. In-tank pre-storage filter
7. External pre-storage filter
8. Supply pumps – direct pressure and via header tank
9. Header tank
10. Air gap
11. Mains water top-up
12. Outside tap

potable services such as toilet flushing, clothes washing and outside uses. Supply is either direct from a pump, or via a header tank. All operations are automatic and instantaneous, with the pump being activated either by a drop in pressure in the service pipe (direct systems) or by a ball valve switch in the case of header tank systems.

A strict requirement of rainwater harvesting systems is that they must not be allowed to contaminate the mains supply, which means there can be no direct connection between the two. There must therefore always be water available within the non-potable system to feed its services, even during prolonged spells of dry weather. This is achieved in a direct pressure system by topping up the storage tank with mains water via an air gap, and directly in a header tank system, using a two-level float valve system. Either way, only a limited amount of mains water is introduced into the non-potable system to allow capacity to be maximised for the next fall of rain.

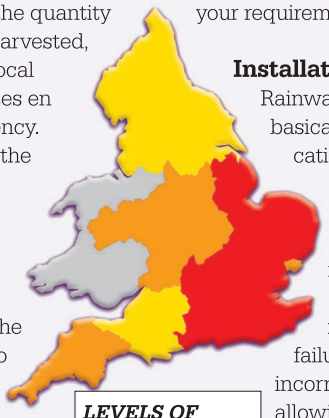
System components

The main components of rainwater harvesting systems are storage tanks, pre or in-tank filters, pumps, and a management module.

Water tanks can be the most daunting items to install as they are usually bulky and need to be integrated into the surface water management arrangements for the project.

The starting point for the design of any system is to calculate the size of the storage tank. This will take into account the quantity of water that can potentially be harvested, which will depend on roof area, local rainfall statistics, mechanical losses en route to the tank, and filter efficiency. The result is then compared with the expected non-potable water consumption of the building. An '18-day' factor is then applied to determine the size of the tank – the water should flow in and out again within an 18-day period. If the tank was larger and took longer to fill and empty, it would be difficult to ensure adequate, particle-free water quality.

In a correctly-sized system, the tank will therefore need to be automatically topped-up occasionally with mains water by the management system, and in periods of heavy rain it will also periodically overflow.



Before reaching the main tank, rainwater flows through the pre-tank filter, which also safeguards the quality of the water supply. The filter also needs to be sized to accommodate the quantity of water it will be required to handle while maintaining efficiency.

Downstream, the storage tank needs to be connected into the overall surface water management arrangements for the project – such as a soakaway or a storm drain – and protected against backflows and access by rodents.

Finally, the management module that automates and controls the system will be a 'black box', specified to take account of the type of system being used (ie direct pressure or header-tank), and the number of pumps being used to ensure capacity demands can always be met.

The right system for the job

System manufacturers all have their own, unique approach to bringing the above components together into a working system to meet project requirements. Most will also provide a free preliminary design and budget quote service that sometimes becomes the specification against which other potential suppliers are invited to tender.

This approach is flawed as it does not allow the purchaser to consider another manufacturer's solution to the same problem, which may be cheaper. Basing a tender specification on a consultant's design suffers the same potential limitation.

The best way to overcome these problems is to go out to tender specifying only essential operational requirements such as roof size, required consumption and conformity with BS 8515 (rainwater harvesting systems). This will enable each manufacturer invited to tender to offer you their particular solution to meeting your requirements.

Installation

Rainwater harvesting systems are basically simple and use high-specification components that are designed for reliability. If problems arise, the main cause is likely to be with the installation. Typical problems include allowing site debris into the tank or pipework, failure to calibrate correctly, incorrect wire terminations and allowing water to stagnate in the tank before commissioning.

All systems are delivered with instructions aimed at first-time installers. However, as with flat-pack furniture, these may not always be as clear to the reader as they were to the writer. For this reason most

manufacturers provide a free telephone 'hotline' service for use before and during the installation sequence. On most commercial projects it is normal for the contract to include on-site pre-installation training and system commissioning.

Installation of the tank and pre-tank filter is usually integrated with initial groundworks to ensure alignment with the surface water management system. This means that the remainder of the system may be installed some time later, during which it is essential to ensure that the tank does not collect water or site dust/debris. This is best avoided by sealing the top of the tank until it is ready to be commissioned, as well as sealing the filter to bypass water into the surface water management arrangements until the system is ready to go live.

IN DOMESTIC APPLICATIONS SYSTEMS CAN REDUCE MAINS WATER CONSUMPTION BY UP TO 50%

For a smooth-running system, it is also essential that site debris and dust is kept clear of all service ducts and pipe runs connected with the system. Obvious measures such as sealing pipes when they are being pulled-through should ensure this.

As some time may elapse between system installation and handover to a client, it is advisable to tie in commissioning of the system with the handover to ensure that it is only fully activated when it is about to be used.

From a main contractor's point of view, it is also sensible to have in place clear and contracted arrangements for dealing with teething problems or queries that arise post-commissioning. In line with normal construction industry practice, responsibility for leaving a system in full working order and for dealing with de-snagging for a defined post-commissioning period lies with system installers, rather than system manufacturers.

Manufacturers may provide the installer with all necessary advice and support, but would not normally attend site unless specifically contracted to do so.

Experienced and careful tradesmen should have little difficulty in installing systems correctly, and the systems should provide end users with years of trouble-free service and minimum maintenance. Commercial systems in particular present a good payback proposition. In the best-case scenario, capital costs can be recovered in as little as three years.

Steff Wright is chairman of Freerain and a founder member of the UK Rain Harvesting Association www.ukrha.org

CPD TEST PAPER

RAINWATER HARVESTING

You've read the module, now complete the questionnaire (below). Fill in the form then photocopy and fax the page to the course administrators on 020 7560 4014. Complete the test online at www.construction-manager.co.uk/cpdjuly/august09 or scan the completed questionnaire and email to cm.cpd@ubm.com. This address can also be used for all CPD-related queries. Tick one box only. Closing date is Friday 4 September.

1. Up to which percentage, typically, will domestic mains water consumption be reduced if a rainwater harvesting system is installed:

- ☐ 25%
- ☐ 30%
- ☐ 50%
- ☐ 75% or more

2. What would the savings typically be in a commercial building with a large roof and a high demand for non-potable water:

- ☐ 25%
- ☐ 30%
- ☐ 50%
- ☐ 75% or more

3. To attain levels 5 and 6 of the Code for Sustainable Homes, daily water consumption per person should not exceed:

- ☐ 105 litres
- ☐ 80 litres
- ☐ 120 litres
- ☐ 60 litres

4. What of the following help determine the size of the storage tank to be used:

- ☐ The height of the roof
- ☐ The width of pipes
- ☐ Likely demand for non-potable water in the building
- ☐ Depth of trench

5. What are the main cause of systems malfunctioning:

- ☐ Site rubble being allowed to ingress into the storage tank or pipework
- ☐ Incorrect system calibration
- ☐ Incorrect termination of electrical contact
- ☐ All of the above

PLEASE USE BLOCK CAPITALS (clarity is vital)

Name .....

Firm or practice name .....

Address .....

..... Post code .....

Telephone .....

Fax .....

Email .....

Unique reference code .....

(this number will be allocated upon your submission and should be quoted thereafter)

I require a new CPD passport ☐

Under which of the following job descriptions would you describe yourself (tick one box only):

- ☐ Project manager
- ☐ Site manager
- ☐ Architectural technologist
- ☐ Quantity surveyor
- ☐ Foreman
- ☐ Building surveyor

Other (please state): .....

By entering your details in the fields above, you agree that your details may be passed to the sponsor of this module as well as agreeing that UBM Information may contact you by mail, email, telephone or fax regarding relevant products or services. If at any time you no longer wish to receive anything from UBM Information please write to the Data Protection Co-ordinator, Audience and Data Group, UBM Information Ltd, FREEPOST LON 15637, Tonbridge, TN9 1BR, Freephone 0800 279 0357 or email cm.cpd@ubm.com