# Rainwater harvesting – getting creative

Interview with Adrian Pickering Aug 2016

1. **What are the main components in your rainwater harvesting system?**
   The main components include remodelled roof guttering and down pipes which feed the base of a 'stilling tower', which then feeds the storage tanks. The rainwater harvested from the roof flows from the bottom of the stilling tower, which calms the flow and allows sand and leaf sediments to settle. It is actually built from a stack of standard 320mm diameter soil system manhole fittings. The rainwater is drawn from the top via a coarse filter and then enters the base of the first of two accurately levelled, connected 350 litre storage tanks. The tanks and stilling tower sit on a large soakaway. When the tanks overflow the cross flow induced ensures freshness. The harvested rainwater is used for the washing machine and general garden watering. There is another system that uses groundwater to flush the toilets.

2. **How large is your rainwater tank and how do you arrive at this size?**
   Two coupled 350 litre purpose-made black polythene water tanks. They are located under a first-floor balcony with limited space. At ground level this provides a head of about 0.2bar. There is space for three tanks and the system was commissioned with just one. The two tanks currently in use have appeared sufficient for the amount of rainwater being used. The washing machine supply hose can be manually moved over to a mains water feed but this is rarely used.

3. **What considerations did you have to bear in mind before choosing the location of your rainwater tank?**
   The major considerations were the availability of accessible space, shade and ventilation. The balcony location is ideal as it also provides gravity feed, is over a large soakaway (a stack of stone-filled gabions used as part of the house foundations) and masked by the balcony decking. Because the local water table is so shallow, any buried tank would not be practical, let alone the expense.

4. **Are there differences in roof efficiencies in capturing rainwater such as roof size /area or types such as tiles vs slate?**
   Arranging the guttering to make the best of the available roof area is a key factor. I was keen to use all the roof so that there was only one, centralised roof drainage solution. The roof tiles tend to encourage moss, which increasingly absorbs the initial runoff. The stilling tower method of collection and filtering is more efficient than downpipe filters.

5. **Is water quality a problem in your rainwater system and how do you improve on the quality?**
   The stilling tower and coarse filter are the primary guards of quality. Remaining fine particulates eventually settle to the base of the storage tanks. The insides of the stilling tower and the tanks quickly develop a slimy biofilm. However, if left alone it has no detrimental effect on the water quality. The tanks and stilling tower have insect filters to avoid occupation by pests, notably mosquitoes. The base of the

stilling tower fills with leaves and other sediments which decomposes anaerobically. There is a soil-pipe 'bung' at the base of the stilling tower to allow it to be drained and cleaned. This rather unpleasant task is done about once a year! The biofilms in the tanks are best left alone. I only cleaned the tanks this year after 4 years of operation and only because they became nearly empty, making it convenient.

6. **How can you harvest the maximum quantity of rainwater?**
   The Standards suggest that a 21-day supply is required to avoid having to switch to backup supplies. My tank space was limited so I have confined rainwater use to the washing machine and light garden watering. At this rate of consumption backup is rarely used. If toilet-flushing was included considerably more storage would be required. However, the groundwater supply used for this appears to be inexhaustible and its slightly lower quality suits the purpose.

7. **What happens when your rainwater tank is full?**
   The excess is discharged into the soakaway system underneath the tanks. The arrangement uses fresh water to purge older water. A simple sight tube outside the window by the washing machine is used to monitor the tank levels. A small florescent fishing float sits on the top of the tube meniscus to make the reading easier to see.

8. **Does your system use a pump?**
   I started using just gravity but some washing machine functions were not working at their best due to the low pressure of the fills. A one-sided, regenerative shower pump was installed in the supply line, which considerably improved the pressure and satisfied all the washing machine programs.

9. **What is the best arrangement for your filters?**
   Only the filtration provided by settlement in the stilling tower and tanks is used. The washing machine has its own built-in gauze inlet filter (which I have never cleaned!).

10. **Do you have secondary storage like a reed pond?**
    No. The overflow is drained into soakaway and thence into the sand beneath which hosts the water table, which is the source of ground water for toilet-flushing.

11. **What are the advantages of washing your clothes with rainwater from your experience**?
    The local mains water is hard and many households have installed water softeners. Rainwater is naturally soft and the usual benefits accrue: using less detergent/fabric softener and lime-scaling is mitigated.

12. **Does using rainwater reduce or prevent lime scale?**
    Scaling cannot happen as harvesting does not introduce any calcium. Indeed, rainwater is slightly acidic (from dissolved carbon-dioxide) so, if anything, has a slight scale-removing property.

13. **How safe is it to do laundry with rainwater from your experience?**
    I have not encountered any issues. Any non-treated water source has legionella issues, but the risk occurs when using warmed water and generating aerosols (e.g.

using a spray attachment while garden watering). Any generated by a washing machine are confined. Occasionally, I use a wash >60degC and this kills legionella. The storage tanks are light-tight, shaded and ventilated. This keeps them cool and prevents development of infections and algae.

14. **From your experience what beneficial effect if any does rainwater have when used for gardening?**
    Rainwater is natural for the plants. The mains water is hard and chlorinated.

15. **For how long can you store rainwater that has been filtered?**
    It appears to be indefinitely. I used thick-walled, black plastic tanks so daylight-promoted algal growth and discolouration does not happen.

16. **What happens to the water during the winter months? Is there the risk of frost?**
    Yes. The tanks sit on 75mm Celotex insulation to ensure there is no risk of extended contact with a body of cold water. This type of insulation has aluminium foil on both sides. So, a serpentine 40W heating element was cut into the upper surface of the Celotex base of the leading tank. This can be safely powered from a 12V source. It has not been used so far, probably because of the tanks' thermal mass and their sheltered position. The pipework is insulated and the pump is in an insulated compartment in a storage outhouse.

17. **What savings if any have you made since harvesting rain water for your usage?**
    In Southampton about £1/$m^3$ is charged for water and £2/$m^3$ for sewage, based on a 92.5% return factor. So £3/$m^3$ saving for each cubic metre of water substituted is considered significant. There is also the storm water drainage rebate as no rainwater is discharged to the sewer any more. 20 years payback period is estimated based on the system installed. So, there aren't any 'savings' and there may never be. But there are the additional intangible benefits of having 'free' soft water to wash clothes in and to water plants with.

18. **From your experience and looking back, what best practice would you recommend and are there any pitfalls to be avoided?**
    Regular maintenance is required. Rainwater harvesting systems are not 'fit and forget' as we are used to with most domestic water systems. The stilling tower needs at least annual emptying and cleaning. However, the tanks less so, provided they do not have any infections, such as mosquito lavae. 1:20 diluted household bleach can be used as a disinfectant when the time comes to clean and sponge-out the tanks. I believe the reason I have had so little trouble with water quality is taking care to store the water in light-tight tanks with proper insect proofing in a sheltered, lightly ventilated and well-drained position. The design employs crossflow to keep the water fresh. In the UK the mains water system is protected by all water installations complying with the Water Regulations. In the context of rainwater systems, this means that there must be absolutely NO shared valve gear or pipework in order to be sure there is no possible backflow of untreated water into the public mains supply. Though the washing machine can be put back onto mains water if necessary, this is achieved by physically moving a flexible hose from one outlet to another: this

requirement cannot be met by any changeover valve. Some water companies will insist on notification, approval and inspection of rainwater harvesting systems. They are entitled to inspect a water installation as they are legally responsible for Water Regulation compliance. Make sure that there is nothing in your installation that would not pass a Water Inspector's scrutiny.

For more information about Adrian Pickering's home refurbishment project see www.superhomes.org.uk/207