Water Neutral Development

January 2021

waterwise

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Definition and Scope

Scope of the report

- Water Neutrality can be applied to products, businesses, existing buildings
- New buildings, mainly looking at new domestic buildings

Our definition of Water Neutrality

For every new development, water demand should first be minimised then any remaining water demand offset, so that the total water demand on the public water supply in a defined region is the same after development as it was before.

Water Neutrality Hierarchy

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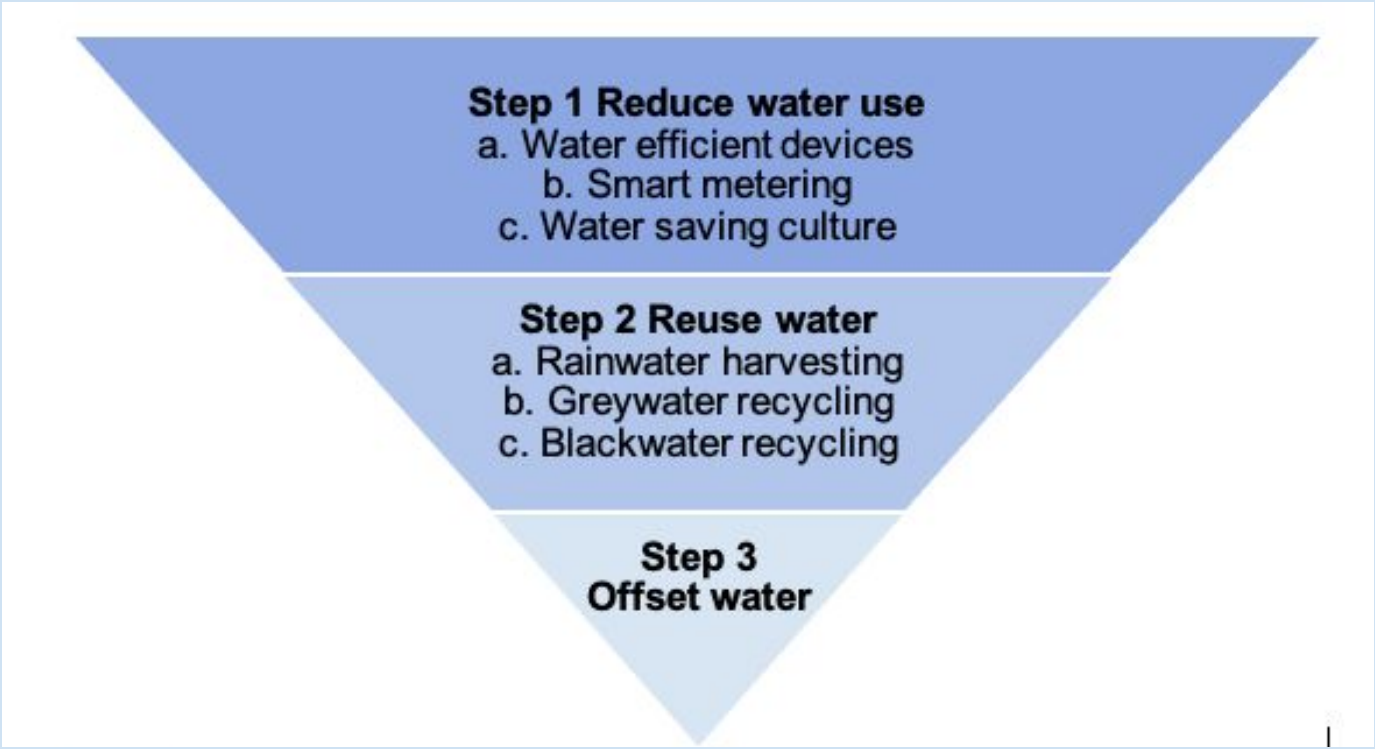
Water Efficiency Strategy for the UK



1. Reduce Water Demand

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Water Efficiency Strategy for the UK

- The smaller the water demand of a building due to its design and fittings the less water is needed to be reused and offset
- Water demand can also be reduced through fitting meters, (especially smart meters, which measure water usage and relay it to the customer), helping to identify leaks and tracking water consumption. Meters can help support and encourage behavioural change by showing homeowners their water usage and cost and the impact of their behaviours.

2. Water Reuse

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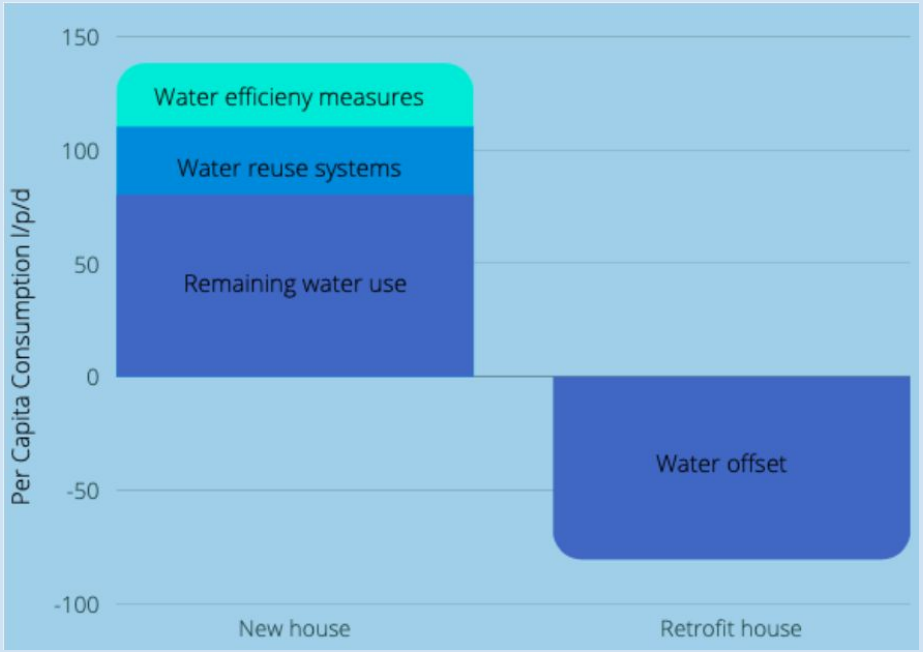
Collection area	Example building types	Costs: CAPEX + OPEX ('000 £)	Water cost savings ('000 £)	Private net benefits ('000 £)	Societal benefits ('000 £)	Total net benefit ('000 £)
Small (<500m^2)	Standalone dwellings, Houses, Bungalows;	£12 - £19	£1 - £19	-£9 - £26	£21 - £77	**£10 - £100**
Medium (500 – 2000m^2)	Some larger houses or two semi-detached houses;	£25 - £38	£8 - £200	-£17 - £150	£50 - £163	**£35 - £340**
Large (2000 – 5000m^2)	Row of terraced houses or blocks of flats;	£20 - £35	£7 - £150	-£15 - £120	£35 - £335	**£20 - £450**
Very Large (>5,000m^2)	Large scale residential developments (including hybrid developments)	£35 - £60	£70 - £340	-£17 – £280	£30 - £920	**£14 – £1,200**

Rainwater Harvesting

Greywater Recycling

Yield	Example building types	Costs (CAPEX + OPEX; '000 £)	Total water cost savings ('000 £)	Private net benefits ('000 £)	Societal benefits ('000 £)	Total net benefit ('000 £)
Low (<500m^3)	Smaller households (such as retired people or young adults), small commercial shops.	£ 45	£ 5	-£ 40	2	**-£ 37**
Small (500 – 1,500m^3)	Larger households (potentially families).	£ 100	£ 52	-£ 48	£18	**-£ 30**
Medium (1,500 – 4,000m^3)	Retail and commercial stores, leisure centres, some offices.	£ 120	£ 108	-£ 13	£34	**£ 25**
Large (4,000 – 10,000m^3)	Large commercial settings such as shopping centres, multi-unit offices or flats.	£ 170	£ 190	£ 21	£67	**£ 88**
Significant (>10,000m^3)	High rise offices or blocks of flat, hotels, multi-purpose developments.	£ 270	£ 780	£ 510	£275	**£ 787**

3. Offsetting



Offsetting is usually done in partnership with other organisations, like a water company, council, local businesses or charity. Some options for offsetting schemes are as follows:

- Funding water efficiency audits and retrofits for existing homes (e.g. through water companies) or for existing businesses.
- Donating/paying a fee to a housing association to retrofit their homes.
- Offsetting by finding leaks and retrofitting school buildings to improve water efficiency.
- Retrofitting water reuse schemes such as in public buildings or schools.

Step 1: Reduce Water				
Toilets	Cistern displacement devices (toilet hippos)	Retrofit flush devices to dual flush	Fix leaky loos	
Taps	Tap inserts (aerators)	Low flow restrictors	Push taps	Infrared taps
Showers/Baths	Low flow shower heads (<8 litres/min)	Shower timers	Reduced bath frequency	Reduce bath volume
Outdoors	Hosepipe flow restrictors	Hosepipe siphons	Water butts	Mulches and composting
Smart Metering	Leakage information	Encourage behavioural change	Innovative tariffs	Savings estimates
Water Saving Culture	Promotional campaigns	Self-audits	Education in schools	Posters/ leaflets/ websites
Step 2: Reuse Water				
Rainwater Harvesting	Small scale water butt	RWH system for individual homes and buildings	Large scale surface water harvesting	
Greywater Recycling	Small systems for individual homes	Larger scale systems for commercial and mixed use sites		
Step 3: Offsetting Water				
Offsetting	Carry out retrofits	Funding a partner to do retrofits	Finding and fixing leaks	

The Benefits

Water Neutrality Benefits

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Water Efficiency Strategy for the UK

1. Water Saving

Around 112,000 litres could be saved every year for each water neutral home built. If all new housing developments in England were built to be water neutral over the next 10 years, we would see savings of approximately 691 Ml/d (million litres per day) in 2030.

Building the First Net-Zero Water Campus in Silicon Valley

Dec 5, 2017 | Josh Henretig

Water Neutral Scenarios	Water Saving
A water neutral new home (assuming a PCC* design standard of 110 litres/person/day)	90,000 litres annual saving per water neutral home
A water neutral new home (assuming average water use with a PCC* of 138 litres/person/day)	112,000 litres annual saving per water neutral home
All new homes in England to be water neutral – savings after 10 years	691 Megalitres per day (Ml/d) savings
All new homes in England to be water neutral – cumulative savings after 10 years	Total saving of 1.4 Billion Megalitres
All new homes in England to be water neutral – savings after 20 years	1500 Mld
All new homes in the Thames Water area were built water neutral after 10 years	147Mld
All new homes in the Thames Water area were built water neutral after 20 years	330Mld
All new homes in the Anglian Water area were built water neutral after 10 years	83Mld
All new homes in the Anglian Water area were built water neutral after 20 years	160Mld
All new homes in the Southern Water area were built water neutral after 10 years	32Mld
All new homes in the Southern Water area were built water neutral after 20 years	68Mld
If all new built homes in Scotland were built water neutral after 10 years	29Mld
If all new homes in Scotland were built water neutral after 20 years	48Mld

Water Neutrality Benefits

2. Carbon Savings

Around 43.8 kgCO_2 equivalent per year per household could be saved on carbon emissions arising from water supply. Based on the number of new builds predicted in England, by 2030 we would be seeing carbon savings from reduced water supply of around 0.11 MtCO_2 equivalent per year in 2030.

If emissions from using water in the home are considered the savings could be around 20 times higher.

Water Neutrality Benefits

3. Money Savings

Annual savings on water and energy bills of around £44 per home can be achieved from reducing water demand in the home to 85 litres per person per day. Coupled with this, if the house was part of a community scale water reuse system, there could be further financial savings over the 25-year life span of the system. Additionally, any existing homes retrofit to offset the new home would benefit from reduced water bills of around £15.50 a year.

Water Neutrality Benefits

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Water Efficiency Strategy for the UK

4. Environmental Impact

Water neutrality will reducing environmental impact by decreasing the amount of water needed to be abstracted from rivers and groundwater sources.

'Water-Neutral' Supermarket

UK supermarket giant Sainsbury's has opened its first "water-neutral" store in Weymouth (which is completely self-sufficient for water), with a second to follow in Leicester at the end of the month. The moves form part of the company's ongoing commitment to reducing its water usage.

Water Neutrality Benefits

5. Improving Resilience

- Improving resilience for the future by minimising the additional pressure on water resources and networks.
- Enabling future housing growth by reducing the impact of new homes and buildings.
- E.g. A new development site of 10,000 homes with average occupancy of 2.23 people per home the average annual water savings if the whole site was water neutral would be around 2.8 million litres a day and carbon savings 1.2 tonnes a day.
- If all homes in England were built water neutral we could see savings of 691 Ml/d in 2030, 17% of the 4000 Ml/d 2050 deficit described by the NIC.

Case Study
Sainsbury’s and Water Scan

- Sainsbury's and their water retailer Waterscan started working together on reducing Sainsbury's operational water consumption in 2011.
- By 2015 Sainsbury’s had achieved ‘triple neutrality’ of carbon, water and waste neutrality in three of their stores. To achieve water neutrality they started by installing waterless urinals, dual flush toilets and sensor taps, and the demand for non-potable water was met using rainwater harvesting technology.
- In the Weymouth Gateway store the rainwater was enough to cover 70% of the store's water needs with the additional 30% being offset through local partners. The partners were then able to offset the water in schools in the local area.
- They estimate that each of these three stores save on average 25 million litres of water each year through this project and the offsetting saves around 18 million litres a year, enough to meet the annual requirement of 120 homes.
- Sainsbury’s hope to reproduce this at more of their stores over the coming years and hope that other companies in the industry will follow suit.

Water Neutrality Benefits

6. Enabling Future Housing Growth

- Water neutrality can help enable future housing growth, particularly in areas of water stress or with environmental constraints, by reducing the impact of new developments on water resources.

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Barangaroo: Sydney's largest urban renewal project aims to recycle more water than it uses

The Barriers

Water Neutrality Barriers

1. The Price of Potable Water

- The price of potable water creates little or no financial incentive for homebuyers to demand, and developers to install, water efficiency and water reuse measures.
- Financial savings on water bills are very low compared to savings made by energy efficiency and carbon offsetting.

- Some of the benefits of RWH and GWR systems fall to society as a whole, rather than to the individual…
- One of the recommendations of this report is that if most of the benefits of water neutrality and water reuse systems fall to society at large, the policies and incentives need to reflect this.

Water Neutrality Barriers

2. Lack of Targets

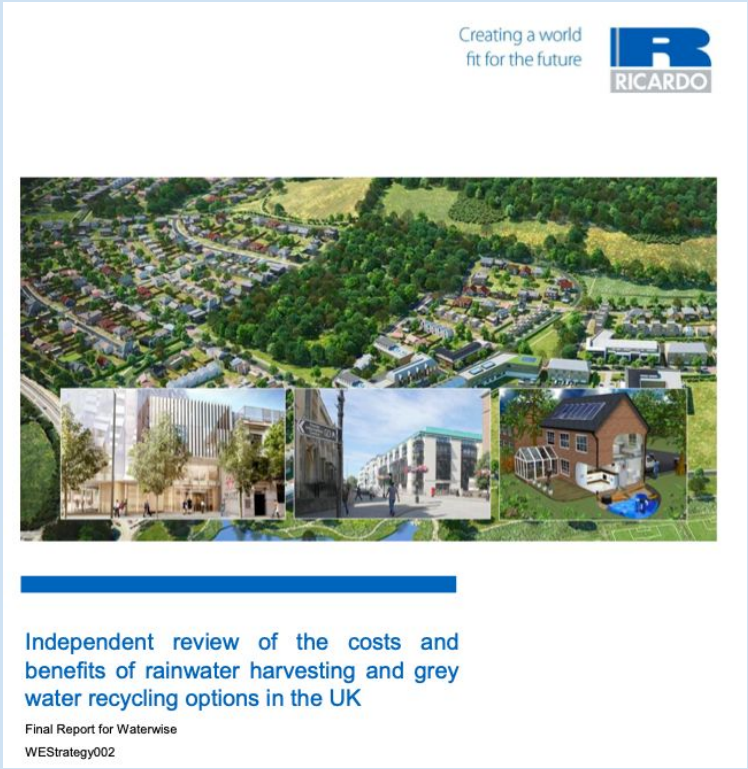
Water neutrality doesn't have national targets or requirements in the way carbon neutrality, flood risk neutrality or biodiversity net gain have.

- Flood risk national planning policy requires a developer to assess the flood risk of its development and to fund and take measures to ensure that any additional flood risk is addressed so the development is effectively neutral
- Biodiversity net gain is recommended to developers but it is believed that the new Environmental Bill will make it a requirement for all new developments to improve biodiversity by 10% and maintain it for at least 30 years

Water Neutrality Barriers

3. Funding

- Funding is a crucial barrier to delivering water neutral projects.
- In a recently approved Greater Brighton water neutral pilot project, the total cost to offset each new home is between £371 and £870.
- Local authorities and water companies are also potential funders, but to date, neither has funded projects of this kind.
- Ricardo Report suggests most of the benefits of RWH fall to society rather than the individual installer…. so who should pay?



Water Neutrality Barriers
4. Focus on Offsetting

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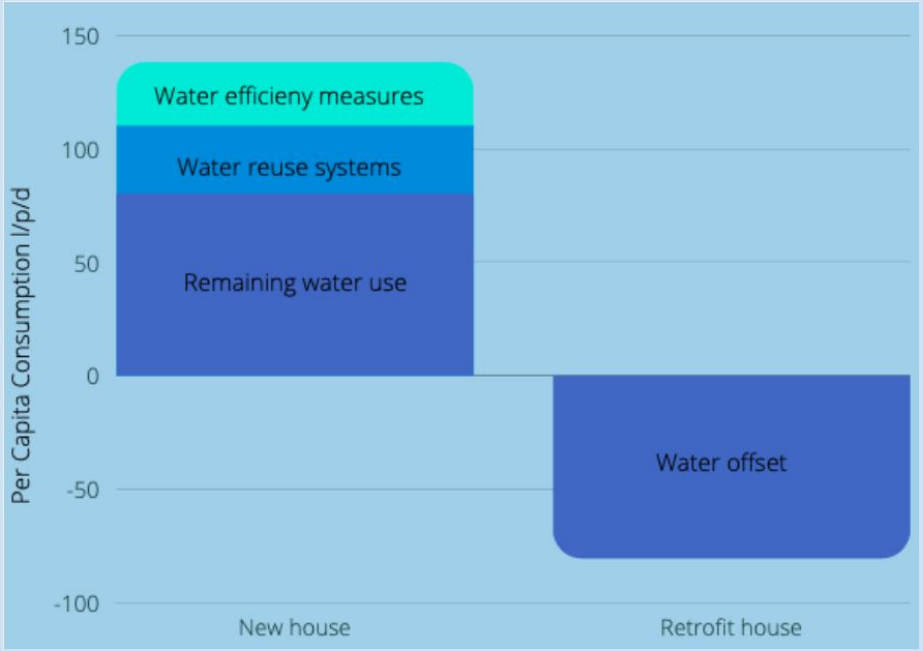
- Attention on offsetting rather than reducing initial water demand.
- A focus on offsetting doesn't drive the ambition towards water efficiency measures in new builds, rather the assumption that any demand can be offset.



Water Neutrality Barriers

5. Multiple Delivery Partners Needed

- Neutrality projects often can involve multiple partners for delivery which can make them challenging.
- For example, the University of California faced various obstacles and barriers whilst trying to implement their own carbon neutral project in 2013. They concluded that without proper planning across the partnering organisations it was difficult to address barriers such as a lack of buy-in, stranded assets, financing, a poor communications strategy, lack of operations management and overall planning.

Water Neutrality Barriers

6. Public Awareness

- Public awareness of water use and resource issues is very low.
- People may not want to buy a water neutral home because of the maintenance of devices and water reuse systems.
- However, research by Waterwise suggests that the public perception of RWH and GWR is higher than assumed, with 87% of the 400 people surveyed saying they would be interested in having a rainwater system in their home.
- Additionally, it is possible to achieve water neutrality without water reuse.

Australian Case Study

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Water Efficiency Strategy for the UK

- A region of Sydney called Barangaroo is home to an exciting urban renewal project aiming to become the first carbon neutral and water positive region.
- Led by urban developers and the City of Sydney, when the project is finished Barangaroo will host 3,000 residents and 23,000 office workers. Whilst the project aims to reduce water usage through water saving appliances and promoting water saving, they are aware there will be additional water usage that cannot be prevented, so all water used and produced on the site will be recycled.
- The greywater and blackwater will be captured from toilets, showers, laundries, waste rooms and restaurants, and additional water will be sourced from rainwater harvesting, cooling tower backwash, and from water mined from Sydney Water's sewer main.

Enabling Water Neutrality

How do we make it happen?

1. Funding

- **Water company programmes,** such as water efficiency audits or smart meter roll outs
- **Local Authorities** already work with a range of stakeholders involved in new developments
- **Large scale marked-based schemes** at a national or international level have been developed for carbon trading, such as the EU Emissions Trading System.
- **Rebates and grants** can help enable the uptake of water saving products, such as rainwater tanks, which could reduce water use in both new and existing homes.
- **Energy efficiency** – Given the links between household water use and energy use there may be opportunities for joint funding of projects that seek to achieve both water and carbon neutrality.
- **Innovation funding** offers an opportunity to deliver pilot projects and to develop a template

How do we make it happen?

2. Supportive Policies

- Top-down supportive policy and leadership is also necessary to take this agenda forward. We have seen this with carbon neutrality, flood risk and biodiversity.
- National policy to promote or require water neutrality to be considered along similar lines potentially linked to the size of the development and the sensitivity of the area in which the site is located.
- Local councils also could have an important role to play in driving water neutral development forward. While there are limitations within the local planning system on requirements for water efficiency, there are opportunities for local authorities to encourage developers to work with other stakeholders to consider water neutrality as part of the planning process for new development. Local plans could include a planning policy to this effect.

Dartford Borough Council's Water Management Policy

a. Work with water companies and monitor development to ensure that new development and water services are coordinated and that the pace of development does not outstrip the water supply and waste water / sewage treatment capacity at any time.
b. Require all new homes to achieve at least level 4 of the Code for Sustainable Homes in terms of water use (105 litres per person per day) in advance of mandatory requirements.
c. Sites of 500 units or more will be required to reduce dependence on potable water through rainwater harvesting, recycling of used water and reduction of water 'hungry' activity. d) Require all non-residential developments of 1,000 sqm and above to meet the BREEAM 'excellent' standards of water efficiency. e) Work with water companies and social landlords to fit existing homes and other buildings with more efficient devices and appliances; reduce leakage; and expand metering.

DARTFORD
BOROUGH COUNCIL

How do we make it happen?

3. Education and Awareness

- Public awareness of water resource issues in the UK is extremely low and consequently there is little public pressure on Government to implement approaches such as water neutrality, compared to something like reducing single use plastic.
- An increase in the general understanding of how precious water is to our lives and how fragile our water resources are in the UK would be very useful for this agenda.
- Education is also crucial to ensure water efficient devices put in place in the new home, remain in situ.

How do we make it happen?

4. Business Resilience

- Businesses with a smaller water demand, or alternative sources of water will be more resilient to interruptions in supply in the future
- Good PR

Water neutrality becoming more common across businesses globally

- Microsoft's Silicon Valley campus in California, has committed to achieving water neutrality. Microsoft have fitted low flow fixtures, wastewater recycling facilities for reuse in irrigation and toilets and other water saving appliances.
- India is severely impacted by droughts and the cement industry, one of the most water intensive industries in India, has become water neutral

How do we make it happen?

5. Good Partnerships

- Water neutrality needs a multi-stakeholder approach, particularly with the offsetting component, so establishing strong partnerships early in the development process is crucial.
- As a starting point, the developer, local authority and water company should discuss ambitions to achieve water neutrality in the very early stages of a development.

A New Home Example

Using the example of a single new domestic building this table works through the costs and savings made throughout the three stage.

Step	Calculation	Standard Home (PCC of around 110)	Ambitious Home (PCC of approx. 82)
Annual water demand of a typical non water neutral new build property (assuming 2.23 occupancy and PCC of 138 l/p/d)		115,851 litres	115,851 litres
1 – Water Efficiency Measures	Annual water saving from efficiency measures	23,506 litres	46,173 litres
	Annual money saved by householder on water and energy bills	£29	£44
	Annual carbon saving from efficiency measures	164.25 $kgCO_2e$	328.5 $kgCO_2e$
2 – Water Reuse	Water reuse systems could bring the water demand of the house down further, reducing the number of retrofits needed and therefore the cost. Section 3.2 demonstrated that these systems can be cost beneficial in their own right. If water was reused for toilets and outdoor use it could save a quarter of total household use.		
3 – Water Offsetting	Annual residual water needing to be saved per water neutral property	92,345 litres	69,679 litres
	Annual assumed water saving per retrofitted property (based on 35 litre per property per day savings from Thames and Southern retrofit programmes)	12,775 litres	12,775 litres
	Approximate number of homes needed to be retrofit to offset	7	5
	Estimated householder saving on energy and water bills for each retrofitted property over 5 years	£73	£73
	Cost per property retrofitted	£48 - £100	£48 - £100
	Total cost of offsetting (per new home built)	£336 - £700	£240 - £500
	Total savings on water and energy bills over five years for the retrofit homes	£508	£365

Conclusion

Key messages

- Water neutrality has the potential to deliver large scale water and carbon savings.
- These savings can help ensure that we have sufficient water available to meet the existing needs of people, business and the environment in a changing climate.
- Water neutrality can also free up the water that will enable future housing and business growth and enhance the environment.
- Water neutrality can be delivered with existing technology and water saving approaches and there are examples of where it is being adopted regionally; for new housing developments; by businesses and by industrial sectors.

Recommendations

1. The National Planning Policy Framework should require the consideration of water neutrality in areas with constrained water resources in a similar way to the requirement for flood risk “neutrality”.

2. Local planning policies should require developers to work with the local water company on proposals to minimise the water demand impact for new developments over a threshold size, and target water neutrality.

3. Engagement between developers, water companies, and local authorities at a very early planning stage to discuss water resources and the potential for a development to be water neutral.

4. There is the opportunity to demonstrate the concept in practice on new developments, such as in the OxCam Arc.