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Westminster sustainablebusiness Forum

BRICKS & WATER

BUILDING RESILIENCE FOR ENGLAND'S HOMES

> We need water wastage to be as socially unacceptable as blowing smoke in the face of a baby.

Sir James Bevan,
CEO, Environment Agency

October 2020

This report follows a six month-long inquiry and was written by Rob Allen, Policy Manager, Sustainability at Policy Connect.

Policy Connect
7-14 Great Dover Street
London
SE1 4YR

www.policyconnect.org.uk

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5. Measure and improve the 'water performance' of new and existing homes.

Foreword

There is an enduring perception that drought and flooding are rare events with minimal impacts on our daily lives. However, as the global climate crisis intensifies, our communities now must confront issues arising from too little and too much water on an annual basis. In consequence, a key challenge we face is to ensure that the construction of new homes does not make these problems worse.

This inquiry by the Westminster Sustainable Business Forum (WSBF) comes at a critical time for housebuilding in England. The Prime Minister has announced a 'New Deal', which sets out how Government plans to 'build back better' after the COVID-19 pandemic and includes a £12 billion affordable homes programme. Ensuring that these homes are built to the highest sustainability standards will not only help the UK meet its commitment to reach net-zero carbon emissions by 2050, but will also ensure that communities are resilient to the effects of climate change, including the reduced availability of water and increased risks from flooding.

Having been confined to our homes for long periods this year, and as we face follow-on local lockdowns, the pandemic has also drawn attention to the value of incorporating nature-based solutions into the design of new developments. This is where the use of Sustainable Drainage Systems (SuDS) can play a crucial role – while effectively managing surface water runoff from roofs and roads we can also provide green spaces for recreation and allow nature to thrive.

The inquiry sets out how better planning policy, building regulations, and national standards can help improve the water efficiency, flood resilience, and drainage arrangements of new buildings. Incorporating these principles in new-build homes is highly cost-effective and far cheaper than retrofit at a later stage.

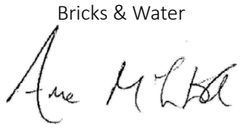
However, new-build homes make up a relatively small proportion of the housing stock. It is therefore vitally important that we also adapt existing homes so that they use less water and are resilient to climate change impacts. The WSBF have put forward a system by which landlords and homeowners can measure the 'water performance' of existing buildings and obtain practical and cost-effective recommendations on how to improve this performance.

This work has been informed by a range of expert opinions, including those from the water, housebuilding, insurance, and academic sectors. I would particularly like to thank our generous sponsors Community Water Management for a Liveable London, Durham University, South West Water, and Yorkshire Water.

As a Parliamentarian and co-chair of the All Party Parliamentary Water Group, I strongly support the design and retrofit of high-quality, resilient homes, to combat water scarcity and manage water sustainably. During the evidence sessions that supported this inquiry, I heard many strong, sometimes contrasting views, and I recognise that not all consultees may agree with all of the report's recommendations. However I was encouraged to hear that participants shared a strong desire to ensure that our homes of the future are resilient to climate change, and provide safe and comfortable places for people to live.

Baroness McIntosh of Pickering

Chair of Inquiry,
Bricks & Water



Executive Summary

Our first Bricks and Water inquiry (2018) highlighted how population growth across England is placing unprecedented demand on water and drainage services, and how new development can exacerbate flood risk. The report made a number of practical recommendations to address these issues, including a tougher, simpler, planning and building regulations framework to deliver the highest standards for water efficiency, flood resilience, and sustainable drainage. We recommended that the most effective way for Government to drive up standards quickly was through the introduction of a 'Bricks and Water Sustainability Code'.

Over the last two years, the UK has had a new Government, left the European Union, and suffered the worst pandemic in a century. These events have held the attention of Parliamentarians and left little space to take action on pre-existing challenges such as improving building standards. However, the current public health and economic crises also present an opportunity to ensure that new and existing homes are built and retrofitted to improve the wellbeing of their occupants, be resilient to climate change, and contribute to a Green Jobs Recovery in the construction sector.

This inquiry has focused on the practical measures available to make new and existing homes more adaptable to the adverse effects of climate change, including the reduced availability of drinking water and the increased risk of flooding from rivers, the sea, and from surface water.

Climate change continues to reduce the amount of water that can be sustainably abstracted from the environment. This reduction in supply, combined with increased demand from population growth, means that running out of water is now a realistic possibility. **Chapter 1** of this inquiry explores how this risk can be managed by reducing personal water consumption from the current national average of 143 litres per person, per day (lpppd). This could be achieved through introduction of a mandatory water label for fixtures and fittings, in much the same way that the EU energy label has improved appliance energy efficiency. If this system is underpinned by changes to building regulations and supported by additional measures (e.g. smart-metering, leakage reduction, water recycling, and better consumer information), then it will be possible to reduce consumption below 90lpppd by 2050, at little-to-no cost to the householder.

Many regions that suffer from too little water during the summer months also experience problems with too much water at other times of year. One in six properties in England are at risk of flooding, and since 2013 we have seen 85,000 new homes built within areas of high flood risk. New homes are not eligible for subsidised home insurance through the Flood Re scheme, and as winter flooding across the country becomes more commonplace, soaring repair bills will be the sole liability of the owners of these properties. **Chapter 2** highlights how installation of Property Flood Resilience (PFR) measures can help to reduce the costs of restoration following a flood and allow buildings to be re-occupied more quickly. Resilience measures are currently being installed at a fraction of the pace required to adapt to the effects of climate change and this must be speeded up. Providing homeowners and house purchasers with better information on flood risk and incorporating the use of resilience measures into building regulations would help to reduce the financial impact and mental distress that occur when a community is flooded.

Unabated conversion of green space to artificial surfaces, such as buildings and roads, increases the rate at which surface water enters the drainage system and exacerbates risks associated with flooding. **Chapter 3** illustrates how the use of Sustainable Drainage Systems (SuDS) can not only help manage water quantity, but can also improve water quality, enhance biodiversity, and provide public amenity spaces. Together, the benefits of SuDS can promote community wellbeing, the importance of which the COVID-19 lockdown has emphasised. Changes to planning policy to mandate the use of high-quality SuDS in England should require these systems as the norm rather than the exception.

Although updates to building regulations and planning policy will help to improve the performance of new buildings, the majority of the homes that will be standing in 2050 have already been built. Measuring the performance of buildings when they are sold or rented would provide a driver for action by sellers, buyers, and landlords to make their homes more water efficient and flood resilient, including the incorporation of sustainable disposal of surface water. Within **Chapter 4**, we have initially proposed that the most effective way to improve the water efficiency of existing buildings would be to integrate some simple water performance measures into the existing Energy Performance Certificate (EPC). This could be done using existing energy assessors, with minimal extra training, and at a very low additional cost (i.e. around £20 per home EPC). The next stage could be performance measures relating to SuDS and property flood resilience. These proposals would incentivise homeowners and landlords to improve the water performance of existing properties and also encourage developers to construct new buildings to the highest standards. Use of the current EPC structure and Standard Assessment Procedure (SAP) methodology would enable prompt roll-out and would minimise the administrative burden to consumers.

Only through this systemic approach of updating the way that we construct new homes and incentivising homeowners to retrofit their existing properties can we ensure that the nation's housing stock is fit for the future.

Key Recommendations

WATER EFFICIENCY

Topic	Recommendation	Owner	Timing
National Target	Government (led by DEFRA) should set a national per-capita consumption target for water, which should be considered within the wider context of overall water use (including leakage and non-domestic). This target should be tightened over time and should drive changes to building regulations.	DEFRA	2020
Water Labelling	Government should introduce a mandatory water label for all fixtures, fittings, and water using products, visible at the point of sale (similar to the existing energy consumption label). The label should be linked to minimum standards for water efficiency, which could be tightened over time.	DEFRA	2020
Building Regulations	Part G of building regulations should be updated to use a 'fittings-based' approach only, underpinned by a mandatory water label. Minimum product standards should be set to achieve 100lpppd initially and be tightened over time to achieve 85lpppd by 2050.	MHCLG	2020

PROPERTY FLOOD RESILIENCE

Topic	Recommendation	Owner	Timing
Building Regulations	Part C of building regulations should be updated to require all properties at risk of flooding to include property flood resilience measures. These measures should be specified and installed in accordance with the industry Code of Practice for property flood resilience.	MHCLG	2022
Flood Re	Given the limited uptake of property flood resilience measures and continued development within the floodplain, Government should either extend the Flood Re scheme to cover residential buildings constructed after 1st January 2009, or put in place an alternative scheme. This should be evaluated as part of the ongoing Blanc review into flood insurance.	DEFRA	2021

SUSTAINABLE DRAINAGE

Topic	Recommendation	Owner	Timing
Planning Policy	The use of Sustainable Drainage Systems (SuDS) for all new developments in England should be made mandatory under Schedule 3 of the Flood and Water Management Act.	MHCLG	2020
Non Statutory Technical Standards	Non Statutory Technical Standards for the design, operation, and maintenance of SuDS, currently under review by DEFRA should include the requirement for SuDS systems to incorporate multi-functional benefits as set out within the SuDS Manual.	DEFRA	2020
Planning Policy	The automatic right for a new development to discharge surface water to existing public sewers should be removed, in accordance with recommendations made within the 2008 Pitt Review.	MHCLG	2020

MEASURING PERFORMANCE

Topic	Recommendation	Owner	Timing
Conveyancing & Letting	The 'water performance' of new and existing homes should be assessed whenever a home is constructed, sold or rented. In the first instance, a system for measuring a building's water efficiency should be incorporated into the existing Energy Performance Certificate, so that the purchaser or tenant knows the efficiency of the home that they are buying or renting.	BEIS & MHCLG	2021
Future Homes Standard	Government should include performance targets for water efficiency, property flood resilience, and sustainable surface water disposal in the forthcoming Future Homes Standard. The scope of the Future Homes Standard should be defined now and legislated ahead of 2025, to give advance market certainty.	MHCLG	By 2025

An action plan for improving the resilience of new and existing homes

GOAL 1: BETTER CONSUMER INFORMATION

From 2020

- Recommendation 3: Introduction of mandatory water labelling.
- Recommendation 9: Information on flood risk should be available as part of the conveyancing process, and should be easier to understand and include eligibility to participate in Flood Re.

From 2021

- Recommendation 7: Extension of Flood Re to cover residential buildings constructed post-2008 and informing newly eligible homeowners of this change.

GOAL 2: ADAPTATION OF EXISTING BUILDINGS

From 2020

- Recommendation 5: Smart meter installation and retrofit should be accelerated.
- Recommendation 14: Water companies should work with local stakeholders to implement property level SuDS retrofit programmes.
- Recommendation 18: The existing network of Domestic Energy Assessors should be upskilled to assess a home's 'water performance'.
- Recommendation 20: Water performance measures relating to water efficiency should be introduced on a voluntary basis, as a low-cost 'bolt-on' to the existing EPC.
- Recommendation 23: Work already underway to assess the flood performance of existing buildings should be developed further, in accordance with the existing industry code of practice.

From 2021

- Recommendation 19: Assessment of a home's water performance should follow the Standard Assessment Procedure methodology and should be rated on a scale from A-G.
- Recommendation 21: Government should consult on incorporation of water efficiency measures into the EPC and subsequently incorporate these on a mandatory basis, whenever an EPC is required.
- Recommendation 24: A system for measuring a home's water performance should include practical actions, linked to likely financial savings.
- Recommendation 25: Data collected to assess a home's water performance should be publically available, to allow scrutiny by third parties.

From 2022

- Recommendation 22: A system for measuring the performance of a home's surface water drainage arrangements should be developed through further discussion with drainage engineers, developers, water companies, and Lead Local Flood Authorities.

GOAL 3: BUILDING RESILIENT NEW HOMES

From 2020

- Recommendation 1: DEFRA should set a national consumption target for water.
- Recommendation 4: Building regulations for water efficiency should be updated to use a 'fittings-based' approach only.
- Recommendation 10: The use of Sustainable Drainage Systems (SuDS) should be made mandatory for all new development.
- Recommendation 11: Updates to Non Statutory Technical Standards for SuDS should include a requirement for multi-functional benefits.
- Recommendation 12: Lead Local Flood Authorities should provide comprehensive guidance for developers on the use of SuDS.
- Recommendation 13: The automatic right for new development to discharge surface water to existing public sewers should be removed.
- Recommendation 15: All water companies should adopt SuDS where they meet approved criteria.
- Recommendation 17: Ofwat should incentivise the use of local wastewater treatment systems in order to reduce pollution incidents associated with Combined Sewer Overflows.

From 2021

- Recommendation 16: Water companies should be given statutory consultee status on major planning applications.
- Recommendation 6: Greater powers should be given to Catchment Partnerships to ensure holistic consideration of flooding and drainage issues as part of the planning process.

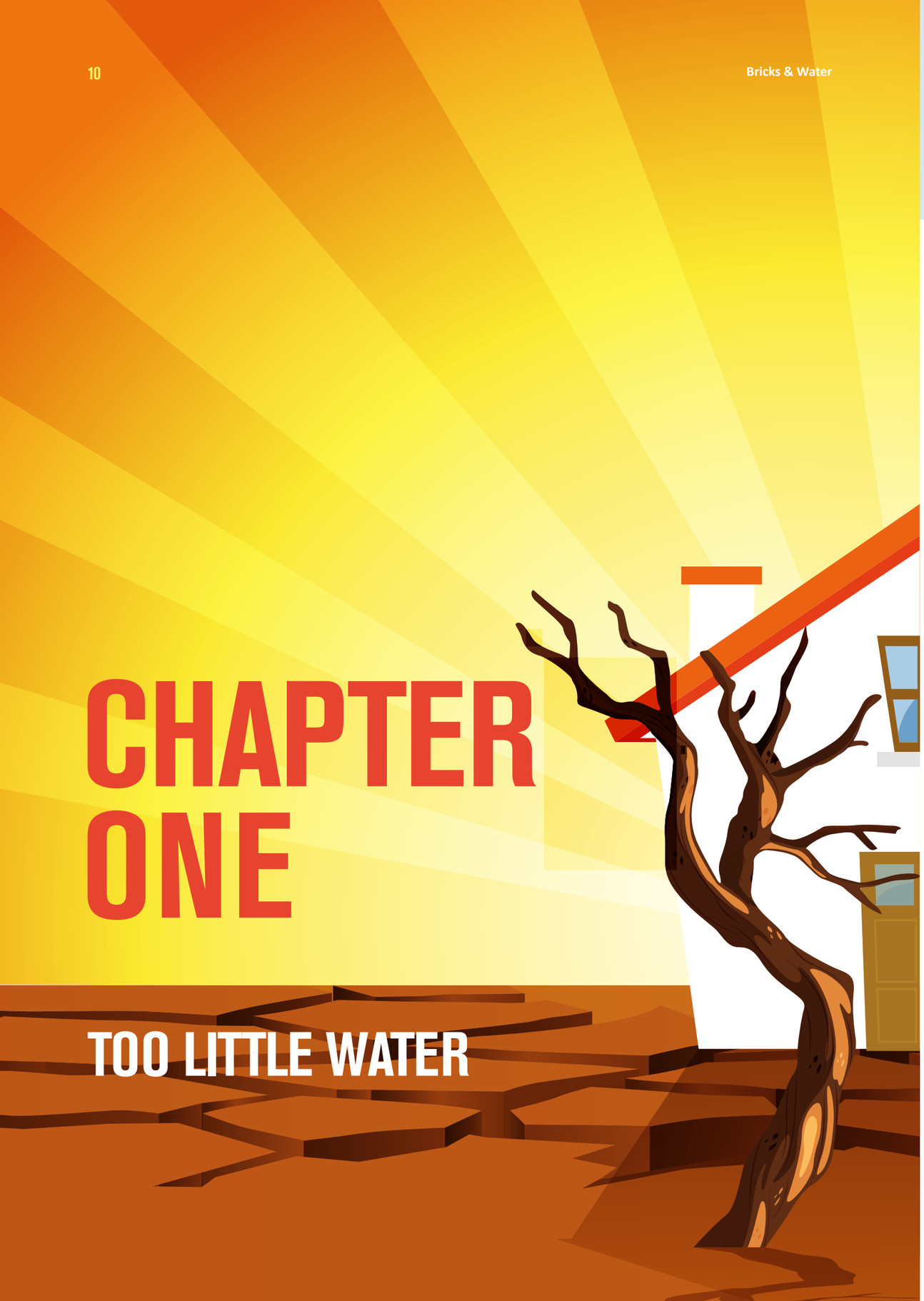
From 2022

- Recommendation 8: Building regulations should be updated to require properties at risk of flooding to include property flood resilience measures.

From 2025

- Recommendation 2: Performance targets for water efficiency, flood resilience, and sustainable drainage should be included in the forthcoming Future Homes Standard.

FROM 2020 FROM 2021 FROM 2022 FROM 2025



CHAPTER ONE

TOO LITTLE WATER

1. Too Little Water

> **We need water wastage to be as socially unacceptable as blowing smoke in the face of a baby.**
>
> Sir James Bevan, Environment Agency CEO

Within the next 25 years, the country is facing the "jaws of death", the point at which we will not have enough water to supply our needs[1]. That was Sir James Bevan's warning to attendees of the 2019 Waterwise Conference. This "existential threat" has arisen as a result of reduced water supply due to climate change and increased demand from population growth.

Climate change is placing increasing pressure on the national water supply. The average recorded temperature between 2009 and 2018 was 0.3°C warmer than that of the previous 30 years[2] and summer 2019 saw a record UK high temperature of 38.7°C[3]. Rising temperatures increase consumption, while also reducing our ability to sustainably abstract water from the environment. In England alone, the effects of climate change are predicted to reduce supply by 600 million litres of water per day by 2045[4]. If current levels of abstraction continue parts of our natural environment, such as the unique chalk stream habitats of southern England, will be irreparably damaged.

Demand for water is increasing. Between 2018 and 2043 the population of England is projected to increase by 10.3% from 56 million to a total of 61.7 million[5]. The Government aims to deliver 300,000 extra homes per year by the mid-2020s[6], and these homes will significantly increase the burden on an already stretched water and wastewater network. At the same time, household consumption is going up. Consumption in England currently stands at 143 litres per person, per day (lpppd) and this number has increased each year since 2014/15[7]. There remains a 'performance gap' between buildings' estimated and actual water use – Thames Water identified that actual use could be up to 25%[8] higher.

The United Kingdom is unprepared for these threats. The National Infrastructure Commission (NIC) reports a 1 in 4 chance of a severe drought before 2050. The Commission concluded that, in order to prevent this, additional capacity of 3,000 million litres of water per day will need to be provided[9]. In their 2017 risk assessment[10] the Committee on Climate Change confirmed that, under high climate change and population growth scenarios, demand for water could exceed supply in many catchments by 2050.

Reducing personal water use will be crucial for making the country more resilient. Resilience can be defined as "the capacity for a system to absorb stresses and maintain function in the face of external stresses imposed upon it[11]". In this chapter we have set out a number of ways in which we can reduce consumption from the current level of 143lpppd[12]. Within our first Bricks and Water[13] inquiry we made a recommendation for an ambitious consumption target of 100lpppd, which should be tightened over time. This chapter explores additional practical steps that we can take to promote resilience.

[1] Escaping the jaws of death: ensuring enough water in 2050 (speech), Sir James Bevan, March 2019
[2] UK Climate projections: headline findings (version 2), Met Office, September 2019
[3] New official highest temperature in the UK confirmed (press release), Met Office, July 2019
[4] Water supply and demand management, National Audit Office, April 2020
[5] National population projections: 2018-based, Office for National Statistics, October 2019
[6] Housebuilding targets, House of Commons Library debate pack, June 2019
[7] Water Supply and Demand Management, National Audit Office, April 2020
[8] Thames Water internal review of new build homes' water use, Thames Water, 2018
[9] National infrastructure assessment, National Infrastructure Commission, July 2018
[10] UK Climate change risk assessment 2017, Committee on Climate Change, July 2016
[11] Building a climate resilience economy and society, challenges and opportunities, K.N. Ninan & Makoto Inoue, June 2017
[12] Average daily consumption per person in England (2018/19)
[13] Bricks and water: a plan of action for building homes and managing water in England, Policy Connect, June 2018

1.1. POLICY CONTEXT

The Government's 25 Year Environment Plan[14] includes the goal of achieving 'clean and plentiful water'. To reach this, Government has pledged to streamline the planning process for new infrastructure and work with water companies to increase resilience. It has also committed to work with the industry to incentivise uptake of water efficiency measures and to reduce personal water use by setting an ambitious personal consumption target.

Last year DEFRA launched the consultation 'Measures to reduce personal water use', which sought to understand potential options for reducing personal water consumption and derive feasible and achievable targets. Although the full summary of this consultation is yet to be published, the WSBF understands that there is a strong majority of support for updates to building regulations and introduction of mandatory water labelling. In her speech to the 2020 Waterwise Conference, the Minister for Floods and Water Rebecca Pow confirmed that the responses showed "overall support for water saving measures" and that she would be "exploring improvements required to building regulations".

Requirements for the water efficiency of new buildings are set out in Approved Document G of building regulations[15]. Since the withdrawal of the Code for Sustainable Homes[16], building regulations have mandated that new homes should not exceed a use of 125lpppd, with an optional limit of 110lpppd, which can be set by Local Planning Authorities as part of the planning process. This option, which leads to regional differences determined by local authorities, is ineffective and should be replaced with an ambitious national target. DEFRA committed to setting such a target by the end of 2018, but is yet to do so.

Any personal consumption target should be considered in the wider context of the amount of water that can be sustainably abstracted from the environment. Given that around 20% of water supplied is lost in leakage, and a further 20% represents non-household use, any water target under the framework of the Environment Bill should take into account overall water use. This approach would accommodate changes in consumption as a result of unforeseen events, such as the COVID-19 pandemic, which saw a significant increase in domestic consumption alongside a fall in commercial and industrial use. In line with recommendations by the Public Accounts Committee[17], a national target led by DEFRA would also emphasise the responsibility that all stakeholders have to save water, including consumers, water companies, and businesses.

Recommendation 1: Government (led by DEFRA) should set a national per-capita consumption target for water, which should be considered within the wider context of overall water use (including leakage and non-domestic). This target should be tightened over time and should drive changes to building regulations.

The Government also plans to introduce a Future Homes Standard by 2025, which will require "new-build homes to be future-proofed with low carbon heating and world-leading levels of energy efficiency"[18]. This will go some way to ensuring that new homes are well-designed and resilient to a changing climate. We believe that it would be a missed opportunity not to also incorporate into this standard performance targets for water efficiency, property flood resilience, sustainable drainage, and overheating.

[14] A green future: our 25 year plan to improve the environment, HM Government, January 2018
[15] Approved document G: sanitation, hot water safety and water efficiency, HM Government, 2015
[16] Code for sustainable homes: technical guide, MHCLG, November 2010
[17] Water supply and demand management, Public Accounts Committee, July 2020
[18] The future homes standard: changes to Part L and Part F of the building regulations for new dwellings (consultation), MHCLG, October 2019

The Committee on Climate Change[19] wrote to the Secretary of State for Housing, Communities and Local Government in February 2020 highlighting the importance of water efficiency measures and calling for the scope of the Future Homes Standard to be set now.

Recommendation 2: Government should include performance targets for water efficiency, property flood resilience, and sustainable surface water disposal in the forthcoming Future Homes Standard. The scope of the Future Homes Standard should be defined now and legislated ahead of 2025, to give advance market certainty.

1.2. WATER LABELLING

Within Part G of building regulations, per-capita consumption (PCC) is calculated either by using a water efficiency calculator, which makes assumptions around building occupancy and frequency of use, or by using a fittings based approach, which sets maximum allowable consumption rates for fittings and water-consuming products. Research by Essex and Suffolk and Northumbrian Water has shown that the methodology used by the efficiency calculator is flawed, in part due to the wide variability in consumer behaviour[20]. It also fails to remove specification of products with very high consumption as these can theoretically be offset elsewhere in the property.

Although a national consumption target should be set by Government to provide context to consumers and drive overall change within the housebuilding industry, it is not an effective way to set minimum standards as part of building regulations. Rather, legislating to introduce a mandatory water label, linked to minimum standards for fixtures, fittings, and water using products would be the most effective way to lower actual use. This would provide a vehicle to implement the recommendation from our first Bricks and Water inquiry of reducing consumption to 100lpppd. Minimum standards set by the label could then be tightened over time, alongside introduction of other measures, such as smart-metering, to achieve 82lpppd by 2065 – a saving of 2,380 million litres per day[21].

It is anticipated that introduction of mandatory water labelling and updates to building regulations could deliver savings of £26 billion to consumers over the next 25 years, through lower water and energy bills[22]. A similar scheme (Water Efficiency Labelling and Standards) currently in operation in Australia is demonstrated to have saved in 2017 alone over $1 billion (Australian) in utility bill reductions and 112 billion litres of water[23]. The scheme has been broadly embraced by both industry and consumers. The Environment Agency[24] has also recently drawn attention to the fact that per-capita consumption could be reduced below 90lpd by 2050, whilst having a favourable cost-benefit ratio.

Feedback to this inquiry from developers indicates that reduction of household consumption through introduction of a mandatory water label would not be resisted by the industry. Businesses would want labelling to be mandated by Government and enforced through building regulations. This would remove the possibility of commercial undercutting whilst giving certainty to the supply chain that there would be a market for their products.

[19] Future Homes Standard and proposals for tightening part L in 2020 (letter), Committee on Climate Change, February 2020
[20] Building regulations Part G :analysis of water consumption, Essex and Suffolk Water and Northumbrian Water, 2018
[21] Water UK pathways to long-term PCC reduction, Artesia Consulting, August 2019
[22] Independent review of the costs and benefits of water labelling options in the UK: extension project, Energy Savings Trust, 2019
[23] Evaluation of the environmental and economic impacts of the WELS scheme, Institute for Sustainable Futures, 2018
[24] Meeting our future water needs: a national framework for water resources, Environment Agency, March 2020

> We think that by implementing water labelling and thereby better informing customers of water usage within the home, we can have a positive impact on our environment, supporting our strategic sustainable journey. To minimise the litres per person per day, we continue to install a vast range of water saving items in our homes. We believe that water labelling is significant in reducing this further, and support Government on this update in building regulations.
>
> Gavin Thorne – Group Utility Service Manager, Barratt Developments (June 2020)

Introduction of mandatory labelling would have an immediate impact on the water efficiency of new homes, and would help to rid the retail market of inefficient products, in the same way that the EU energy label has done for appliance energy efficiency. Furthermore, products would start to be installed within existing homes straightaway, as old ones are replaced. This is particularly important as new homes make up a relatively small proportion of the problem and more than 85% of the building stock that will exist in the year 2050 has already been constructed[25].

The WSBF understands that a significant majority of respondents to last year's DEFRA consultation 'strongly agreed' that information on water efficiency should be displayed on water-using products. Independent research carried out for industry body, Water UK, also found that "the single most cost-effective intervention to save water is a mandatory Government-led scheme to label water-using products, linked to tightening building regulations and water supply fittings regulations"[26].

Recommendation 3: Government should introduce a mandatory water label, for all fixtures, fittings, and water using products, visible at the point of sale (similar to the existing energy consumption label). The label should be linked to minimum standards for water efficiency, which could be tightened over time.

Recommendation 4: Part G of building regulations should be updated to use a 'fittings-based' approach only, underpinned by a mandatory water label. Minimum product standards should be set to achieve 100lpppd initially and be tightened over time to achieve 85lpppd by 2050.

[25] All Party Parliamentary Group for Excellence in the Built Environment inquiry into sustainable construction and the Green Deal (submission by The Chartered Institute of Building), January 2013
[26] Water UK pathways to long-term PCC reduction, Artesia Consulting, August 2019

1.3. METERING

Measuring water use is an essential aspect in reducing personal consumption. Within our first Bricks and Water inquiry we recommended moving as close to 100% metering coverage as possible, given that metered households use 12-22% less than those who pay by rateable value[27]. In 2018 the National Infrastructure Commission made recommendations for increased meter penetration by 2030[28]. Given the Government's current commitment to net-zero by 2050, we consider that this roll-out should be more ambitious.

The use of smart meters offer additional benefits as they allow for more targeted engagement between water companies and customers, helping to reduce usage and bills. Customer supply pipe leakage (see section 1.4.1) is included in water companies' overall leakage calculation, however the water lost, if metered, is billed to the customer. Therefore, both water companies and homeowners have an incentive to ensure that leaks are fixed. Real-time information from smart meters can help identify and prevent domestic leakage from supply pipes, taps, and toilet cisterns, which can double a household's annual consumption[29]. Smart metering can play a key role in identifying leaks early and water companies can use the data collected to contact customers, sometimes before they are even aware of the problem.

Research on the potential for reduction in household water use[30] identified that the deepest reductions (to 82lpppd by 2065) can only be achieved through a combination of mandatory water labelling and introduction of smart meters. Under this scenario, water companies would facilitate smart meter installation and then switch customers to a metered bill.

Recommendation 5: In addition to metering allocated within Water Resource Management Plans, meter installation and retrofit should be accelerated for delivery prior to 2030 and include delivery of smart-meters from the outset. Water company support (including home visits) should be extended for vulnerable customers where metering could result in an increase in payments.

[27] The effect of metering on water Consumption: policy note, C. Ornaghi & M. Tonin, June 2017
[28] Preparing for a drier future: England's water infrastructure needs, National Infrastructure Commission, April 2018
[29] Leaky loos: summary position statement, Waterwise, March 2019
[30] The long term potential for deep reductions in household water demand, Artesia Consulting, May 2018

1.4. LEAKAGE REDUCTION

1.4.1. SUPPLY PIPE LEAKAGE

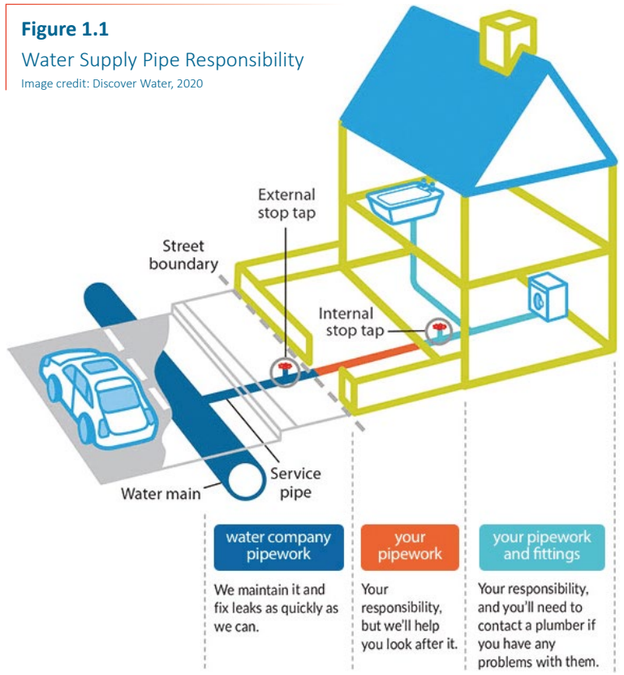
Between 2012/13 and 2018/19 leakage from supply pipes owned by water companies was only reduced by 2%[31], and last year 3,170 million litres of water was lost every single day[32]. Although improvements are being made (in 2018/19 fifteen out of eighteen water companies met their regulatory leakage targets), more must be done to cut levels of leakage by 50% by 2050, in accordance with recommendations made by the NIC.[33]

Modelling by the Environment Agency[34] has demonstrated that if water companies only achieve a 30% reduction in leakage by 2050, this would leave a significant water shortfall of 550 mega litres per day, which would have to be saved elsewhere. This is concerning given that even current water company leakage targets (i.e. reducing leakage by at least 15% by 2025) are considered to be highly ambitious and Ofwat has acknowledged that achieving them will rely on adoption of unknown or untested approaches[35].

To be regarded as achievable, leakage reduction targets should be based on known techniques using currently available technology, and be backed by robust implementation plans. In July 2020, the Public Accounts Committee[36] recommended that DEFRA should hold water companies to account by publishing annual league tables showing performance on tackling leakage.

Whilst the majority of leakage is from water company pipework, the focus of this inquiry is at the property-level and around 25% of overall leakage is from customers' supply pipes[37] (i.e. pipework within the home or the pipes that carry water from water company pipework at the property boundary into the home). Homeowners are responsible for the maintenance and upkeep of these pipes, including leak detection, and leakage is estimated at 30 litres per property, per day, equating to 8% of household consumption[38].

Figure 1.1
Water Supply Pipe Responsibility
Image credit: Discover Water, 2020



[31] Water supply and demand management, National Audit Office, April 2020
[32] Discover water, Water UK
[33] Preparing for a drier future: England's water infrastructure needs, National Infrastructure Commission, April 2018
[34] Meeting our future water needs: a national framework for water resources, Environment Agency, March 2020
[35] Water supply and demand management, National Audit Office, April 2020
[36] Water supply and demand management, Public Accounts Committee, July, 2020
[37] Consultation on measures to reduce personal water use, DEFRA, July 2019
[38] The long term potential for deep reductions in household water demand, Artesia Consulting, May 2018

1.4.2. LEAKAGE FROM FIXTURES & FITTINGS

Leakage from fittings within the home can be significant, especially from toilets. These 'leaky loos' can waste up to 400 litres of water every day and it is anticipated that 5-8% of all toilets leak, especially products with a dual-flush[39]. The product testing regime can identify these design flaws and ensure that products are fit for purpose before the products come to market.

> **We need to ensure that we provide solutions that run end to end. From design, testing, and installation, to make the most of the water we have throughout the lifetime of the product or service. BSI is pleased to be part of this important project, working with the industry to ensure a Kitemark can be awarded for the product and installation. This needs to be an inclusive process to give everyone confidence in these requirements from consumer, the supply chain, and manufacturers.**
>
> Martin Townsend - Global Head of Sustainability & Circular Economy, BSI (June 2020)

However, even with a Kitemark, gains made through the use of high quality, water efficient fixtures and fittings will be lost if these products are not installed correctly. Alongside work on product standards, an approved installer scheme should be developed to ensure that fixtures and fittings operate robustly. Together these measures will both reduce water leakage and save the householder from potentially costly repair bills.

[39] Leaky loos: summary position statement, Waterwise, March 2019

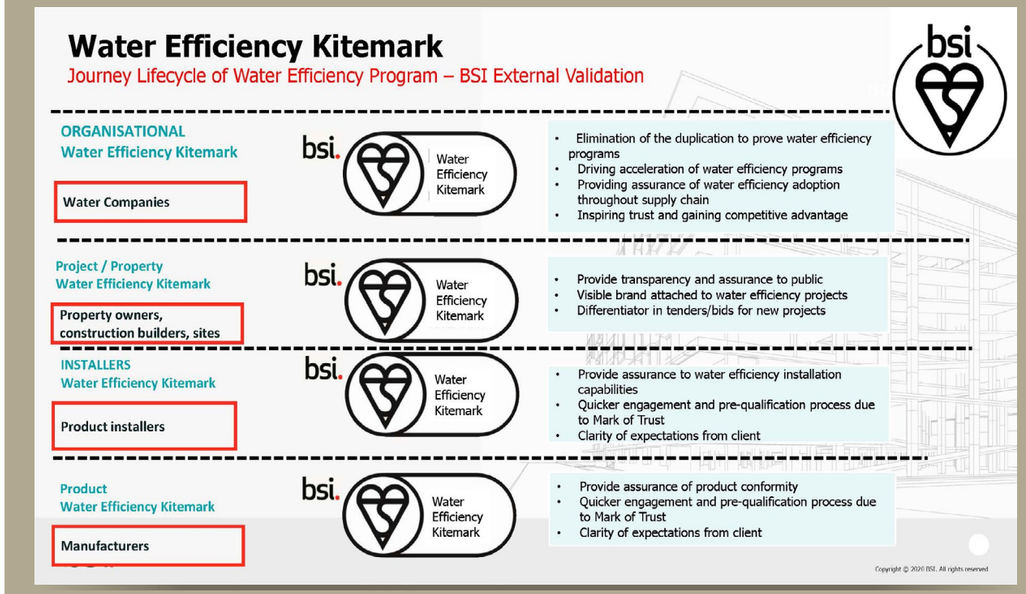
CASE STUDY: Developing a Kitemark for water efficiency

Image copyright: BSI, 2020

The Kitemark is a symbol used to demonstrate the safety, reliability, and quality of a product or service. The Kitemark is owned and operated by the British Standards Institution (BSI) and is awarded to confirm that a product or service has been thoroughly tested and is proven to meet a recognised industry standard or need.

Following the Bricks and Water evidence session on water efficiency in February 2020, the BSI have been liaising with the WSBF and other key industry stakeholders to establish a working group and develop a Kitemark for water efficiency. The aims of this project are to identify best practice in product design, raise standards for product installation, and provide the public with confidence that water efficient products will be both functional and reliable.

Initial scoping work has identified that a Kitemark could be awarded on a variety of scales, from certification of individual fixtures and fittings up to demonstration of competence at an organisational level:



1.5. WATER REUSE

Rainwater harvesting and greywater recycling present opportunities to further reduce potable water use, given that a significant proportion of domestic water use does not need to be drinking water standard. Rainwater harvesting refers to the collection and storage of water, whereas greywater recycling refers to the treatment and reuse of this water for non-potable purposes such as flushing toilets, washing clothes, and watering gardens. Both can be implemented on a variety of scales from large developments down to the individual property.

Table 1.1 Greywater Reuse Systems[40]

Reuse system	Description
Direct	Water is siphoned directly to where it is required e.g. from a bath to a harvesting tank for garden watering
Short retention	Application of basic treatment methods, such as skimming or settling to remove debris such as the reuse of shower water for toilet flushing
Basic physical/chemical	Greywater is filtered and chemical disinfectants are used to stop bacterial growth
Biological	Greywater is pumped through gravel and reed beds and organic contaminants are digested by bacteria
Integrated	Treated greywater and recycled rainwater are combined if either source is insufficient on its own
Blackwater	Biological or chemical treatment of wastewater, that includes sewage from toilet flushing

At the most basic level, water reuse can involve harvesting rainwater within a water-butt and recycling it for watering purposes. However, more significant savings can be made through community schemes that harvest surface water runoff from roofs and hardstanding, and collect it in a locally centralised pond or tank, before recycling it for non-potable use. The main criticisms of these schemes are that they can be expensive and are not always suitable for high density settings, such as blocks of flats, where the water demand exceeds the collection capacity. Potable water often has to be used as a back-up during dry periods where there is little rainfall.

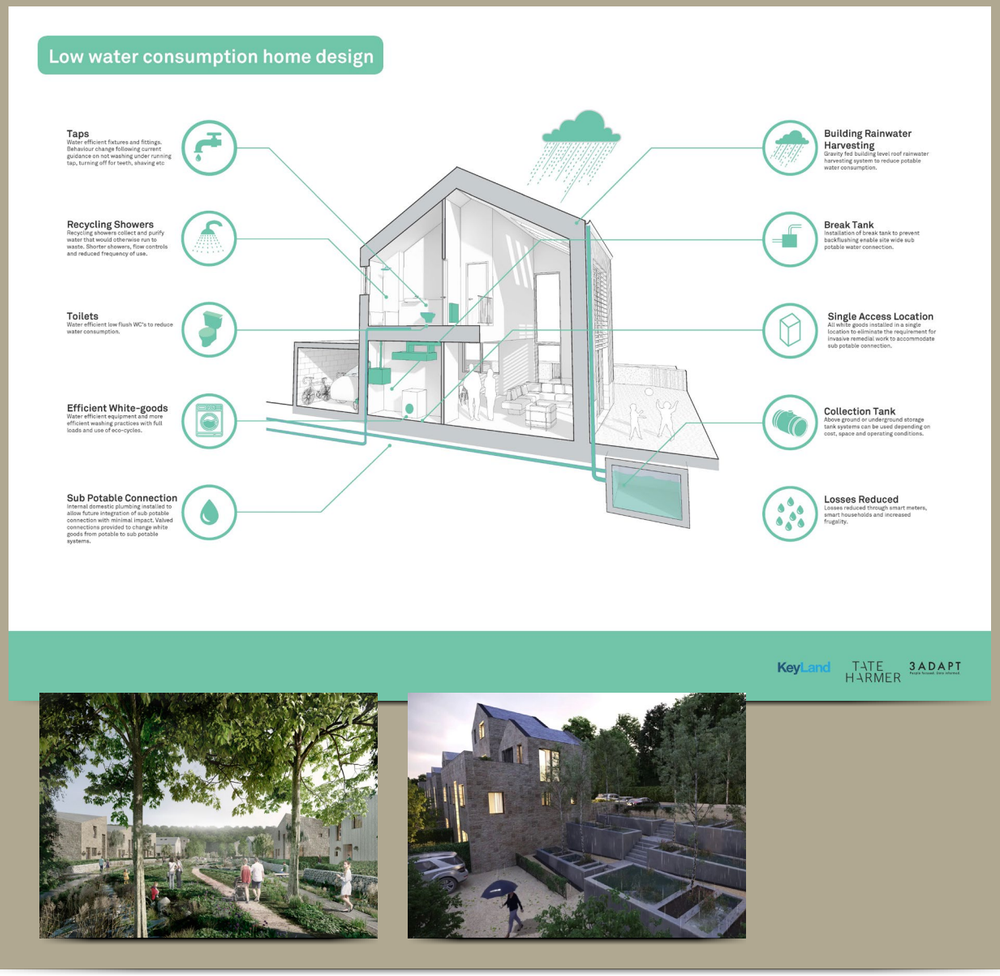
Blackwater recycling systems avoid these problems by recycling sewage within a local treatment facility and resupplying it to homes for reuse. These schemes usually achieve the highest levels of water efficiency and can often be cheaper than installing new connections to the wastewater system in absolute terms. In addition, blackwater reuse systems do not require connection to the public sewerage system. This helps to reduce pollution and river damage associated with Combined Sewer Overflows (CSOs), which occur when the drainage system becomes overloaded and untreated effluent is discharged directly into rivers. Tightening building regulations to achieve a water consumption target of 85lpppd by 2050 will increase the economic viability of grey and black water recycling schemes as other types of water saving measures will need to be combined with water efficient fittings and fixtures.

[40] Greywater for domestic users: an information guide, Environment Agency, May 2011

CASE STUDY: Esholt, West Yorkshire

Image credit: Keyland Developments, 2020

Yorkshire Water, together with its sister company Keyland Developments, have proposed to redevelop redundant areas of its sewage treatment works at Esholt into a sustainable, mixed use development. The £100 million project will include businesses that can reuse the heat, power and water generated by the existing treatment works, along with 150 eco-homes that will promote ultra-low water use. The scheme aims to reduce per-capita consumption below 80l per day, through a combination of water efficient fixtures and fittings, behavioural change, rainwater harvesting and greywater recycling. Alongside this, the landscaping strategy has been designed to mimic natural drainage through the use of Sustainable Drainage Systems (SuDS), which include bio-retention water gardens, swales and balancing ponds.



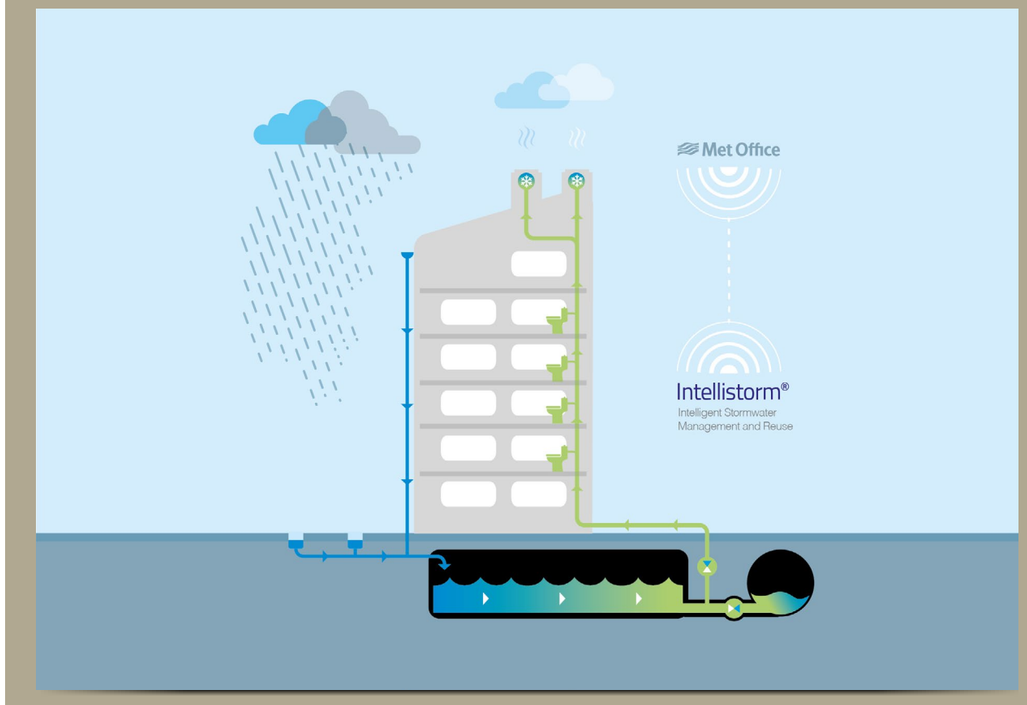
1.6. ADOPTING NEW TECHNOLOGY

The construction industry has historically been slow to adopt new technologies that can help save water. However, recent advances have been made through the introduction of the Water Technology List, which promotes user-friendly products that encourage sustainable water use. Businesses can offset the cost of these products against their taxable profits through the Enhanced Capital Allowance scheme.

CASE STUDY: Smart rainwater harvesting systems

Image credit: SDS, 2020

The major criticism of rainwater harvesting systems is that they can become full following periods of heavy rainfall and are therefore ineffective at managing runoff. However, smart rainwater harvesting, such as the SDS Intellistorm system (below) are now coming to market, which use Met-Office supplied weather prediction data to ensure that storage capacity remains available. When a storm is forecast, water in the tank is automatically discharged so that capacity is not exceeded when flooding risk is highest. Such systems are currently being rolled-out via water companies and have been approved by the Greater London Authority and City of London Corporation.



In order to bring new technologies to market and ensure widespread adoption, it is important that organisations developing these products work collaboratively with Government, consumers, and the housebuilding industry.

CASE STUDY: The Water Hub

The Water Hub is a collaborative initiative between Durham University, Durham County Council, the Environmental Agency, and Northumbrian Water. The Hub's aim is to help small businesses to develop innovative solutions to address societal challenges around water and the environment.

The first phase of the project, funded by the European Regional Development Fund, delivered support to small businesses through challenge events, partnership working, flexible small grants, and access to test facilities. Successes of the initiative include:

- Increased turnover of SME beneficiaries by 46%;
- Increased R&D spend in SME beneficiaries by 121%;
- Increased employment in SME beneficiaries by 14%;
- Delivered a return of at least £6.80 for every £1 of funding invested in the project.

The Water Hub has been a driver for change, enabling the sustainable use of the planet's natural resources through creating collaborations between its network of partners, businesses, and communities. It demonstrated the range of solutions that already exist to innovate in the water sector to improve water efficiency but also improve Sustainable Drainage Systems and manage flooding. Pitch events were designed to promote uptake of new technology and these led to increased adoption of novel solutions in partner organisations.

1.7. RETROFITTING & ACHIEVING WATER NEUTRALITY

Given that the majority of the homes that will be standing in 2050 have already been built, retrofitting existing properties will be crucial in reducing overall water consumption.

Analogous to carbon neutrality, water neutrality is based on the concept that new development should not result in a net increase in water use, instead, demand from new homes is offset by making existing homes more efficient[41]. Retrofitting existing properties with water saving technology forms the foundation of effective water neutrality programmes. Development within water stressed areas, such as the Oxford-Cambridge Arc, will provide opportunities for implementation of the water neutrality concept at scale.

Completion of water efficiency audits can also support the goal of achieving water neutrality. Many water companies offer complimentary audits to customers, and we recommend continued expansion of these programmes. Along with smart-metering, efficiency audits are important for identifying leaks and encouraging behaviour change. Thames Water's Smart Home Visits programme is free to the consumer and includes retrofit of water saving devices, internal leak fixes, and development of a personalised water savings plan.

Although beyond the scope of this inquiry, embodied water use, i.e. the water that is used in making a building or structure, can also be significant. Embodied water includes the resources associated with the extraction, processing, transportation, and assembly of materials within a building. This merits further investigation prior to finalisation of the scope for the Future Homes Standard.

[41] Water Neutrality: An improved an expanded water resources management definition, Environment Agency, October 2009

1.8. INCENTIVISING BEHAVIOURAL CHANGE

Following publication of our first Bricks and Water inquiry the WSBF held a roundtable on Valuing Water and Behavioural Change, which was chaired by Angela Smith MP[42]. This session identified that public awareness around water scarcity is low – indeed, when polled by the Consumer Council for Water, 73% of respondents were confident that their supply would be available long term, without restriction[43].

This lack of awareness of the significant pressure on water supply, combined with habitual over-consumption makes it difficult to change attitudes towards water. Through discussion with academics and behavioural psychologists, we identified that the optimal time for effective communication is during a period of change, such as when someone moves house. Measuring the 'water performance' of a building whenever a home is sold or rented, could therefore be an effective way to promote water saving behaviours, for example during any internal works carried out to a newly purchased home.

Alongside this, water companies should not neglect their statutory duty to promote efficient use of water by their customers. Water bills should be used as a tool for 'nudging' consumers towards water-saving behaviour. In addition, greater attention and funding should be given to industry wide campaigns such as 'Love Water', which has seen little promotion since its launch.

1.9. BENEFITS OF WATER EFFICIENT HOMES

Reducing personal water use has other environmental and financial benefits that consumers should be made aware of. Improved water efficiency reduces not only water bills, but energy bills too. Heating water for cooking and personal washing is the second biggest use of household energy (behind space heating) and produces a quarter of the total CO_2 emissions from our homes[44].

Research by the Energy Saving Trust[45] indicates that reducing per-capita consumption to 100lpd would save households an average of £37 per year and would reduce CO_2 emissions by 48.1 megatons over 25 years. This would be significant given that carbon emissions associated with water use make up 6% of the UK's total[46] and the majority of this comes from heating water for domestic use[47]. Communications with consumers should make clear the link between saving water and saving energy, along with the associated reduction in bills. Linking a proposed water efficiency label for white goods, such as dishwashers and washing machines, with the existing product energy label could help to promote this.

By adopting the measures set out within this chapter we can help mitigate the causes of climate change by reducing the CO_2 emissions associated with pumping, treating, and heating water.

[42] Do the public care about water and flooding?, Westminster Sustainable Business Forum, November 2018
[43] Water matters highlights report 2018/19, Consumer Council for Water, June 2019
[44] Quantifying the energy and carbon effects of water saving: full technical report, Energy Saving Trust & Environment Agency, April 2009
[45] Independent review of the costs and benefits of water labelling options in the UK: extension project, Energy Saving Trust, October 2019
[46] At home with water, Energy Saving Trust, July 2013
[47] Greenhouse gas emissions of water supply and demand management options, Environment Agency, July 2008

CHAPTER TWO

TOO MUCH WATER

2. Too Much Water

> When we talk of flood control, we usually think of dams and deeper river channels, to impound the waters or hurry their run-off. Yet neither is the ultimate solution, simply because floods are caused by the flow of water downhill. Strip the hills, drain the bog lands, and you create flood conditions inevitably. Yet that is what we have been doing for years.
>
> Hal Borland, American Author

Warmer, wetter winters and more frequent summer storms are making flood events commonplace. On 7th November 2019, many parts of the UK received more than the monthly average amount of rainfall in a single 24-hour period[48]. This resulted in rivers throughout the Midlands and Yorkshire bursting their banks and flooding local communities. Storms Ciara and Dennis subsequently hit in February 2020, causing widespread flooding across England and Wales and resulting in several direct fatalities. The Association of British Insurers estimated the damage to exceed £360 million, the highest repair bill since storms Desmond, Eva, and Frank caused £1.3 billion of damage in 2015[49].

Flood risk is exacerbated by population and housing growth. One in six properties in England are at risk of flooding[50] and since 2013 there have been 85,000 new homes[51] built within flood zone 3[52], the area with the highest risk of flooding from rivers or the sea. Aside from the direct risks to development within the floodplain, the addition of buildings and hard surfaces increase the amount of surface water entering the drainage system, in turn increasing the risk to vulnerable properties downstream.

Traditional flood defences are costly and carry residual risks. In the 2020 Budget the Chancellor announced an investment of £5.2 billion over six years for flood and coastal defences in England[53]. However, this falls short of the £1 billion per year estimated by the Environment Agency as the optimal, long term average level of investment[54]. It will not be possible to protect everyone from all sources of flooding and difficult decisions will have to be made as to which areas are prioritised.

Homes can be adapted to mitigate these risks. Flooding is not a problem specific to riparian or coastal communities. It can derive from a wide variety of sources including surface water runoff, high groundwater, sewer surcharge, or failure and overtopping of defences, amongst others. Property Flood Resilience (PFR) measures make homes more resilient to these events by reducing the costs of restoration following a flood and allowing buildings to be re-occupied more quickly.

In this chapter we explore how property flood resilience measures can not only make homes resilient to a changing climate, but also how wider uptake can help vulnerable communities with access to affordable home insurance.

[48] Briefing note: severity of the November 2019 floods - preliminary analysis, UK Centre for Ecology and Hydrology, November 2019
[49] Insurance pay outs to help customers recover from storms Ciara and Dennis set to top £360 million (news article), Association of British Insurers, March 2020
[50] Flooding in England: a national assessment of flood risk, Environment Agency, 2009
[51] Land use change statistics 2013-2018, MHCLG, 2019
[52] Flood zone 3 is defined as assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any given year
[53] Budget 2020: delivering our promises to the British people, HM Treasury, March 2020
[54] Long term investment scenarios 2019, Environment Agency, May 2019

2.1. POLICY CONTEXT

The National Planning Policy Framework[55] states that "Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk". However, the Government's aim to deliver 300,000 new homes per year by the mid-2020s is putting unprecedented pressure on Local Planning Authorities (LPAs) to allocate land for development and to grant planning approval for new homes even in floodplains.

The Environment Agency has made an economic assessment of the damage to property associated with future planning policy scenarios[56] (i.e. no new development, current planning policy, and weakened planning policy). This analysis demonstrates that the increase in damages associated with the 'current planning policy' scenario would be limited to 4%, providing new development is predominately located within areas of low flood risk (i.e. causing limited damage) and mitigation measures (e.g. raised floor levels) are adequately specified. However, recent work by the Committee on Climate Change[57] has highlighted evidence of non-compliance with planning conditions to mitigate flood risk, and inadequate use of protection measures.

Given the Government's current housebuilding targets it is unrealistic to expect that planning policy will be tightened to preclude all new development on the floodplain. Indeed, the location of essential infrastructure in these areas may be appropriate, subject to adequate mitigation measures. Furthermore, evidence submitted as part of this inquiry indicates that Local Planning Authorities are reluctant to object to individual planning applications on the basis of flood risk, given that these decisions are often overturned by the Planning Inspectorate on appeal, leaving the Local Planning Authority liable for costs. Finally, Local Planning Authorities have limited capacity to consider the effects of applications cumulatively and to understand the impacts that new development can have on the catchment as a whole.

Within our first Bricks and Water inquiry we highlighted that Local Planning Authorities (LPAs) and Lead Local Flood Authorities (LLFAs) are struggling with a lack of funding and expertise. We also identified a need for leadership at the sub-national (or catchment) level and recommended that expertise from LPAs and LLFAs is brought together within existing Catchment Partnerships.

Recommendation 6: Government (through MHCLG) should grant greater powers to Catchment Partnerships, especially with regard to issues surrounding flooding. These bodies should act as a statutory consultee to the planning process and ensure that flooding and drainage issues are considered holistically across the catchment.

[55] National planning policy framework, MHCLG, June 2019
[56] Long term investment scenarios 2019, Environment Agency, May 2019
[57] Progress report in preparing for climate change: 2019 report to Parliament, Committee on Climate Change, July 2019

2.2. THE PROBLEM: ACCESS TO AFFORDABLE HOME INSURANCE

The Flood Re scheme was developed between Government and the insurance industry to make home insurance available and affordable in areas at risk of flooding. Insurers pass the flood risk element of the insurance policy to Flood Re, which reimburses the insurer if a claim is made. The scheme is funded through an insurance industry levy, which insurers sometimes pass on to consumers through higher general premiums.

To avoid incentivising new development on the floodplain, Flood Re is only available to properties built before 1st January 2009. However, the number of homes at high[58] risk of flooding has more than doubled since 2013[59]. Furthermore, in their 2019 Progress Report to Parliament, the Committee on Climate Change found 'no evidence' that this cut-off date has influenced where new development is located[60]. Research carried out by think tank Bright Blue[61] estimates the amount of uninsurable (post-2008) homes in areas at high risk of flooding in England at 20,000, with this number rising to 70,000 if properties that benefit from protection by flood defences are included. This suggests that either the Government needs to either make planning policy more robust, to preclude development on the floodplain (which is unlikely to be practicable), or review the eligibility criteria of Flood Re.

In addition to its re-insurance obligations, Flood Re plays a role in managing the transition of the insurance market to affordable and risk-reflective pricing by 2039, at which point it will be withdrawn[62]. To transition to this point, Flood Re has committed to incentivising measures that would reduce insurance premiums for homes in areas at risk of flooding[63]. The most effective way of doing this is installation of property flood resilience measures that reduce the cost associated with restoring a property after a flood.

The winter flooding of 2019/20 also highlighted the number of vulnerable properties that remain un-insured. There appear to be various reasons for this, including a lack of understanding around flood risk and a lack of awareness around eligibility for Flood Re (which isn't available to commercial properties, mixed use buildings, some flats, and properties constructed on or after 1st January 2009). In December 2019 the former Environment Secretary, Theresa Villiers, announced the initiation of a review[64] into flood insurance. This will be led by the former Chair of the Association of British Insurers, Amanda Blanc, and will seek to identify why so many households had insufficient insurance during the 2019 floods.

Recommendation 7: Given the limited uptake of property flood resilience measures and continued development within the floodplain, Government should either extend the Flood Re scheme to cover residential buildings constructed after 1st January 2009, or put in place an alternative scheme. This should be evaluated as part of the ongoing Blanc review into flood insurance.

[58] Within Flood Zone 3 (1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any given year)
[59] Land use change statistics 2013-2018, MHCLG, 2019
[60] Progress report in preparing for climate change: 2019 report to Parliament, Committee on Climate Change, July 2019
[61] High and dry: preventing tomorrow's 'flood ghettos', Bright Blue, February 2020
[62] Our vision: securing a future of affordable flood insurance, Flood Re, July 2018
[63] Regulation 27: quinquennial review, Flood Re, July 2019
[64] Review into insurance cover following recent flooding (press release), DEFRA, December 2019

2.3. THE SOLUTION: PROPERTY FLOOD RESILIENCE

As we highlighted in our first Bricks and Water inquiry, it will not be possible to protect all communities from flooding. Even where defences do exist, there remains the residual risk of flooding from breach or overtopping of these structures.

Property flood resilience describes the measures that can be taken at the household-level to reduce the risk to people and property from flooding. In general these interventions can be subdivided into resistance measures (i.e. those that keep water out) and recoverable measures (i.e. those that limit the damage caused if water does enter a building), hereafter collectively referred to as property flood resilience (or resilience measures).

Property flood resilience reduces the costs associated with building restoration and allows homes to be re-occupied more quickly following flood events. Retrofitting homes with resilience measures will also be crucial in providing the insurance industry with the confidence required to keep premiums affordable following the withdrawal of Flood Re in 2039. A way of tracking home adaptations will also need to be developed in order to demonstrate to insurers that resilience measures remain in place and are operating effectively at the time of policy renewal.

However, resilience measures are only being installed at a fraction of the pace required to make vulnerable communities insurable once Flood Re is withdrawn. The Committee on Climate Change[65] has found that to coincide with the withdrawal of Flood Re, resilience measures should be installed at a rate of around 9,000 properties per year. Current deployment is around 415 properties per year, far short of what is required to adapt to even a 2°C warming scenario.

Property flood resilience measures for residential buildings come in a wide range of forms, and many will only be appropriate for properties of a certain age, type, or construction. Resilience measures work best when installed as a package and are most cost-effective when completed alongside home improvement work or during restoration following a flood. Ideally, they should be implemented as part of a wider flooding strategy for a building, in which residents sign up for flood warnings and alerts provided by the Environment Agency, and develop a Flood Plan. This allows time for active measures, such as gates and doors to be deployed, valuables to be relocated to upper floors, and vehicles to be moved to higher ground. Commonly installed resilience measures are set out in Figure 2.1. A key challenge will be the development of flood alerts and warnings to inform residents of impending surface water flooding, as surface water alerts are not currently provided by the Environment Agency. Risks from surface water flooding are often more site-specific and can vary due to a range of factors including the nature of surface coverings, local topography, and the condition of existing surface water drains.

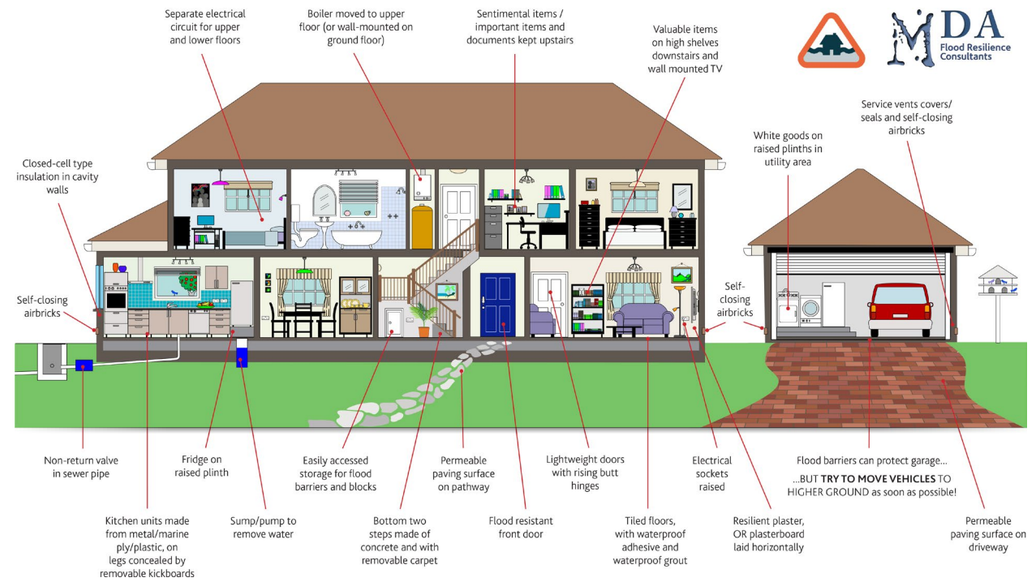
Recommendation 8: Part C of building regulations should be updated to require all properties at risk of flooding to include property flood resilience measures. These measures should be specified and installed in accordance with the industry Code of Practice for property flood resilience.

[65] Progress report in preparing for climate change: 2019 report to Parliament, Committee on Climate Change, July 2019

Figure 2.1

Flood Resilience Measures

Image credit: Mary Dhonau Associates, 2020



CASE STUDY: The property flood resilience code of practice

Looking to capitalise on the provision of Government grants to affected communities in the aftermath of storms Desmond, Frank, and Eva in 2015/16, a significant number of rogue traders entered the market and drove down standards in the flood resilience industry. The Code of Practice for property flood resilience was initiated through DEFRA's Property Flood Resilience Action Plan, to help improve standards and restore market integrity.

The Code was launched earlier this year and sets out a framework for homeowners, designers, and planners who want to implement resilience measures. The framework for the Code is based around six standards, representative of best practice.

1) Hazard assessment – completion of a Flood Risk Assessment (FRA), proportionate to level of risk and size of the property.
2) Property survey – determination of the construction type of the property, its current level of flood resilience, ground conditions and options for drying and decontamination.
3) Options development – identification and consideration of the most appropriate options to restrict water entry and to make the building more recoverable.
4) Construction – completion by a qualified person and undertaken to deliver the benefits identified within the options development standard.
5) Commissioning and handover – demonstration that the measures installed will operate efficiently and as designed. Preparation of a handover pack to allow the nominated person to deploy the system.
6) Operation and maintenance – justification that the measures installed remain suitable and are maintained appropriately so they can be deployed efficiently following a flood event.

CASE STUDY: Practical application of property flood resilience measures

In Summer 2019 specialist flood consultant, Mary Dhonau, undertook a review of homes and businesses who have suffered from flooding and have subsequently made adaptations to help them recover more quickly.

One of many case studies included in this review was that of 'Clare in Todmorden', West Yorkshire, who had no idea that her cottage was at risk of flooding and no knowledge of the nearby river overtopping its banks. Her property flooded in 2006 and 2015, when contaminated floodwater entered through the doors, walls, and floors. After the 2015 event she installed a variety of flood resilience measures including 'tanking' of the ground floor with a waterproof membrane, insulating foam, and concrete. Walls to the property were rendered in a resilient material and flood doors bearing the BSI Kitemark were installed by a builder with knowledge of flood resilient repair.

In February 2020 these measures were put to the test when storms Ciara and Dennis hit, causing yet another flood. Mary Dhonau returned to interview Clare, who confirmed that the work had been successful:

"I had water up the outside of the house as high, if not higher than the previous times our house has flooded. This was the first time it had flooded this badly since we had had all the work done, so was its first proper test. The tanking held. The PVC flood doors held. The concrete floor held. Instead of standing in half a foot of water inside I just had a dribble coming in where some wires went through the wall to the meters outside. It was getting through at a speed at which I could mop it up. In end I had a third of a mop bucket of water instead of a £25,000 insurance claim. Couldn't be more happy."

2.4. BARRIERS & INCENTIVES TO UPTAKE

In order to facilitate uptake of property flood resilience measures at scale it will be crucial to understand the barriers to adoption and how the public can be incentivised to take action.

2.4.1. BARRIERS

Research by the Social Market Foundation[66] explored the barriers to uptake of property flood resilience and found that they typically occur at three stages in the decision making process:

1. Motivation – households need to understand the risk of flooding to their property and acknowledge that they are responsible for protecting it.
2. Ability to access and assess information – households need information on the various products that are available and to be able to weigh the costs and benefits of installing them.
3. Take action – households need to act on available information and have the financial resources to do so, unhindered by behavioural biases.

[66] Incentivising household action on flooding: options for using incentives to increase the take up of flood resilience and resistance measures, Social Market Foundation, March 2018

Within our first Bricks and Water inquiry we drew attention to the lack of public understanding around flood risk. A follow-up roundtable session[67] to the inquiry identified that the public find messaging around flood risk confusing. In particular, the way annual probabilities are framed ('1 in 100 year flood') leads to underestimation of the risk and subsequent under-investment in flood resilience measures. DEFRA's research into Public Dialogues on Flood Risk Communication[68] also highlighted the problems associated with talking in mathematical language and the need for better clarity around risk and impacts from flooding.

Only around one-third of homeowners know the flood risk of their property[69]. The Pitt Review[70] into the summer 2007 floods recommended that flood risk should be made part of mandatory search requirements when a home is purchased, so that the new owner is not left unaware. This information was briefly included within Home Information Packs, which were withdrawn in 2010.

Recommendation 9: Information on flood risk obtained as part of the conveyancing process should be made more specific, understandable, and useful. This should include provision of a map showing the risk of flooding from a variety of sources and details on eligibility to participate in the Flood Re reinsurance scheme.

CASE STUDY: The Yorkshire property flood resilience pathfinder project

The City of York Council has received Government funding to boost uptake of property flood resilience as part of one of three Pathfinder Projects set up by DEFRA. The initial phase of this work seeks to identify barriers to the uptake of resilience measures within vulnerable communities.

With support from academics and third party consultants, the project aims to empower and encourage the public to adopt resilience measures through community engagement. Following the onset of the COVID-19 pandemic, online activities have been developed to facilitate this, including a website, online training, and social media campaigns. The website will signpost to resources providing information on risk awareness and the implementation of property flood resilience measures. In recognition that every community is different, training materials will be developed that are appropriate to the specific context and audience.

The project runs until March 2021

[67] Is our approach to flooding working?, Westminster Sustainable Business Forum, February 2019
[68] Public dialogues on flood risk communication, DEFRA, December 2015
[69] Six out of ten people admit to never checking their flood risk (news article), Landmark Information Group, November 2019
[70] The Pitt review: lessons learned from the 2007 floods, Sir Michael Pitt, June 2008

2.4.2. INCENTIVES

Grant funding (i.e. from central or local Government and charities) is commonly available to affected communities in the wake of significant flood events. Grants to individual homeowners typically range in value from £1,000 to £10,000, and funds can be put towards property restoration and installation of property flood resilience measures. However, many of these schemes, such as the £5,000 grant offered to those affected by flooding in England in November 2019, have been criticised for their restrictive qualifying criteria. For example, applications could be refused on the basis of the date of flooding, the location of the property, or the number of homes flooded in a given area.

As part of its commitment to transitioning to a risk-reflective insurance market, Flood Re has proposed a number of changes to the way home insurance is provided[71], which would further promote the uptake of property flood resilience measures. These include:

1. Offering discounted premiums for the proactive installation of property flood resilience measures.
2. Implementation of the 'Build Back Better' scheme, whereby a claim would not only pay for like-for-like refurbishment but would include a payment of up to £10,000 for uptake of resilience measures in order to reduce the cost of repairing future flood damage to the property.
3. Changes to Flood Re's statutory objective to include transition to both risk-reflective and affordable pricing for household insurance.

In July 2020, the Government announced that discounted premiums and the Build Back Better scheme would be approved, subject to consultation[72]. The WSBF agrees they should be approved.

2.5. BENEFITS OF FLOOD RESILIENT HOMES

The most direct benefits of flood resilience are the access to affordable home insurance and the reduced cost associated with restoration following a flood. However, accurately weighing the cost-benefit of installing resilience measures can be challenging because the costs of flooding often go beyond the financial implications of replacing possessions and restoring a property. Indirect costs of flooding include those associated with finding temporary accommodation, absence from work, post-traumatic stress, and travel expenses. Although some progress has been made as part of the Environment Agency's Funding Partnership Calculator[73], many costs remain difficult to measure including poor physical and mental health, and fear of future flooding.

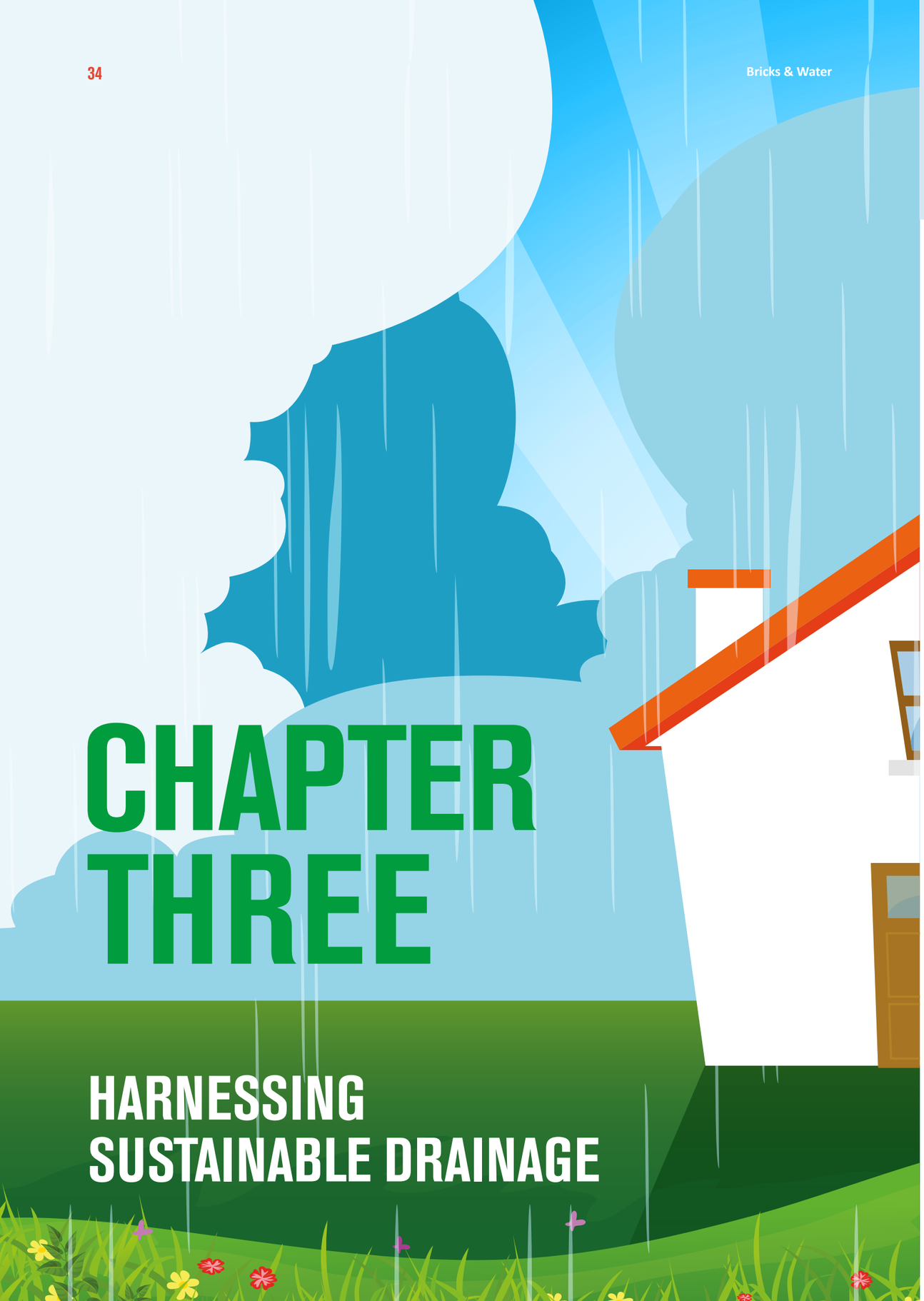
Research by DEFRA[74] identified a number of property flood resilience measures defined as 'low cost', or 'low additional cost' that could pay for themselves after just one subsequent flood event. The Committee On Climate Change[75] has indicated that it would currently be cost-effective to install flood resilience measures in at least 153,000 properties, with this number rising to 217,000 by the time Flood Re is due to be withdrawn.

[71] Regulation 27: quinquennial review, Flood Re, July 2019
[72] Multi-billion pound investment as Government unveils new long term plan to tackle flooding (press release), DEFRA, July 2020
[73] FCRM Partnership Funding Calculator, Environment Agency, February 2014
[74] Supporting the uptake of low cost resilience: summary of technical findings, DEFRA, July 2016
[75] UK Housing: fit for the future?, Committee on Climate Change, February 2019

CASE STUDY: The Home for All Seasons

The Home for All Seasons is an award-winning concept in resilient building design by JTP and The Environmental Design Studio. The home is designed to be resilient to extreme weather conditions including flooding, overheating, and extreme cold. The concept is centred around an avoidance-based approach to property flood resilience with habitable zones positioned on the first floor level and above to ensure a future proof, high flood datum design. The building's minimal hardstanding 'footprint' limits the displacement of water to surrounding areas and enables clear conveyance channels to reduce the risk of any backlogging. Its ground floor area includes a multi-use 'garden room', which can be quickly cleaned and restored following a flood. The utilities (e.g. power/water) are also elevated and embedded in the first floor 'causeway' to ensure continuity of services before, during and after a flood event. Following flood warnings, residents would be encouraged to move their vehicles to safe zones and to reoccupy their homes via the raised causeway. The scheme's avoidance-based property flood resilience strategy and recoverable materiality (in at-risk zones) means that restoration costs are likely to be minimal, residents would not be displaced and the flood risk to surrounding areas is not exacerbated.

A site-specific sustainable drainage strategy ensures that runoff is managed according to the site's location within the catchment, whilst also providing green space and amenity. The home also offers wider benefits including measures to reduce overheating during summer (through passive stack ventilation up through its high thermal mass ground floor zone) and high-quality insulation / air tightness to ensure comfort during winter.



CHAPTER THREE

HARNESSING SUSTAINABLE DRAINAGE

3. Harnessing Sustainable Drainage

> **For after all, the best thing one can do when it is raining, is to let it rain.**
>
> Henry Wadsworth Longfellow, American Poet

The proliferation of dense, urban catchments and the conversion of green space to artificial surfaces can cause increased surface water flooding. Runoff from roofs and hardstanding enters the drainage system sooner, having not soaked into the ground, and can lead to flooding in receiving watercourses.

The use of Sustainable Drainage Systems (SuDS) helps to alleviate flooding by slowing, storing, and re-using rainfall close to where it falls. SuDS work best as part of an Integrated Water Management (IWM) approach, which coordinates the management of water at a broad scale, across the natural and built environment. Similarly, the use of SuDS can also form part of Natural Flood Management (NFM) techniques that work with natural processes to slow, store, disconnect, and filter[76] water as it moves through the catchment.

The benefits delivered by different SuDS schemes vary widely. In a recent review of SuDS delivery, 96% of Lead Local Flood Authorities (LLFAs) reported that the quality of the submissions they received was 'inadequate' or 'mixed'[77]. Hard SuDS, such as subsurface geocellular storage, are too frequently used to fulfil planning requirements for new developments. The highest quality SuDS not only manage water quantity, but also improve water quality, enhance biodiversity, and provide amenity and health benefits as part of a multi-functional approach[78]. The health and well-being benefits of green spaces around buildings have been demonstrated during the COVID-19 crisis – particularly for householders without access to private gardens.

In this chapter we review the benefits of adopting high quality SuDS in new developments and for retrofitting existing homes.

[76] Retrofitting for flood resilience: a guide to building and community design, E. Barsley, January 2020
[77] Achieving sustainable drainage: a review of delivery by lead local flood authorities, Landscape Institute, January 2019
[78] The SuDS manual, CIRIA, December 2015

3.1. POLICY CONTEXT

Schedule 3 of the Flood and Water Management Act (FWMA) calls for the mandatory use of SuDS in new developments. In January 2019 the Welsh Government introduced legislation under the FWMA that required SuDS for developments of more than one dwelling. Under this legislation, drainage systems for new development must be designed and built in accordance with statutory SuDS standards and schemes must be approved by the Local Planning Authority prior to commencement. In contrast, parallel legislation was never enacted in England, and adoption of SuDS on a voluntary basis has been slow.

2018 Revisions to the National Planning Policy Framework[79] for England require the use of SUDS on major developments and within areas at risk of flooding. Whilst these changes are welcome, the specification of SuDS is still delivered through local policy on a non-statutory basis, using DEFRA's Non Statutory Technical Standards[80]. There remains wide variability in local SuDS policy across England, and 25% of Lead Local Flood Authorities have no formal policy and no plans to implement one[81]. Developers responding to this inquiry noted that this lack of consistency made it difficult to plan for the incorporation of SuDS when assessing the viability of a proposed development project.

Recommendation 10: The use of SuDS for all new developments in England should be made mandatory under Schedule 3 of the Flood and Water Management Act.

Recommendation 11: Non Statutory Technical Standards for the design, operation, and maintenance of SuDS, currently under review by DEFRA should include requirement for SuDS systems to incorporate multi-functional benefits as set out within the SuDS Manual[82].

Recommendation 12: Lead Local Flood Authorities should provide information for developers, detailing the range of SuDS components available, along with guidance for design and adoption to meet Local Planning Authority requirements.

3.2. MANAGING SURFACE WATER RUNOFF

A variety of SuDS components can be used to manage surface water, and some systems will be more effective than others in certain contexts. Some SuDS components are likely to be more appropriate for new development sites, and others when retrofitting existing properties. The use of some SuDS can be appropriate for both.

[79] National planning policy framework, MHCLG, June 2019
[80] Non-statutory technical standards for sustainable drainage systems, DEFRA, March 2015
[81] Achieving sustainable drainage: a review of delivery by lead local flood authorities, Landscape Institute, January 2019
[82] The SuDS manual, CIRIA, December 2015

3.2.1. NEW BUILD

New-build can offer the best opportunities for incorporation of high quality SuDS that provide multifunctional benefits. Consideration of SuDS for new developments should be undertaken as early as possible in the planning process and should follow the design methodology set out within the SuDS Manual[83]. This involves setting 'strategic surface water management objectives' to comply with local and national policies, before refining the scheme through conceptual, outline, and detailed design stages. SuDS components should be selected that are most appropriate to the characteristics of both the site (e.g. topography, geology, watercourses) and the proposed development (e.g. infrastructure, building design, maintenance arrangements). The following table includes a non-exhaustive list of SuDS components that can be appropriate for new developments.

Table 3.1 SuDS Components for use in New Development

Component	Description
Conveyance	
Swales	Vegetated channels that usually run parallel to roads. Swales store and convey water following periods of heavy rainfall and can either be 'wet' (i.e. containing water permanently) or 'dry' (i.e. where a sub-surface pipe channels water to an outfall). Swales can also infiltrate water and remove pollutants.
Filtration	
Filter strips	Sloping, vegetated strips of grass that slow the movement of surface water and remove particulate matter through filtration. Filter strips typically connect to other SuDS, such as swales or discharge to a watercourse.
Filter trenches	Shallow channels filled with granular material that filter surface water and remove pollutants.
Bioretention systems	Landscaped areas often located adjacent to areas of hardstanding that filter contaminants from surface water and allow infiltration.
Infiltration	
Soakaways	Square or circular excavations that receive surface water to soak into the ground, recharging underlying groundwater. Soakaways can be individual or linked together to drain larger areas.
Infiltration basins	Vegetated depressions that infiltrate larger volumes of surface water than traditional soakaways.
Retention & Detention	
Detention basins	Large, grass covered areas that are dry under normal conditions and can function as recreation areas, but fill with water during storm conditions to store runoff.
Balancing ponds	Ponds that receive and store surface water before discharging it to a watercourse at a regulated rate. Balancing ponds can also incorporate areas of organic treatment, such as reed beds and marginal areas of planting.
Geocellular storage	Subsurface modular systems that are used to store surface water runoff before discharging it to a soakaway or watercourse.
Wetlands	
Wetlands	Densely vegetated water bodies and marshy areas that remove sediments and filter contaminants. Due to their significant amounts of vegetation, wetlands also intercept rainwater and aid evapotranspiration.

[83] The SuDS manual, CIRIA, December 2015

Given the variety of options for incorporating SuDS into new developments, connection to the surface water drainage network should only be necessary in exceptional circumstances. Removal of the automatic right for a new development to connect to public surface water sewers was a recommendation of the Pitt Review following the 2007 floods, but was never actioned. However over the last decade the application and cost effectiveness of SuDS has been widely demonstrated, including by DEFRA, who identified that the capital costs associated with SuDS are, in general, significantly cheaper than installation of traditional drainage systems[84].

Recommendation 13: The automatic right for a new development to discharge surface water to existing public sewers should be removed, in accordance with recommendation 10 made within the 2008 Pitt Review, which is now cost-effective to implement.

3.2.2. RETROFIT

New developments usually provide the best opportunities for strategic management of surface water so that runoff from the site does not exceed the Greenfield Runoff Rate (i.e. the rate at which water would runoff the site under pre-developed conditions). However, where existing homes connect to either the surface water drainage network or combined sewers (i.e. receiving both foul and surface water) there can be significant benefits associated with retrofitting SuDS. Retrofit options at the property-level typically involve 'source control' systems, which manage surface water where it falls, rather than discharging it to a site-wide system. Even where flooding from surface water is not a significant issue, retrofitting SuDS within existing homes offers the potential to 'offset' impacts from surface water flooding elsewhere in the catchment.

The following table includes a non-exhaustive list of source control components, which can be retrofitted into existing properties, but may also be appropriate for adoption in new developments".

Table 3.2 SuDS Components for Retrofit

Component	Description
Green roofs	Vegetated surfaces that intercept rainwater and reduce the amount of surface water runoff from a building. Green walls can also be created, which often include addition of creeping plants
Rain gardens	Small scale bioretention systems created by disconnecting existing downpipes from roofs so that they discharge into areas for planting, rather than to the surface water drainage system.
Rainwater harvesting	Water collection systems that harvest rainwater from roofs into above or below ground tanks for re-use. At the simplest scale, this can involve collection of rainwater within water butts for re-use in garden watering. Problems associated with tanks becoming full and ineffective during wet periods can now be overcome through 'smart' systems (see section 1.6).
Permeable paving	Surfacing that allows rainwater to infiltrate into the underlying geology as it would under pre-developed conditions. Systems can either allow water to filter directly into the ground or can capture water within permeable sub-base before discharge.

[84] Water availability and quality programme: comparative costings for surface water sewers and SuDS, DEFRA, February 2011

These SuDS options can provide opportunities for homeowners to remove their property's surface water connection to the public sewer. Where this can be adequately demonstrated, water companies are obliged to offer a rebate against the fees charged for surface water disposal, which can provide modest incentives for action. Local government could add additional financial incentives, through targeted programmes such as downpipe disconnection schemes, as has successfully demonstrated in Oregon, USA and Devon, UK.

Figure 3.1
Residential property, pre-SuDS retrofit
Image credit The Environmental Design Studio

a Low Infiltration
b Fast Run-off Rates
c Drainage Network Capacity Exceeded

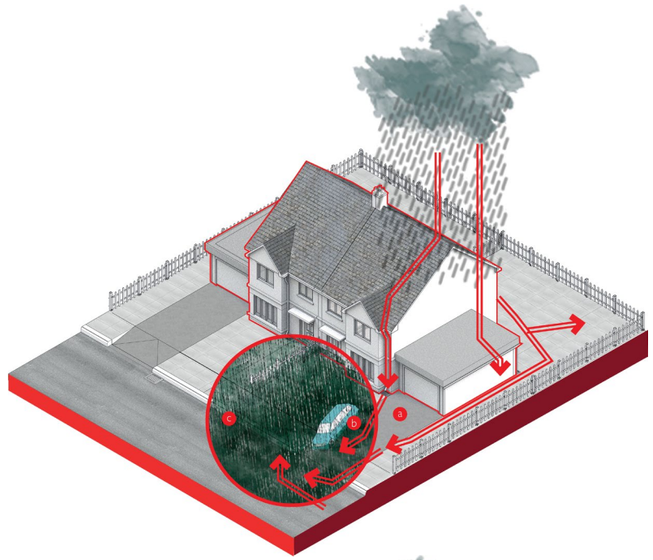
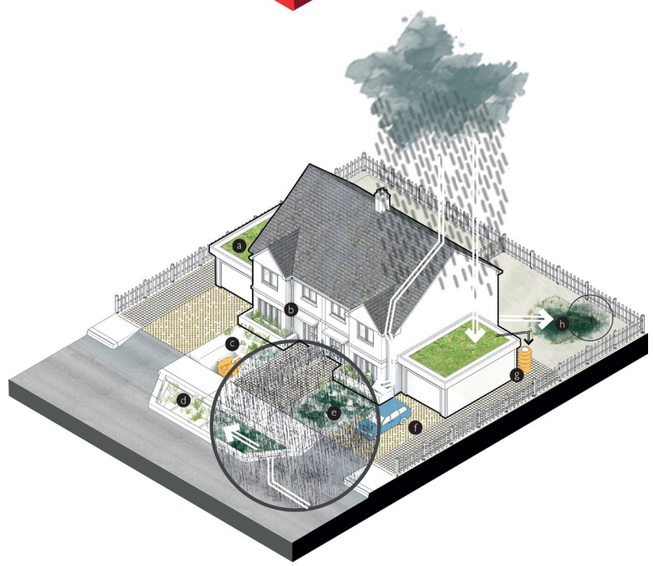


Figure 3.2
Residential property, post-SuDS retrofit
Image credit The Environmental Design Studio

a Green Roof
b Disconnected Downpipe
c Rainwater Harvesting Tank
d Bioretention Cell
e Raingarden
f Permeable Paving
g Water Butt
h Retention Pond



CASE STUDY: Downpipe disconnection programmes

The US city of Portland, Oregon, introduced its 'Downspout Disconnection' programme in response to repeated flood events associated with overloading of the combined sewerage network. The programme, which ran between 1993 and 2011, offered financial incentives to homeowners for redirecting the surface water from roofs into garden and yard areas. Over the duration of the programme it is anticipated that over 56,000 downpipes were disconnected, removing over 768 million gallons of water from the sewerage system. The City still offers detailed guidance for homeowners who would like to complete this work.

In 2017, South West Water ran a similar programme in the village of Aveton Gifford, which had experienced historic flooding issues associated with surface water runoff. South West Water offered "100% grants" for disconnecting downpipes and recycling water into filter drains, rain gardens, and planters.

Recommendation 14: In areas at risk of flooding due to overloading of the combined sewerage network, water companies should work with a range of partners including Lead Local Flood Authorities, Local Planning Authorities, Parish Councils and individual homeowners to implement property-level SuDS retrofit programmes.

3.3. ENSURING EFFECTIVE OPERATION

Soil quality can play a role in determining the effectiveness of SuDS[85]. The construction process can have a detrimental impact on soil quality through compaction, contamination, and addition of impermeable surfacing, thereby reducing the ability of the soil to absorb and transfer water.

Preservation and re-use of topsoil is crucial for maintaining effective drainage across a site, not just as part of SuDS such as swales, filter strips, and detention basins, but also within domestic gardens and areas of landscaping. Developers that carry out a Soil Resource Plan as part of a Materials Management Plan or Site Waste Management Plan can help to identify the most sympathetic techniques for protecting, stripping, stockpiling, and re-spreading topsoil in new developments, to preserve its drainage capability and avoid negating the benefits of SuDS[86].

3.4. ADOPTION & MAINTENANCE

Within our first Bricks and Water inquiry we highlighted challenges associated with the adoption and maintenance of SuDS. Depending on the nature of the scheme, these issues can fall to Local Planning Authorities, water companies, or property management companies. There remains no automatic path for the adoption of SuDS in England. However, Water UK have recently published Sewage Sector Guidance[87] that defines the mandatory criteria under which water companies should adopt selected SuDS and most water companies have signed up to this. Whilst this does not cover adoption of all SuDS components, it should allow for adoption of a wider range of SuDS found on new developments.

[85] Construction code of practice for the sustainable use of soils on construction sites, DEFRA, September 2009

[86] Within Bricks and Water (2018) we highlighted the wider environmental benefits of soil quality, particularly in the upper catchment, and recommended that this be placed high up the list of priorities for public subsidy in the scheme that will replace the Common Agricultural Policy. However, the focus of this inquiry is at the development-scale and therefore these issues fell outside of the scope for investigation.

[87] Sector guidance in relation to the adoption of sewerage assets by sewerage companies in England, Water UK, October 2019

Recommendation 15: All water companies should adopt SuDS where they meet the requirements of Code for Adoption Agreements, approved by Ofwat.

Where SuDS schemes fall outside this Code then water companies may be more inclined to adopt them if they have been consulted on their design at the planning application stage. Evidence submitted to this inquiry indicates that water companies would welcome the ability to comment on the design and construction of SuDS as part of new planning applications. However, there has been a reluctance to insist upon this, given the significant administrative burden that such a commitment can carry for the water companies themselves. Within our first Bricks and Water inquiry, we suggested that this burden could be minimised by adding a de minimis level for the size of a development (e.g. 10 units) that would trigger a water company consultation.

This approach could also pave the way for water companies to comment on wider aspects of a planning application linked to the urban water cycle, such as issues that could affect the catchment as a whole and water efficiency measures, especially within areas of water stress.

Recommendation 16: Water companies should be given statutory consultee status for 'major' development to enable them to comment on the suitability of SuDS schemes and work with developers to adopt a wider range of SuDS components.

3.5. COMBINED SEWER OVERFLOWS

Combined Sewer Overflows (CSOs) occur when the capacity of the combined sewerage system is exceeded during periods of heavy rainfall, and dilute effluent is discharged, untreated, to rivers and streams. Even new developments, which must have separate surface and foul sewer networks, may exacerbate this problem if the surface water from the development connects into the combined system downstream. The current planning and regulatory systems fail to address this, because they incentivise new developments to discharge into regional systems that often include sewer overflows rather than through local, community-based wastewater treatment and resource recovery centres.

Recommendation 17: Through opening existing water and sewerage company cross subsidies to the market, Ofwat should review the way that it incentivises discharge of wastewater to the public sewerage system, which should avoid exacerbating pollution incidents associated with CSOs. Costs for discharge to local treatment systems should benefit from this market and more accurately reflect the wider benefits associated with reduced flooding, improved surface water quality, water recycling, and reduced energy use.

3.6. BENEFITS OF INCORPORATING SUSTAINABLE DRAINAGE

Within this chapter we have highlighted the benefits that SuDS can provide in managing surface water runoff, reducing flood risk, and improving water quality. However, the use of SuDS provides a host of wider benefits including biodiversity net-gain, reducing urban overheating, improvements in air quality, carbon sequestration, traffic calming, and increased aesthetics, amongst many others[88].

[88] Integrating green and blue spaces into our cities: making it happen, Imperial College London Grantham Institute, July 2019

Perhaps the most important upside to the use of SuDS is the amenity and health benefits associated with the addition of green spaces. Landscaped areas, ponds, and wetlands can add to the desirability of a development, provide areas for sports and recreation, facilitate better mental health, and present opportunities for education and learning. The importance of access to green spaces has been highlighted through restrictions on movement during the COVID-19 pandemic, which impacted most on those with no access to a garden or communal green space. Access to gardens and green space can also help improve public health directly by providing opportunities for exercise and preventing obesity. Housebuilders responding to this inquiry reported shifting public sentiment towards sustainable living, with increased priority on availability of green spaces as part of house buying decisions.

> **The public have demonstrated the extent to which they value SuDS, as research has shown that houses sell more quickly and for higher value when overlooking SuDS and green spaces. However, to achieve that value, they must be appropriately and attractively designed and fully integrated with the public space.**
>
> Sue Illman – Managing Director, Illman Young Landscape Design (June 2020)

Finally, there is a strong economic case for the use of SuDS. As detailed above, research by DEFRA[89] has indicated the financial incentives for using SuDS, compared to traditional drainage systems. Furthermore, incorporation of high quality SuDS with amenity benefits can increase property values by up to 10-15%[90 91].

CASE STUDY: Enhancing amenity through sustainable urban design

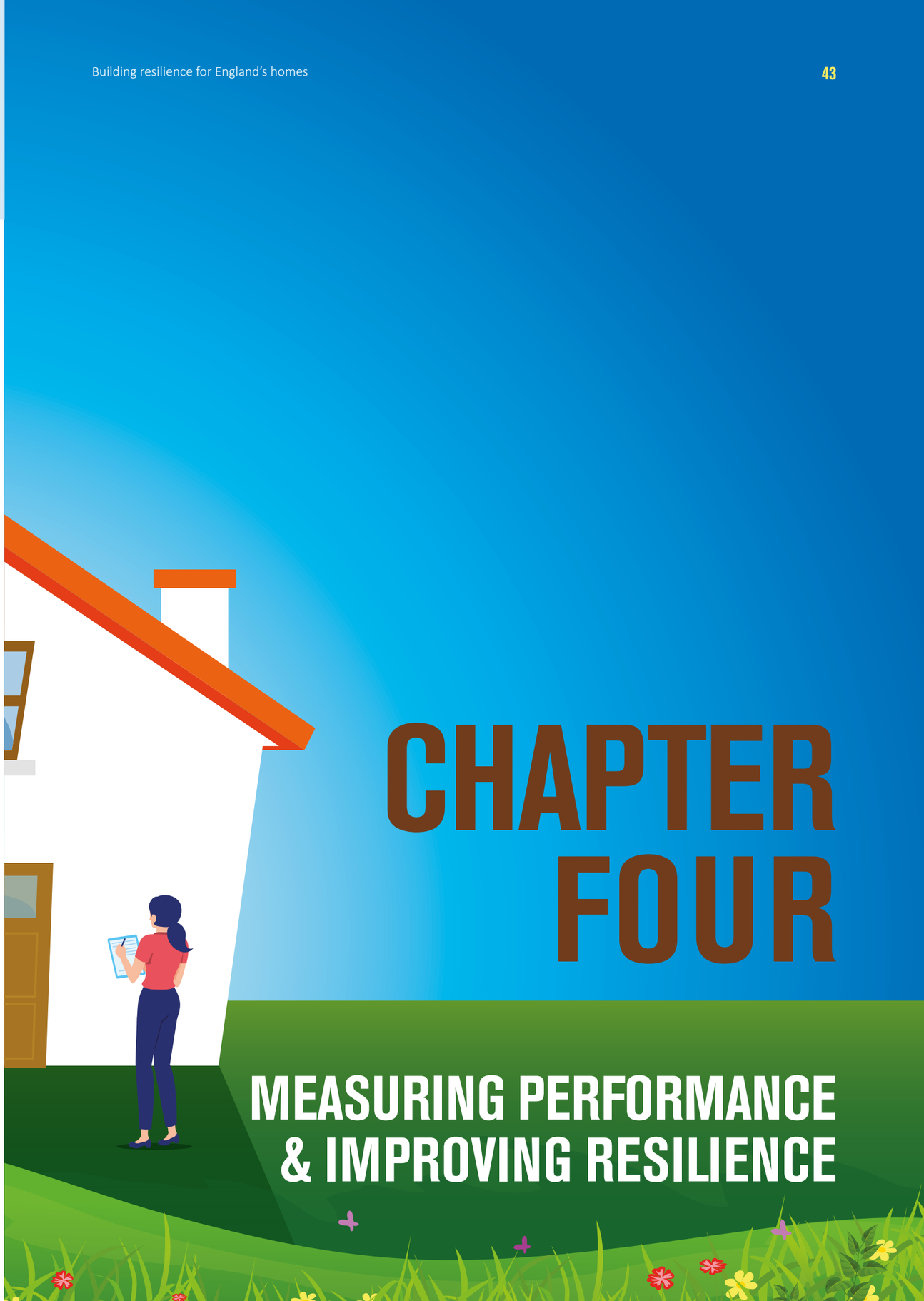
Urban natural capital, which includes soil, air, vegetation and water bodies, performs many important functions. An urban natural space, for example a city park or SuDS feature containing green and blue spaces, provides physical and mental health benefits for local people, an oasis for biodiversity, helps purify air, regulates urban temperature and reduces the volume of rainfall entering an often over-burdened drainage network.

Understanding the complex roles played by urban natural capital is, however, challenging. Improved urban design can be informed by evaluation tools, ideally co-created with stakeholders and capable of assessing benefits and co-benefits provided by urban natural capital, helping to highlight pathways towards improved urban resilience. The Community Water Management for a Liveable London (CAMELLIA) project seeks to improve understanding of key feedbacks and interdependencies between the built and natural environment that could influence the quality of life in cities, and how urban design could be done together with local residents and relevant stakeholders.

Using pilot sites, sited in Brent, Southwark, Thamesmead and Enfield, to explore human and natural environment interactions, the CAMELLIA team are creating assessment tools which will help developers, planners, water companies, regulatory bodies and citizens to evaluate the benefits and co-benefits generated by a social or environmental change. These tools will also assess interdependencies between key urban design variables, and how the quality of built and natural urban systems change over time. This will be done by assessing the ecosystem services provision of different types of land use through a set of important variables including biodiversity, water management capacity, and amenity.

Variables defined by relevant stakeholders, including residents and local community groups, could be tailored to a specific location through a participatory and co-design processes, and adapted to a range of urban scales, from local development projects to a city as whole, increasing the relevancy of the outputs and helping deliver real-world impact.

[89] Water availability and quality programme: comparative costings for surface water sewers and SuDS, DEFRA, February 2011
[90] Water, people, places: a guide for master planning sustainable drainage into developments, AECOM, September 2013
[91] The effect of urban quality improvements on economic activity, T. Whitehead, D. Simmonds, & J. Preston, Journal of Environmental Management, July 2006



CHAPTER FOUR

MEASURING PERFORMANCE & IMPROVING RESILIENCE

4. Measuring Performance & Improving Resilience

> **What gets measured, gets managed.**
>
> Widely attributed to Peter Drucker, Management Consultant

The recommendations for better Planning Policy, building regulations, and national standards set out within Chapters 1-3 of this report will help to improve the water efficiency, flood resilience, and drainage arrangements for new buildings. It has been widely demonstrated that the cost of implementing these recommendations does not pose a barrier to uptake, indeed these standards are already being met by sustainably-minded developers. Many interventions, such as the incorporation of SuDS rather than traditional drainage systems, have even been shown to be cheaper in capital cost.

> **If new homes are not built to be low carbon, energy efficient, water efficient and climate resilient, then we are saving ourselves up a huge problem in the future. Getting the design right from the outset is very obviously the most sensible decision.**
>
> Chris Stark - Chief Executive, Committee on Climate Change (June 2019)

However, new-build homes are only a small part of the problem. The majority of houses that will be standing in 2050 have already been built, and we must find a way to improve the water efficiency, flood resilience, and drainage arrangements of the 20 million homes already in place across the UK. Recommended changes to Planning Policy and building regulations will have little, if any impact on the performance of the majority of these properties.

Measuring and communicating the 'water performance' of buildings when they are constructed, sold, or rented is crucial if developers, landlords, and owner-occupiers are to make their properties water efficient and resilient to flooding. This is particularly important for driving improvements in existing homes, given that there is no trusted and standardised way for homeowners and tenants to understand the water performance of their properties. Water performance information would help householders to appreciate the risks and costs that they face and the ways in which they could improve the liveability of their homes. Access to such standardised information would raise expectations amongst homebuyers and encourage developers to construct new buildings to the highest standards.

This chapter explores how the water performance of a property could be measured and improved.

4.1. MARKET CONTEXT

Measuring the performance of buildings with regard to water, flood risk, and drainage is not a new concept. Several schemes have sought to include these metrics when demonstrating a home's sustainable credentials either on a mandatory or voluntary basis. The table below provides a summary of previous schemes, their scope, and their operational period.

Table 4.1 Current and Historic Certification Schemes

Scheme	Scope	Period	Mandatory?
BREEAM	Measures the performance of non-residential buildings against nine criteria including energy, water, materials, land use, waste, pollution, wellbeing, management and transport. Assessed during design, specification, construction and operation of a building.	1990-Present	No
Energy Performance Certificate	Measures the energy efficiency of a building and provides information on CO_2 impact and running costs (see section 4.1.1 below).	2007-Present	Yes, when a building is constructed, sold, or rented
Code for Sustainable Homes	Measured the performance of new dwellings against nine criteria including energy, water, materials, surface water runoff, waste, pollution, wellbeing, management, and ecology. Assessed during design and on completion of construction.	2008-2015	Yes (while in operation), when a building was constructed
Home Quality Mark	Measures the performance of new dwellings across three areas including cost, wellbeing, and environmental footprint. Assessed at the design stage and on completion of construction.	2015-Present	No

4.1.1. THE ENERGY PERFORMANCE CERTIFICATE

Energy Performance Certificates (EPCs) were developed alongside the EU Energy Performance of Buildings Directive and were first introduced as part of Home Information Packs for larger domestic properties. When Home Information Packs were withdrawn in 2010, the requirement for an EPC was retained by the Government.

An EPC rates a building's energy efficiency on a scale from A (most efficient) to G (least efficient), and is required whenever a home is constructed, sold, or rented. EPC surveys are carried out by domestic energy assessors, who usually operate as independent contractors and must be licensed through an approved accreditation body. These accreditation bodies, in turn, must register with a Government-endorsed quality scheme. Assessors receive training from their accreditation body, who audit individuals in order to ensure consistency and quality. Larger accreditation bodies, such as Elmhurst Energy, also provide Application Processing Interface software for assessors to generate EPCs and lodge certificates with MHCLG.

Assessors use the Standard Assessment Procedure (SAP) to determine a home's rating and issue an EPC. This procedure differs between new-build homes (i.e. where accurate details of a building's specification can be obtained from the designer) and existing properties, where a 'reduced data' method makes assumptions about a building's design based on its age and construction materials.

An EPC also provides details on a home's CO_2 emissions and fuel costs, along with a list of recommended measures to improve the performance of the building. The certificate is valid for 10 years and must be completed by the developer, vendor, or landlord. In many cases, it is commissioned by the estate agent or property manager, so as not to burden the homeowner. Costs for completion of an EPC typically range between £50 and £150, and certificates must be lodged on a central register[92], administered by MHCLG and Landmark Information Group. To date, it is estimated that over 20 million EPCs have been completed at over 13 million properties – i.e. some 65% of current homes.

The main criticism of the EPC is that it fails to address the 'performance gap' between a building's anticipated and actual performance. Whilst this gap should not be ignored, the scope of the EPC is to allow a direct comparison of similar or dissimilar buildings, based on notional occupancy profiles, rather than to provide a prediction of the building's performance based on 'lived in' conditions. Complementary products such as occupancy assessments and use of actual meter data can help provide further information on a home's actual performance. In October 2016 the WSBF held a roundtable[93] which focussed on this topic, and made a number of recommendations to help increase the accuracy and consistency of EPCs, including incorporation of behavioural components into the Standard Assessment Procedure. Although many of these recommendations are yet to be implemented, we consider that the EPC remains the most robust and easily understandable tool for measuring and comparing the performance of existing buildings. It is felt to be trusted by the public as a useful piece of data in the purchase or letting process.

Figure 4.1
Extract from an Example EPC
Image credit: MHCLG

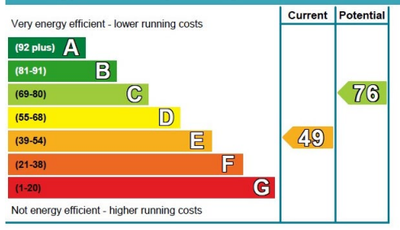
Estimated energy costs of dwelling for 3 years	£5,367
Over 3 years you could save	£2,865

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£375 over 3 years	£207 over 3 years	You could save £2,865 over 3 years
Heating	£4,443 over 3 years	£2,073 over 3 years	
Hot water	£549 over 3 years	£222 over 3 years	
Totals:	£5,367	£2,502	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating



The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Increase loft insulation to 270 mm	£100 - £350	£141	✓
2 Cavity wall insulation	£500 - £1,500	£537	✓
3 Draught proofing	£80 - £120	£78	✓

[92] Domestic energy performance certificate register (online), MHCLG
[93] Assessing the building performance gap and accuracy of EPCs, Westminster Sustainable Business Forum, October 2016

4.2. QUALIFYING CRITERIA

In April 2020 the WSBF held an evidence session which sought to look in detail at water performance measures. The discussion identified qualifying criteria for effective measures and how they might be administered in a consistent way:

Brevity – There remains concern that the requirement for vendors to provide additional information can hinder property transactions due to added time and cost. This was one of the main criticisms that led to withdrawal of the Home Information Pack in 2010. However, the EPC is a short document using an easily understandable traffic-light chart. Water performance measures should be similarly succinct and understandable.

Clarity – Research by the Social Market Foundation[94] has found that understanding risk and access to information are prerequisites to taking action. The way in which performance measures are described (i.e. to aid adaptation of buildings so that they are more water efficient and resilient to a changing climate) must be clearly communicated to the consumer.

Affordability – There will be costs associated with both completion of a property survey and implementing recommendations to improve a building's performance. The former are likely to be limited and would be borne by the developer or owner. The latter would be optional and could be subject to financial incentives by Government or the insurance industry, such as the Build Back Better scheme detailed in section 2.4.2. Performance measures should be confined to ones that will be affordable for homeowners.

Value – Building and retrofitting homes that are water efficient, flood resilient, and feature sustainable drainage can yield savings through reduced bills and insurance premiums (see section 4.6). Water performance measures should link interventions to financial savings in order to demonstrate value to the consumer.

Trust – Public trust in the measurement methodology and in the positive impact of taking action will be vitally important to the success of a new scheme. Without trust it is unlikely that recommendations made for improvements of a building's water efficiency, flood resilience, or drainage would be acted upon. A scheme for measuring a building's water performance should avoid the recognised shortcomings of previous initiatives.

4.3. PROPERTY SURVEY

The majority of the information required to measure a building's water performance will be collected through completion of a property survey, which should be undertaken by a competent person. This could be supported by some 'desk based' information, such as specifications from the building designer or information provided by third parties (i.e. CON29 searches). Evidence submitted to this inquiry suggests that an assessment of a home's water efficiency (which unlike SuDS and flood resilience measures would be relevant to all homes) might only add around £20 to the cost of an EPC, which then lasts for 10 years.

[94] Incentivising household action on flooding, options for using incentives to increase the take up of flood resilience and resistance measures, Social Market Foundation, March 2018

The existing network of domestic energy assessors could be used to complete the water as well as energy efficiency aspects of property surveys. This would avoid the need to develop an independent certification and training programme for a new cohort of surveyors. Respondents to this inquiry indicated that, in the first instance, it could be relatively straightforward to upskill energy assessors to survey for water efficiency, with only a nominal increase in survey cost. The scope of the survey could be broadened subsequently to include an assessment of flood resilience and SuDS.

> **Many energy assessors are motivated by the positive environmental impact that they deliver and would feel very comfortable extending the existing property visit to include a water efficiency assessment and, assuming the two events can coincide, at a nominal cost. With nearly 10,000 energy assessors, accredited and overseen by 6 Government approved bodies, the infrastructure already exists to deliver a national solution quickly.**
>
> Martyn Reed - Managing Director, Elmhurst Energy (June 2020)

Recommendation 18: The existing network of domestic energy assessors should be upskilled to assess a home's 'water performance', initially including water efficiency measures and subsequently property flood resilience, and surface water drainage arrangements.

4.4. CREDIT ALLOCATION & RATING PERFORMANCE

It is beyond the scope of this inquiry to assign a definitive weighting for all water efficiency, flood resilience, and sustainable drainage measures that could be incorporated into new and existing homes. However, the methodology for producing water performance measures should be complementary to the Standard Assessment Procedure used to assess energy performance as part of the EPC. Under this process a home is given a numerical credit score from 1-100, which then corresponds to the building's rating, from A-G.

Recommendation 19: Assessment of a home's 'water performance' should follow the standard assessment procedure methodology and should be rated on a scale from A-G.

Within this section, we have identified potential measures for which credit should be awarded in order to measure a home's water performance. We would anticipate that these would be further developed alongside initial implementation of the scheme.

4.4.1. WATER EFFICIENCY

Table 4.2 Credit Allocation for Water Efficiency

Measure	Description	PCC Achieved	Credit score
Grey and black water recycling	Community-scale grey and blackwater recycling systems offering the highest reductions in Per Capita Consumption.	<80lpd ↑	Higher ↑
Rainwater harvesting	Rainwater harvesting for non-potable re-use.		
Home audits	Fittings retrofit, leak fixes, compliance with a personalised water savings plan.		
Smart metering	Installation of a smart meter and switching customers to metered billing.		
Water labelling	All fixtures, fittings, and water using products should meet minimum standards dictated by a water label.	100lpd (initially)	Lower

4.4.2. PROPERTY FLOOD RESILIENCE

Table 4.3 Credit Allocation for Property Flood Resilience

Measure	Description	Credit score
Compliance with Code of Practice	Installation of property flood resilience measures in accordance with the Code of Practice. Measures should be regularly maintained and residents should be trained in their operation and maintenance.	Higher ↑
Owner and tenant-led	Installation of basic property flood resilience measures by the owner or tenant, for example: • Signing up to EA flood alerts and warnings. • Developing a flood plan for use when flood alerts and warnings are issued. • Moving valuables to upper floors. • Low cost interventions during home renovations (e.g. use of hard flooring, quick drying or sacrificial materials, and siting new electrical appliances above ground level).	
Information	• Information on the flood risk posed to the site from a variety of sources including likelihood and severity. • Information on eligibility to participate in the Flood Re scheme. • Information on the availability of flood alerts and warnings.	Lower

4.4.3. SUSTAINABLE DRAINAGE

Table 4.4 Credit Allocation for Sustainable Drainage

Measure	Description	Credit score
SuDS with multi-functional benefits and water re-use	Discharge of surface water to a development-scale SuDS system with multifunctional benefits, as below, and including grey water re-use.	Higher ↑ Lower
SuDS with multi-functional benefits	Discharge of surface water to a development-scale SuDS system which manages water quantity, improves water quality, enhances biodiversity, and provides amenity benefits.	
Retrofit	Retrofit of existing properties to prevent surface water discharging to the public sewerage system. Options for SuDS retrofit are detailed within section 3.2.2 and where possible should facilitate reduction of runoff to (or below) the Greenfield Runoff Rate.	
Information	Information on the method of surface water disposal i.e. combined sewer, surface water sewer, or on/off site SuDS components.	

4.5. IMPLEMENTATION OF WATER PERFORMANCE MEASURES

Some of the water performance measures detailed in section 4.4 above will be more straightforward to implement than others. For example, measurement of a home's water efficiency is likely to be relatively simple and the direct link between water and energy use would align well with the existing Standard Assessment Procedure (SAP). Introduction of mandatory labelling for water using products would make this survey and assessment process even easier.

We consider that water efficiency, flood resilience, and the use of SuDS should all be considered for incorporation into the EPC to give a holistic view of a home's water performance, but we acknowledge that a phased approach to adoption is likely to be most successful. This would allow the scope for more complex measures, such as flood resilience measures, to be further refined prior to implementation.

The following sections set out a timescale for the implementation of water performance measures, along with any issues that require resolution prior to adoption.

4.5.1. TIMESCALE: NOW

A system for measuring a home's water efficiency would be relatively straightforward to implement and could be introduced following a short period of assessor training. Evidence submitted to this inquiry indicates that costs for incorporation of water efficiency measures into the EPC survey process could be as low as £20 per property and could easily be offset via basic changes to consumer behaviour relating to water use. A similar system for measuring the water efficiency of new homes is already in place as part of the BRE Home Quality Mark[95].

[95] Home quality mark ONE: technical manual England, BRE, August 2018

Recommendation 20: Water performance measures relating to water efficiency should be introduced now, on a voluntary basis, as a low-cost 'bolt-on' to the existing EPC.

4.5.2. TIMESCALE: SHORT TERM

Formal changes to the EPC to include water efficiency measures would require consultation by Government, which should take less than a year to complete given their wide acceptance by industry and NGOs, as demonstrated in Chapter 1 of this inquiry. In the meantime, introduction of mandatory labelling for water using products would help assessors more accurately determine a home's water use.

Recommendation 21: Government should consult on incorporation of water efficiency measures into the EPC and subsequently incorporate these on a mandatory basis, whenever an EPC is required. The consultation should indicate an intent to introduce drainage and property flood resilience measures at a later stage.

4.5.3. TIMESCALE: MEDIUM TERM

It is less straightforward to rate a home's performance in relation to its surface water drainage arrangements, given that these are not always obvious and surface water runoff may be discharged to a development-scale system, operating at a remote location. Furthermore, it is recognised that the highest ratings associated with incorporation of multifunctional SuDS with greywater re-use may only be available to some properties and would favour new or recent developments.

Recommendation 22: A system for measuring the performance of a home's surface water drainage arrangements should be developed through further discussion with drainage engineers, developers, water companies, and Lead Local Flood Authorities. A finalised scope for this assessment should be offered to Government for consultation, prior to introduction of the Future Homes Standard in 2025.

This option could be explored as a potential follow-up piece of work to this inquiry.

4.5.4. TIMESCALE: LONG TERM

Rating a home's flood resilience can be a complex process. The level of protection necessary will be dependent upon a number of factors including the source of flooding (i.e. tidal, fluvial, pluvial etc.), the presence of formal flood defences and the level of protection that they offer, and the age and nature of the building itself. Where it can be demonstrated that a property is not at risk of flooding from any source, then compliance could be achieved without demonstration of flood resilience measures.

The process for assessment, survey, installation, and commissioning of property flood resilience measures has been set out within the industry code of practice launched earlier this year (see section 2.3). This should form the basis for rating a home's performance in relation to flood risk.

Given the level of detail and the work, which has already commenced on development of an independent Flood Performance Certificate (see below), it may prove more effective to pursue this as a stand-alone document, rather than incorporate it into the EPC. Ultimately, this should be led by what works best for the consumer.

Recommendation 23: Work to assess the flood performance of existing buildings should be developed further, in accordance with the existing industry code of practice. Whether performance measures relating to flood resilience are incorporated into the EPC or developed separately should be dictated by consumer benefit.

CASE STUDY: A flood performance certificate

In 2019 WPI Economics was commissioned by Flood Re to explore the development and implementation of a Flood Performance Certificate. Their forthcoming report will explore the role that property flood resilience measures can play in mitigating flood risk and how a Flood Performance Certificate should be designed and implemented.

The work will recommend close alignment of the process with the Code of Practice (see section 2.3), in particular with the stages of risk assessment, property surveying, and development of options for property flood resilience measures. The certificate itself would provide a rating from A-D, which would be reflective of the risk of flooding to a property and the implications should a flood occur (i.e. likely time spent displaced from the home). The certificate would make recommendations for uptake of the most effective property flood resilience measures.

The work also reviews voluntary and mandatory adoption models and how the scheme could be regulated, either through a single or multiple registration bodies, much like the current Gas Safe Register and Energy Performance Certificate schemes respectively.

Finally, a timeline for implementation is proposed, which would see mandatory use of flood performance certificates by 2028.

4.6. RECOMMENDED ACTIONS & SAVINGS

In addition to rating a building, a system for measuring water performance should include recommendations for action, so that the homeowner understands the benefits associated with making improvements to their property. This would fit well with the EPC, which currently sets out key ways in which a property can be made more energy efficient. The savings associated with implementing recommendations are likely to fall into the following categories.

- Reduced water bills – facilitated through installation of water efficient fixtures and fittings (meeting the requirements of a mandatory water label), switching to a smart meter, rainwater harvesting and grey/black water re-use.
- Reduced energy bills – facilitated through reduction in the amount of water heated for washing and bathing.
- Reduced sewage charges – facilitated through demonstration that a property no longer discharges to the surface water or combined sewerage network.
- Reduced insurance premiums – facilitated through demonstration of property flood resilience measures to an insurer.

In addition to these savings, compliance could help unlock Green Finance options such as grants for installing property flood resilience measures or access to innovative financial products such as ‘green mortgages’.

Recommendation 24: A system for measuring a home’s water performance should include practical actions that a landlord or owner can take to improve the efficiency and resilience of their home. These actions should be linked to likely financial savings.

4.7. DATA MANAGEMENT

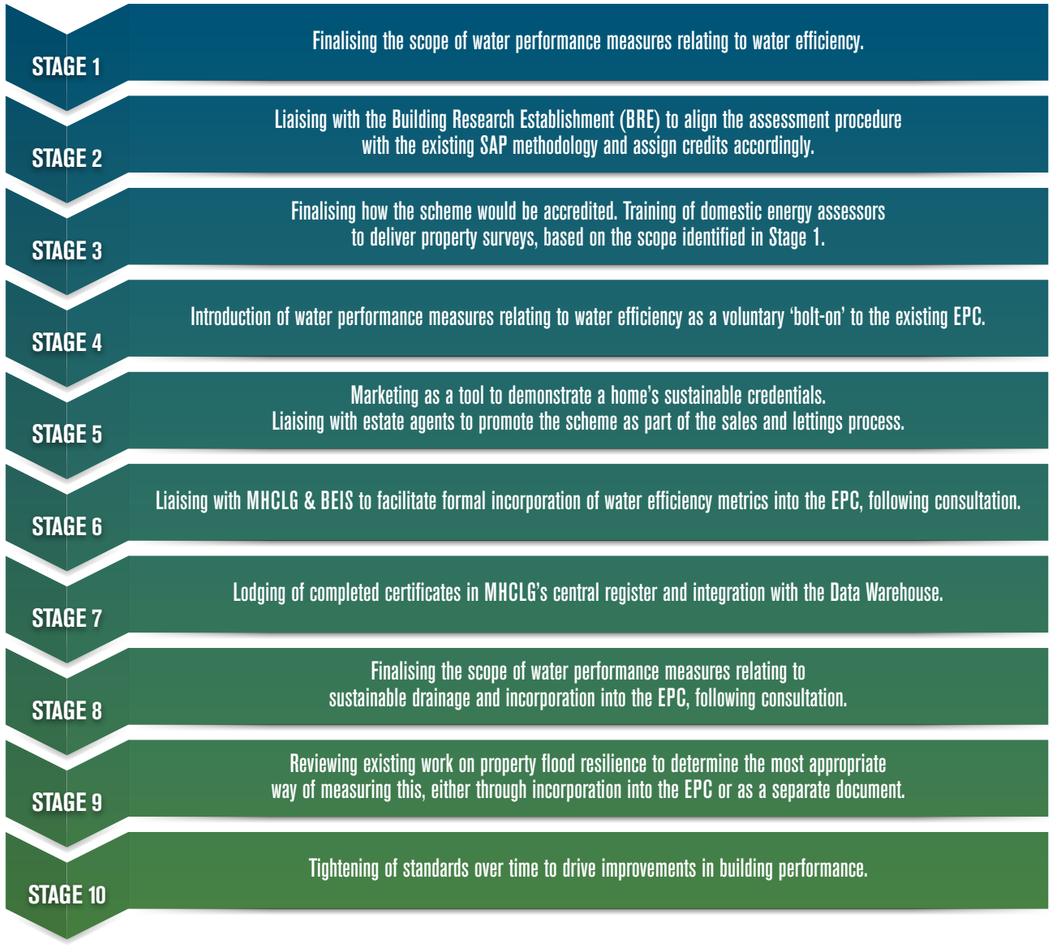
The Each Home Counts Review[96] into energy efficiency and renewable energy made recommendation for a Data Warehouse, where information on home improvements could be stored to allow consumers access to accurate data about the performance of their homes. In order to reduce survey costs, this database could be used to obtain baseline information on water performance measures for a property. Obtaining accurate data on a building’s construction materials (e.g., closed-cell and spray applied insulation offer better flood resilience than mineral wool), rather than making assumptions based on its age and nature can help reduce performance gap issues as detailed in section 4.1.1. Such data is itself of considerable value to the householder and, for example, is increasingly being required for H&S assessments following the Grenfell tower tragedy.

Within the energy sector, EPCs have been carried out to date in over 13 million homes[97] and access to the underlying data is freely available online[98] for download. This allows for public scrutiny and research into associated issues such as fuel poverty and climate change. Such comprehensive information on the energy performance of existing buildings has allowed the Government to introduce minimum standards within the private rented sector. For example, since 1st April 2020, landlords can no longer let properties if they have an EPC rating below E, unless they have a valid exemption in place. Water performance measures should be equally transparent and available to all, not just the current householder.

Recommendation 25: Data collected to assess a home’s water performance should be held in a central register administered by MHCLG and shared with the Data Warehouse, to allow public scrutiny. It should be used to develop minimum standards in order to drive improvements in efficiency in residential buildings and to meet the UK’s net-zero commitments.

[96] Each home counts: an independent review of consumer advice, protection, standards and enforcement for energy efficiency and renewable energy, MHCLG, December 2016
[97] Lodgement statistics for RdSAP and SAP EPCs (online), MHCLG, May 2020
[98] Energy performance of buildings data: England and Wales (online), MHCLG

4.8. ROADMAP FOR IMPLEMENTATION



4.8.1. FINANCING

Within the 2020 Budget[99] the Treasury committed to providing £200 million over six years for a 'place-based resilience programme' supporting local areas to take forward 'innovative actions' that improve resilience to flooding. Proposals to improve the water performance of buildings set out in this chapter could form the basis of such a programme. Funding could be used to further develop a system for measuring the water performance of new and existing homes, or for direct installation of performance measures themselves, with priority given to vulnerable communities, as suggested within the Budget.

[99] Budget 2020: delivering our promises to the British people, HM Treasury, March 2020

4.9. WIDER CONTEXT

Within this report we have drawn attention to the links between water efficiency, property flood resilience, and the use of sustainable drainage. However, these water-specific issues are also closely tied to a host of external factors including energy efficiency, overheating, air quality, urban cooling, and wellbeing. The Committee on Climate Change and BEIS' Green Finance Taskforce have made recommendation for consolidation of these issues into a single, Green Building Passport[100] [101], or Building Renovation Passport[102], which could provide a holistic and long-term view of a home's performance.

Digital building passports could act as a place to lodge information about home improvements (e.g. energy efficiency measures or heat upgrades) so that the performance of the UK's building stock and its progress towards net-zero can be more accurately measured. A passport would also provide reliable evidence to insurers and creditors to allow them to make informed decisions on risk prior to providing home insurance or finance. Digital building passports, which are consistent with the EPC, have already been successfully launched in France, Denmark, and the German state of Baden-Württemberg[103].

We consider that integration of performance measures for water efficiency into the existing EPC, followed by sustainable drainage and flood resilience where appropriate, presents the most cost-effective and rapid option for facilitating much-needed improvements to the existing building stock. These no-regrets measures could then be built into a digital building passport. Only through a combined approach of updating the way that we construct new homes and incentivising homeowners to retrofit their existing properties can we ensure that the nation's housing stock is fit for the future.

[100] UK Housing, fit for the future? Committee on Climate Change, February 2019
[101] Accelerating green finance, Green Finance Taskforce, March 2018
[102] Financing energy efficient buildings: the path to retrofit at scale, Green Finance Institute, May 2020
[103] Baden-Württemberg Refurbishment Schedule, Ministry for Environment, Climate and Energy, August 2015

Methodology

Work on this ***Bricks and Water*** inquiry began in December 2019, when the WSBF held a scoping session entitled 'Bricks and Water 2: property resilience for new and existing homes'. This session was kindly chaired by Policy Connect CEO Jonathan Shaw.

This project draws on third party research from a large number of organisations, as well as primary data collected following a call for evidence and through one-to-one interviews with experts across industry, academia, Government, and NGOs. A total of twenty interviews were undertaken between January and June 2020, with two further written submissions received. The following evidence sessions were completed, which focussed on the following topics:

Roundtable 1
Water efficiency – 5th February 2020 (Chaired by Luke Pollard MP)

Roundtable 2
Sustainable drainage – 10th March 2020 (Chaired by Baroness McIntosh of Pickering)

Roundtable 3
Property flood resilience – 25th March 2020 (Chaired by Ruth Jones MP)

Roundtable 4
Administering a property resilience certificate – 29th April 2020 (Chaired by Baroness McIntosh of Pickering)

Policy Connect would like to thank all the individuals and organisations that participated in this inquiry. A full list of contributors is outlined below. The views in this report are those of the author and Policy Connect. Whilst these were informed by the listed contributors, they do not necessarily reflect the opinions of these organisations.

Parliamentarians:
Baroness McIntosh of Pickering
Luke Pollard MP
Ruth Jones MP

Housebuilding & Construction:
Barratt Developments
Berkeley Group
BRE (Building Research Establishment)
BSI (British Standards Institution)
CIRIA (Construction Industry Research and Information Association)
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Lendlease
SDS
Tim O'Hare Associates
Travis Perkins
Trustmark

Water:
Albion Water
Anglian Water
LoDEG (London Drainage Engineers' Group)
Polypipe
Southern Water
South West Water
Thames Water
Water UK
Waterwise
Yorkshire Water

Local Authority:
City of York Council
London Borough of Hillingdon
Royal Borough of Kensington and Chelsea

NGO/Environmental:
Business in the Community
CIWEM (the Chartered Institution of Water and Environmental Management)
Elmhurst Energy
Landmark Information Group

Consultancy:
Consulting With Purpose
GJB Consultancy, Oxford
Mary Dhonau Associates
WPI Economics

Government:
Committee on Climate Change
DEFRA (Department for Environment, Food and Rural Affairs)
Environment Agency
Homes England
MHCLG (Ministry of Housing, Communities and Local Government)

Academia:
Durham University
Imperial College London
University of Nottingham

Architecture:
Illman Young Landscape Design
TEDS (The Environmental Design Studio)
Wei Yang & Partners

Insurance:
ABI (Association of British Insurers)
AVIVA
Flood Re

About this report

The Westminster Sustainable Business Forum

The Westminster Sustainable Business Forum (WSBF) is Policy Connect's coalition of high-level stakeholders informing better policy-making on sustainability issues for the built environment.

The WSBF's members include key UK businesses, Parliamentarians, Civil Servants, academics and third sector organisations. Providing a politically neutral environment for knowledge sharing and discussion on sustainability policy, we help to impact the agenda in government and are a trusted source of independent information and advice for policymakers.

We publish authoritative research reports; impact on Government policy through our in-depth round table policy discussions and outputs; and inform the wider sustainability debate by convening key stakeholders at our larger policy events and seminars. The WSBF works in the policy areas of construction, infrastructure, water, sustainable planning, green finance and natural capital. We are cross-party, independent and not-for-profit.

The Sustainability Team

The All-Party Parliamentary Climate Change Group (APPCCG), All-Party Parliamentary Sustainable Resource Group (APSRG), Carbon Connect, the Sustainable Resource Forum, and the Westminster Sustainable Business Forum (WSBF) make up the Sustainability team at Policy Connect.

Policy Connect

Policy Connect is a membership-based, not-for-profit, cross-party think tank. We bring together parliamentarians and government in collaboration with academia, business and civil society to inform, influence and improve UK public policy through debate, research and innovative thinking, so as to improve peoples' lives. We lead and manage an extensive network of parliamentary groups, research commissions, forums and campaigns. We are a London living wage employer and a Member of Social Enterprise UK, and have been operating since 1995. Our work focuses on key policy areas including: health & accessibility; education & skills; industry, technology & innovation; and sustainability. We shape policy in Westminster through meetings, events, research and impact work.

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WEI YANG PARTNERS

CONTACT

Policy Connect
CAN Mezzanine
7-14 Great Dover Street
London SE1 4YR

@Policy_Connect
policy-connect
info@policyconnect.org.uk
0207 202 8585

Design & Production Ashley Ads Ltd. 01603 701700 | ashleyads.co.uk