

Water Conservation and Rainwater/ Grey water Recycling

Around 25% of all water use in the UK is in homes. The average domestic use is currently around 280 litres per person per year but this figure is expected to rise by around 40% by 2010. In addition to the financial costs to the user, the environmental costs of pumping water over long distances and of disposing of water after it has been used is becoming an escalating major problem. Furthermore, with the expected greater extremes of weather patterns (due to the rapid onset of climate change) along with increasing water demand there is the distinct possibility that sporadic water shortages may become a real and recurring problem.

Water Conservation

There are many simple methods of reducing domestic water consumption and hence reducing your water bills. These include:

Fix leaks

Losses from a tap dripping at 30 drops per minute add up to about 250 litres per month.

Take showers rather than baths

Taking a bath typically consumes 5 times more water (and 5 times more fuel to heat the water) than taking a shower.

Avoid power showers.

A 15-minute power-shower typically uses as much water as taking a bath – if possible fit low-flow showerheads.

Fit water conservation devices

E.g. install spray heads to taps rather than allowing a steady open flow.

Reduce the amount of water used to flush your toilet.

Standard toilet cisterns use around 10 litres (2 gallons) of water per flush. Replacement dual-flush mechanisms are available to convert your existing toilet cistern or, if buying new, ensure only dual-flush cisterns are purchased. This should

reduce overall flushing water used by around 25%. Alternatively, adjust the ball-cock or put a sealed plastic bottle of water (or a brick or 'Hippo' or any other water-displacing device) in the cistern to reduce water volume in the cistern (Efficient flushing depends upon the velocity of the water rather than the volume).

Recycle more

All the water used in the home, apart from flush water, can be re-used to some degree. Water can be collected from seven main sources in the home

Write to your local water company

Find out how much water it loses in its pipes through leakage and what measures it is taking to alleviate the situation. In some areas this figure is over one third. Demand to know why consumers should suffer shortages, rising costs and metering if the company will not plough more of its profits into conservation itself.

Adopt the common-sense approach

Use full loads in your washing machine, or if purchasing look for economy features such as half load capability or reduced water consumption. Don't leave taps running when you are washing your hands or cleaning your teeth.

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Refrigerate drinking water in order to prevent running the tap for long periods waiting for cold water.

Insulate hot water pipes to prevent running the tap for long periods waiting for hot water.

Wash dishes by hand, using a bowl (uses less water than it takes to fill the sink).

Car washing: It is possible to wash a car with only one bucket of water. But does it really need washing?

Recycling Water – Rain water, grey water and brown water

Rainwater recycling is, as the name suggests, recycling rainwater for domestic or commercial use in order to reduce the consumption of mains-supplied water.

Grey-water is commonly taken to be water previously used for washing (baths, showers, washing machine, dishwasher etc). Brown-water is water that has been flushed down the toilet.

All water can be re-used in some way but the simpler the treatment needed, the less costly or complex is the process. Making the water clean enough for drinking (usually by extensive filtration and treatment with ultraviolet light) adds significantly to the cost and complexity of treatment. But if your water consumption is metered, these costs can often be repaid in only a few years due to the savings in combined water charges. For example, storing rainwater for toilet flushing and garden watering could reduce a household's water charges by about one third. Treating this water to make it suitable for drinking could reduce water charges by more than half. Recycling rainwater, grey-water and brown-water (the latter via reed beds) could effectively allow a household to be virtually self-sufficient in their water use and wastewater treatment.

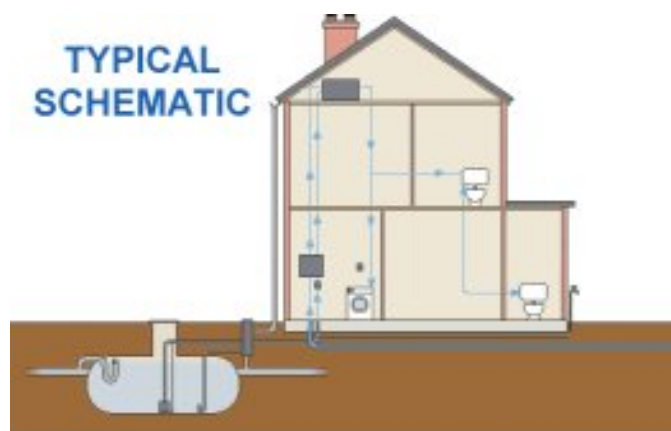
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Rainwater

If you have a garden, using a simple water butt can save you large amounts of money on metered water charges – especially if you currently use a mains-water hosepipe for lawns etc.

Greater use of rainwater can be made if it is collected via a filter system, stored in an underground or over-ground tank, and pumped to a separate water storage tank (usually sited in the loft) for use in toilet-flushing and for washing machines. For most households, this could reduce water consumption by 30% - 50%. Systems can be made up from component suppliers or bought as a complete kit for DIY installation. Kits with storage tanks, and filters can be bought for around £1000 but it is possible to make a system up yourself for less than £200 from recycled components (see Thornhill Eco House).



Rainwater can also be used for supplementing your normal water supply but would need to receive further treatment if it is to be connected to taps that supply water that may be consumed. Treatment is normally by ultraviolet lamps (UV) and the cost of the UV system will depend upon flow-rate of the water that is being treated. The equipment cost increases as flow-rates requiring treatment

increases (around £250 to treat 4 litres/minute to around £1500 to treat 100 litres/minute). In addition, the electricity consumption of the UV (and therefore running costs) increases with the size of the system e.g. for most domestic-sized systems 40w/hour - 150w/hour.

A DIY system constructed at 'Thornhill Edo House' is described below:

Story of a raindrop that lands on our roof (taken from <http://www.thornhill-ecohouse.org.uk/>)

All of the catchment area of the roof is slate, we avoided lead flashings. The water goes through zinc guttering and down drains into a hopper which has a large bottle brush 'coarse filter' in the outlet to catch leaves and large debris.

The water is then led into a 150 litre water butt.

The outlet to the main storage tanks is taken from just below the surface of the water to avoid floating debris. This water goes into the first of seven 2000 litre recycled orange juice containers. Each tank is connected 10cm from the bottom to the tanks either side of it. The two furthest from the inlet are connected to the central tank which has the outlet for the house and garden supply. This succession means that the containers act as settling tanks.

Water is pumped from 20cm above the bottom of the central tank by a pump inside the house that uses a pressurising chamber to give the equivalent of mains pressure. The pump only comes on when the pressure in the chamber drops.

The water then goes through a string filter and inflow Ultra Violet treatment unit which makes the water fit for drinking. The water then enters the cold water supply for the house. We can switch to mains supply if needed and we have a third tap in the kitchen that always has mains water.



We used a figure for the rainfall in our region and the area of the roof to work out the volume of water that we would catch over a year. It turns out that this is not a very useful figure because when it is rainy you collect much more water than you need. The important figure is the volume of storage you need to keep your water supply going during a drought. Most water bills now tell you your usage. We took our daily water use for four people (approx. 300l) and multiplied it by the longest period that we thought we might have a drought. We worked on about six week's supply of water meaning that we needed 13000 litres of storage.



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Greywater

Greywater can also be reused in similar way to rainwater but because of the fats contained in it (from soap, skin oils, detergents etc) and various other additives (softeners, bleaches, disinfectants etc), treatment can be more complex.

The quality of the grey water you collect ultimately depends upon what you put in it when it is clean, so to get good quality grey water you will need to filter out any particles by using a simple mesh filter on the plughole. Relatively clean water from baths and showers can usually be used directly on the garden but soap and detergent residues can be harmful so it is best to use biodegradable cleaning products, sparingly.

Where all greywater is being recycled (inc washing machine and dishwasher outputs) it should be passed through several filtering systems i.e. a settling tank, then grease trap, then sand filter before the resulting water can be used with little worry over the potential accumulation of harmful chemicals. It can then be applied to all types of vegetation.

Untreated grey water can still be used selectively in the garden but the less contaminated the grey water, the better. Care should be taken to water only ornamental plants or mature well-established vegetable plots, it is also advisable to avoid contact between the grey water and the vegetation itself, i.e. water the soil around the plants only. Sodium, contained in detergents, can build up after lengthy periods of application necessitating adding gypsum to the soil to lower the alkalinity which sodium causes. This build up can easily be detected by making a test for pH. Any possible harmful effects can be minimised

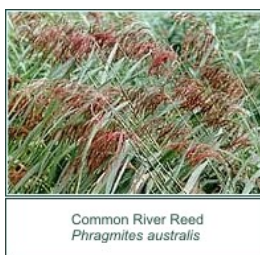
by diluting the grey water with collected/fresh or filtered water.

It is possible to buy a complete greywater recycling system that filters and treats the water to drinking-water standards. These systems are usually about the size of a small wardrobe and would ideally be installed in a basement or garage. Installation should be simple and within the capabilities of competent DIYers. Costs vary according to suppliers but £3000 is not an unrealistic price for a domestic-sized system. These purpose-made systems have many benefits but running costs e.g. energy use and maintenance will offset a proportion of financial savings from lower water bills.

Alternatively, grey water can be treated for use in the garden via a reed-bed filtration system. Reed-bed filtration is used at the Thornhill Eco House and a brief description of the system they employ is given below:

Grey water reed bed at Thornhill Eco-House

All of the wastewater from the house, except for the toilets, drains into a 150 litre holding-tank outside the house. It contains a submersible pump with a float switch that pumps the water to the reed bed.



Common River Reed
Phragmites australis



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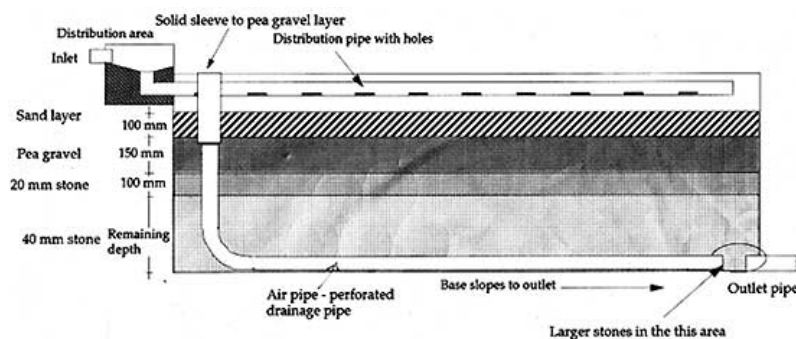
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- Bed area to be no less than 1 sq.m. per person on the system
- Bed divided into at least two separate sections below the sand layer
- A distribution area to change flow between sections
- Change between sections at least every week or when on-line section is ponding
- *Phragmites australis/ communis* planted into the sand layer at 4 per sq.m.
- All stones must be clean
- Sand should be well draining sharp washed sand

The cleaned greywater can then be used for general garden watering



General specifications for a vertical flow reed bed.



Cost-saving from rain/grey water recycling

In principle, a typical UK house with 100 square metres of roof can supply around 120m³ of rainwater per year. Assuming typical domestic combined water charges of around £3.00 per m³, this in theory could reduce your combined (metered) charges by £360 per year. Unfortunately, savings of this level are unlikely because most significant rainfall comes in short bursts, which means that large storage tanks would be needed to store it all.

If you have a metered water supply, your sewage charges (about two thirds of your bill) are estimated from your water consumption. Therefore if you use less metered water, your sewage charges are proportionately reduced. However, it is worth noting that you are actually only reducing your water consumption whereas you are not reducing your sewage output (unless you do not put the rainwater proportion down the mains sewer).

Assuming you are paying combined water/sewerage charges and you have enough storage capacity for several weeks use, you could expect a reduction of around 30% if you recycle rainwater for flushing toilets and supplying a washing machine. If you recycle both rainwater and greywater, those savings are likely to be nearer 50%. If you also recycle rainwater and greywater and treat one or both of these sources so that are of drinking-water quality, savings on water bills are likely to be around 70%.

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More Information

Some possible contacts for water recycling systems:

<i>Company</i>	<i>Website/ Email</i>	<i>Telephone</i>	<i>Address</i>	<i>Further information</i>
Centre for Alternative Technology	http://www.cat.org.uk	(0)1654 705950	Machynlleth, Powys, SY20 9AZ, UK	Advice and publications on all forms of water recycling including environmentally-friendly methods of sewage treatment
Klargester Treatment Systems	http://www.envireau.co.uk/info@envireau.co.uk	01296 633000	College Road, Aston Clinton, Aylesbury, Buckinghamshire HP22 5EW	Do a budget rainwater collection, filtration, pumping and storage kit for around £1000
Freewater UK Ltd	http://www.freewateruk.co.uk/index.html freewateruk@ntlworld.com	0870 241 6964	340 Brant Road, Waddington, Lincoln, Lincs. LN5 9AJ	Supplies grey water and rainwater recycling systems. Grey water treatment system costs around £3000 (supply only as it is a DIY installation)
Water Support Services	http://www.water-support.co.uk/wss.htm info@water-support.co.uk	01305 266614	44 high East Street, Dorchester, Dorset DT1 1LLN	Suppliers of combined rainwater/greywater recycling systems using chemical to treat water which is then used for toilet flushing/ garden-watering.
Cresswater Ltd	http://www.cresswater.co.uk/info@cresswater.co.uk	01905 422 707	61 Woodstock Road, St. John's, Worcester, WR2 5ND	Reed-bed systems

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