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## Inside

Business 6

Will Self 8

Scorpio 9

Reviews 14

Technical 16

Recruitment 18



# BUILDING DESIGN

Restoration  
drama: Enric  
Miralles takes  
centre stage at the  
RIBA. Eat your  
heart out, Venturi  
**24**

Craig Moffat of  
Studio MG says he  
finds pleasure in  
failure  
**15**



Nottingham  
Don't judge a book  
by its cover. ECD's  
interior for the  
new Boots Library  
at Nottingham  
Trent University is  
a lesson in  
deferred  
gratification.  
First you must  
experience its less  
than elegant  
exterior.  
Full story on  
pages 12-13



# WATER

# Stopping water going

The predicted increase in water demand should be forcing us all to consider various methods of water conservation, writes Joe Simpson

"Demand for water could increase by 25% over the next two decades, leading to major shortfalls in some areas," says Lilli Matson, head of transport and natural resources at the Council for the Protection of Rural England (CPRE). "New housing is one of the factors fuelling this demand," Matson continues, "but water issues hardly register in the decisions about where and how many houses should be built."

There is no doubt that recent droughts have provided a timely reminder that water is a scarce and valuable resource. Despite this, effective water conservation is still in its infancy in the UK. However, according to the Association for Environment Conscious Buildings (AECB), this situation is about to change. "Before long, water collection from building roofs and waste systems will become an everyday design feature of new buildings. In fact the Building Research Establishment Energy Assessment Method already awards a point for inclusion of a water butt."

In the UK every person uses about 140 litres of water every day, but only 2.5% of this is used for drinking. A survey of domestic consumption by Anglian Water revealed that 15% of our water goes down the kitchen sink, 15% in the bath, 5% in the shower, 8% in the wash basin, 6% in the garden, 12% in the washing machine, 4% in the dishwasher, and a massive 35% down the toilet.

As our housing occupation pattern changes with a rise in single occupancy, the problem of water shortage will be exacerbated. The DoE found in its 1996 study, *Climate Change and the Demand for Water*, that people living in single-occupancy houses use 25% more water each day for toilet flushing. Of the 4.4 million households projected to be needed by 2016, 3.5 million will be single-person households. This will bring the number of single-person households to 8.6 million – with obvious implications for total water demand in the UK.

Complete rainwater harvesting systems, such as those available from The Green Shop, are

one obvious solution. Such systems make use of run-off from the roof for toilet flushing, washing machines, garden hoses and other non-potable applications.

One of the acknowledged experts in this field, manager of the Schotten Environmental Office Dr Hans-Otto Wack, stresses careful specification for such roofs. While noting that most roofing materials are suitable for the collection of rainwater, he advises against roofs covered with grass or sedum, because the discharged water is coloured and, in his words, "only useful for watering the garden".

Dr Wack also stresses avoiding weathered asbestos-cement roofs and those with a fresh bitumen coating or permanently flexible bitumen felt covering, and advises against metal roofs, except stainless steel, because of the metal ions that leach into the water. However, recent projects, such as Michael Winter's Boundary House in Tunbridge Wells, have featured a copper roof as part of a rainwater harvesting system.

All suitable roof areas should

be connected to the collection system. Water should pass through a fine filter before entering the storage tank. No further fine filtration is required, either on the suction or the pressure side and, indeed, such filters can reduce the service life of the pump by increasing flow resistance. Dr Wack claims that they can also develop into a source of germs through the growth of bacteria on the filter insert. Vertically-mounted filters like the Vortex are ideal because they are self-cleaning and dry out after use to prevent bacterial build-up.

It is important to specify the correct size of storage tank. A good rule of thumb is one cu m per 25 to 40sq m of roof area. The tank, as well as being watertight, must be sealed against sunlight. Underground locations allow the ideal storage temperature of 18deg C or less to be maintained, although adequate frost protection is a must. One-piece concrete cisterns are ideal. Various pump options exist, of which the favourites are multiple submersible pumps which obviate suction problems. Self-prim-

ing, multiple-stage, rotary pumps can also be used. Tanks should also have a mains water feed to keep the system operable during periods of insufficient rainwater, although these are extremely rare if the correct tank is specified from the outset.

Most rainwater harvesting systems feature an automatic control system which protects the pump from running dry and reacts to household usage patterns. Some systems also feature UV treatment at the water take-off point. This provides added protection against bacterial infection without disrupting the flow, although care should be taken to ensure that the unit has sufficient output to cope with peak demand.

It is good to see these rainwater harvesting systems coming into the mainstream. At Inter-build last November, one of the best-known names in the use of ecologically-sensitive materials, Construction Resources, premiered a rainwater harvesting system whose central element is a self-cleaning filter which diverts about 90% of the rainwa-

## In the gutter, but looking at the stars

The Green Shop, one of the pioneers in rainwater recycling systems, offers complete systems from £530, including the storage tank.

Its Rain Harvester systems are designed to offer a low-cost, low-maintenance, automatic water supply for toilet flushing, washing machines and general household cleaning, as well as garden use. All systems are essentially bespoke designs which take into account the size of the roof catchment area, likely demand and other variables.

The systems work by channelling rainwater through a normal gutter/downpipe arrangement to an underground storage tank. Water passes through a multi-stage cleaning process before use. The first

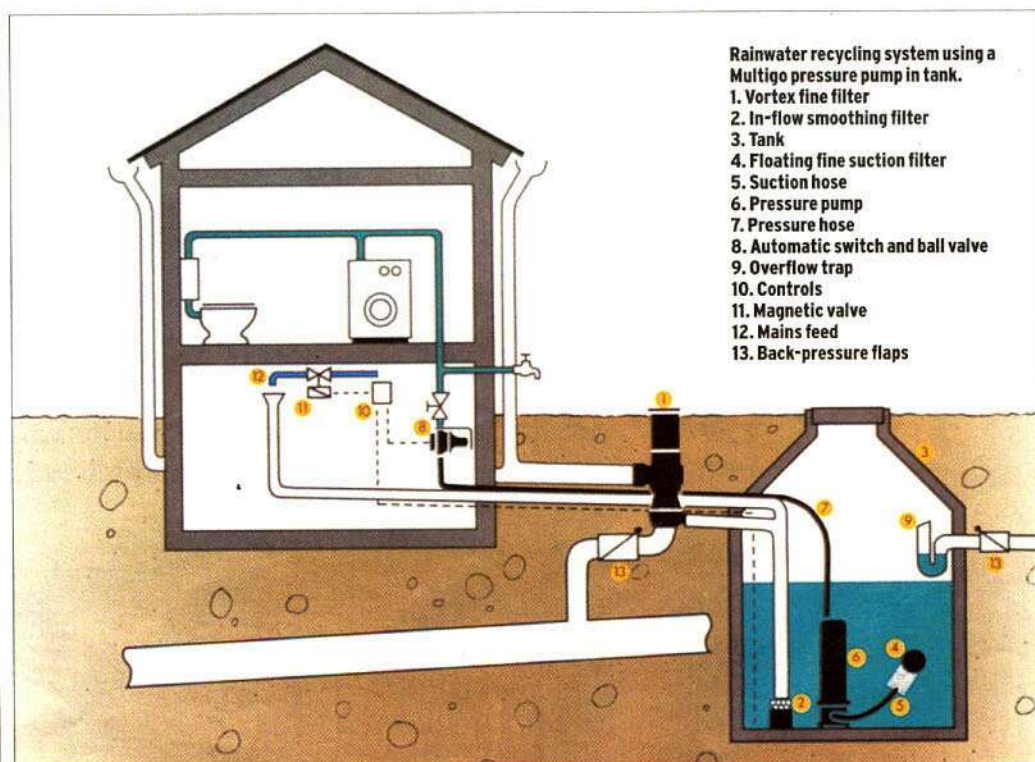
stage is a primary filter, installed vertically in the downpipe, which removes leaves and particulates greater than 0.17mm. The Green Shop offers the Filter-Collector for roof areas up to 200sq m, and the Vortex Fine Filter for roof areas up to 500sq m. Once in the storage tank, water is extracted by means of a floating filter that takes water from the cleanest part of the storage tank, above any heavy material which sinks to the bottom of the tank, and below any floating material. The system also regularly flushes away any floating material, such as pollen, through an overflow pipe.

Ideal storage is provided by a concrete tank which aids neutralisation of acid rain. Plastic (polyethylene) tanks may

also be used but are only suitable for installation within a cellar or basement. Tanks are designed to maintain a permanent sedimentation layer in the bottom. This provides a habitat for beneficial microbes which further aids the cleaning process.

The Green Shop recommends automatic systems which sense when a tap or valve is turned on and off. They also use a level sensor to protect the tank and pump running dry by drawing down from the mains when rainwater is in short supply.

As with all systems of this type, there should be strict separation of potable and domestic water systems together with complete identification of all components in the system as "not for drinking purposes".





# down the drain

ter from a roof into a storage tank, while the remaining 10% carries leaves and other debris straight down into the drains. Rainwater filtered by Wisy can be used without further treatment for flushing toilets, in washing machines, and for indoor and outdoor cleaning and for garden watering.

Rainwater harvesting is still a new technology and, since the installed base is low, economies of scale have yet to be fully realised. However, based on the limited experience, paybacks of between five and 12 years are generally recognised. Of course, the capital cost versus cost-in-use equation is greatly affected by the type of installation. For instance, a central, shared system providing domestic water for four or six properties should work out more cost-effective than a single-dwelling system.

What is not in dispute is that rainwater harvesting relieves the pressure on both mains water supplies and sewage disposal, and therefore has important macro-environmental benefits. In the UK, a family of four uses approximately 220,000 litres of water each year. This requires 120kWh of energy to produce and 100kWh to treat as sewage with the consequent release of 200kg of CO<sub>2</sub> per family into the atmosphere as a result. The case for water conservation is clear.

There are, of course, alternatives to rainwater harvesting. Water Dynamics offers one: a grey-water recycling system termed Supply Management Recycling (SMR). This intercepts waste water from hand basins, baths, showers, etc. This water is then filtered, disinfected and reused to flush toilets or water the garden. The SMR concept makes no attempt to balance or synchronise grey water supply and demand. Instead, it ensures that grey water or mains water are always available by switching automatically to mains water if there is insufficient grey water in the storage cistern. SMR is not designed to reuse all the water from the property: black water (from wcs) and water from the kitchen sink or dishwashers is avoided. This keeps the level of organic matter in the SMR grey water to a minimum.

The basic principle of the SMR system is simple. Grey water is pumped from a storage reservoir to a header "break tank" which both incorporates the mains water supply mechanism and provides a gravity feed to the wc. Control of the water supply is by a traditional float switch and ball valve.

In operation, priority is given to grey water from the storage reservoir by way of a float switch in the header tank which is activated by a drop in water level as the wc is flushed. This energises the pump in the storage sump and grey water replenishes the break tank. As the water is fed in it is chemically treated using slow-dissolving hypochlorite tablets. The system's filters, which remove hair, soap particles, etc, are backwashed by grey water and sprayed by disinfected water from the break tank after every pumping cycle. This helps

ensure maintenance-free operation.

Installation costs for a single home are between £1,000 and £1,300, and operational costs are minimal. The Building Research Establishment is evaluating the system under the DoE's Partners in Technology scheme. Water Dynamics has also installed 10 systems which are being monitored over two years by the Environment Agency with the aim of assessing the feasibility of grey-water systems by obtaining cost data and information of water demand reduction and water quality.

Another option is the Flush Saver from Aquavert – a grey-water recycling system that was on show at Interbuild. While harvesting rainwater run-off and reusing grey water are potentially important, limiting water use is the most widely adopted conservation strategy. Here the options are vast; from simple metering to the installation of automatic taps.

One radical alternative is composting toilets. They work on the same principle as the garden compost heap. Solid human waste is broken down by micro-

organisms, leaving a residue that, in approximately six months, can be used as a garden manure.

There are several alternative systems. Perhaps the best known is the Clivus Multrum from Kingsley Clivus Environmental Products. This consists of a large plastic vessel placed immediately below the toilet bowl, which is shaped to allow gradual sinking of the composting material to the bottom. Urine and other liquids are drained off into a separate storage tank. A small fan is used to create a negative pressure in the vessel to prevent foul air escaping from the toilet.

The Centre for Alternative Technology has a twin-vault system which means that when one chamber is full its contents may be composted in situ while the other is used day-to-day. According to *Green Building Digest*, the disposal of liquids such as urine may be a problem with such systems.

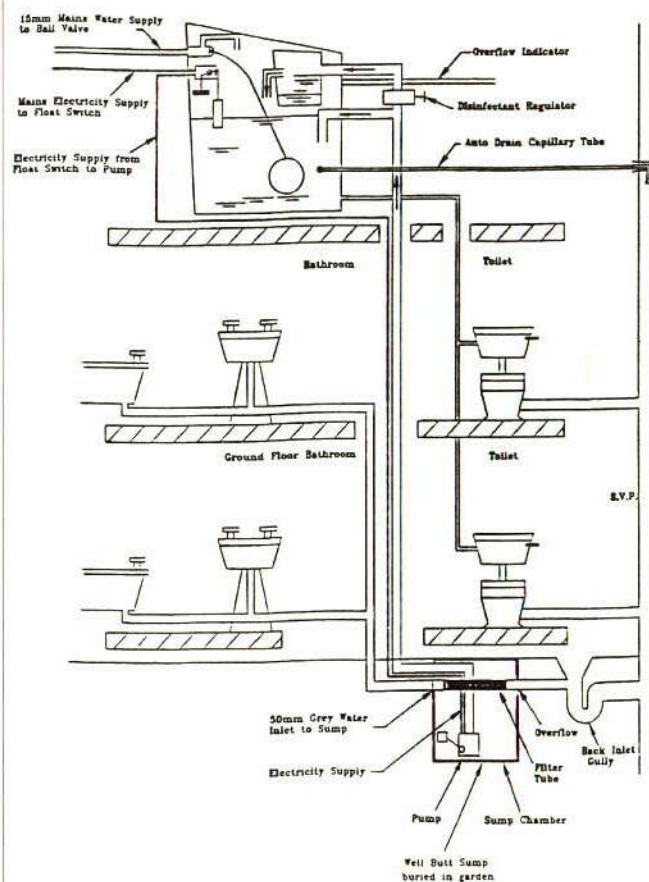
Other options include de-watering and urine separating toilets. These are available from a range of sources, including the Sunseed Trust.

The potential for water saving in the UK is vast. Project manager for the Environment Agency's National Water Demand Management Centre Dr David Howarth has calculated that if reduced-flush wcs, and efficient showers, dishwashers and washing machines were installed in each of the proposed 4.4 million new homes, the savings could amount to 1,434 megalitres per day – sufficient to supply 3.7 million households at current levels.

Existing homes and water supply systems must also be targeted. Leakage remains the main culprit and, if fully addressed, could result in total water savings of 34%. However, it has been estimated that low-flush wcs could reduce demand by as much as 13% and water-efficient showers by 9%. Domestic recycling could save a dramatic 18%, while metering is expected to deliver savings of 16%.

The message is clear: architects can design water savings into each and every house. The forthcoming studies into water-saving technology will surely make the case for their use unanswerable.

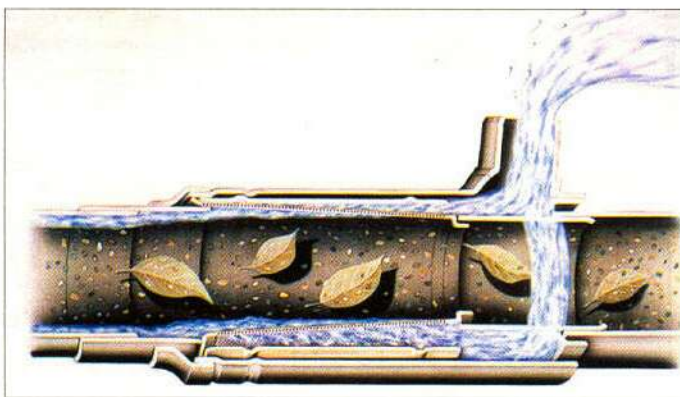
## THE WELL BUTT SYSTEM



## Suppliers of water recycling equipment

**Kingsley Clivus Environmental Products**  
**Association for Environment Conscious Building**  
**Centre for Alternative Technology**  
**The Sunseed Trust**  
**ECO-Logic**  
**Aquavert**  
**Construction Resources**  
**The Green Shop**  
**Waterless**  
**Washroom International**  
**Water Dynamics**  
**The Environment Agency**

**01703 615 680**  
**01559 370 908**  
**01654 702 400**  
**01480 411 784**  
**0121 603 1331**  
**01623 812 694**  
**0171 450 2211**  
**01452 770 629**  
**01865 553 290**  
**01843 233 222**  
**01622 873 322**  
**0171 840 6141**



**Above: Wisy collector for rainwater harvesting filter.**  
**Left: Rainwater filtered by Wisy can be used without further treatment for flushing toilets.**