

**Project:** Radical Water Retrofit of Victorian Semi and Garden  
**Domestic:** Nottingham Ecohome and urban permaculture garden  
**Owners:** Penney Poyzer and Gil Schalom

The central aim of our radical eco retrofit of a Victorian semi and garden was to see how far we could reduce our environmental footprint through a systems approach to management of our energy, water and food requirements. Our privately funded, 'Whole Plot' experimental approach to retrofit led to the integration of water systems for the house and garden. Through a range of internal and external measures and behaviour change, our potable water use has been drastically reduced to around 55L pppd against UK average of 150L and rainfall outlets and other surface water, which formerly discharged to storm drains, is now 100% managed on site.

The whole site water management strategy was undertaken to determine whether it was possible for a building and the plot on which it sits to better manage the drought / deluge cycle that the UK faces. Rainwater harvesting potential was limited by roof area and size of garden meant soakaways were not feasible. Attenuation tanks were possible because of reduced run-off. Also, collection efficiency reduces in heavier rain (WISY filters).

#### **Internal and external measures:**

##### **Internal**

- Rainwater harvesting system supplies toilets, washing machine and irrigation – estimated to meet 20% of total water demand. Saved 122m<sup>3</sup> potable water over 14 years (note: the system was down for 2 years)
- Ultra low flush (2/4L) Ifo Cera toilets (x3)
- Low flow aerating shower heads – Ecocamel 'Halo' restricted to 6 l/m
- Low dead leg design using microbore pipes for hot and cold water and minimising distance to mains pressure cylinder
- Water saving bath – 130L capacity
- Highly efficient washing machine – 39L / 6 kg load
- Dishwasher – Bosch 6L /cycle on eco setting (1820 l / year – the most water efficient model in EU), hot fill from solar and wood heat
- Behaviour change

##### **External measures**

- Installation of sustainable urban drainage systems including attenuation tanks to front and back gardens.
- Porous surfaces throughout – 30m<sup>2</sup> tarmac taken up
- Installation of 4 edible green roofs for garden structures approx 8m<sup>2</sup> delays and reduces run off
- Innovative design of horizontal wall mounted water butt to collect run off from green roofs and use for irrigation
- French drain around building
- Pond for wildlife and aquatic food plants

Rainwater harvesting is estimated to produce more CO<sub>2</sub> than mains (due to pump energy, equipment and maintenance) but other measures have CO<sub>2</sub> benefits from pure savings and better management. Showers, hot fill dishwasher and low dead-leg designs save additional CO<sub>2</sub> as they save hot water.

Assuming 50% of the saved water is cold and 50% hot, heated from 10°C – 40°C,  
Hot water assumed to be generated by 50% electricity (cheap rate immersion) with remainder met by renewables,  
For hot water, energy saved per year 50 L pppd x 365 x (40-10°) x 4.187 kJ/kg.K = 2,292,383 kJ = 637 kWh / year,  
Assuming cheap rate electricity @ 7.55p/kWh gives a saving of £48.09 and assuming 0.56 kg CO<sub>2</sub>e/kWh on brown tariff,  
CO<sub>2</sub> saved = 357 kg / year

Payback didn't come into our strategy as water is so cheap, we wanted to test out a range of emerging measures. Some costs are integrated into other things such as hot water system.

Estimated cost of all water saving / management measures = £10,000

Surface water charges £60 / year saved

Cost of potable per m<sup>3</sup> = £1.52

Saving 100L pppd x 4 people x 365 = 146m<sup>3</sup>

Saving is £1.52 x 146 = £222

Total saved / year = £60 + £222 = £282

Payback = all measures £10,000 / (water cost saving £282 + energy cost saving (hot) £48.09) = 30.3 years

(Does not account for pump electricity or maintenance costs for rain harvesting or fluctuations in charges - based on current charges. Includes savings due to behaviour, which need no outlay.