



**PROMOTING
DOMESTIC WATER EFFICIENCY
VIA BEHAVIOUR CHANGE**
AN AGENDA FOR RESEARCH
AND ACTION



**INSTITUTE FOR
SUSTAINABILITY**

UNIVERSITY OF SURREY

Authors

Prof Benjamin Gardner, Water Efficiency ARC Lab & Institute for Sustainability, University of Surrey

Prof Ian Walker, School of Psychology, Swansea University

Dr James Daly, University of Bristol

Dr Julia Brown, School of the Environment, Geography & Geosciences, University of Portsmouth

Sofie Voss, Water Efficiency ARC Lab & Institute for Sustainability, University of Surrey

Dr Pablo Pereira Doel, Water Efficiency ARC Lab & Institute for Sustainability, University of Surrey

Please cite document as: Gardner, B., Walker, I., Daly, J., Brown, J., Voss, S., & Pereira Doel, P. (2026) *Promoting domestic water efficiency via behaviour change: An agenda for research and action*. Guildford: Institute for Sustainability.

Find us online: www.waterefficiencyarc.co.uk.



This work is licensed under CC-BY-NC-ND 4.0. The research material may be reproduced for non-commercial purposes as long as the reference source is cited. For further enquiries, please email benjamin.gardner@surrey.ac.uk.



TABLE OF CONTENTS

Executive Summary	5
1. Background	8
The water scarcity challenge	8
The benefits of behavioural science	8
2. Aim	9
3. Method	10
Overview	10
Activity 1: Workshop	12
Activity 2: Survey	13
Activity 3: Webinar	14
Cross-activity integration and development	14
4. Results	15
A research and action agenda	15
Understanding and promoting change among consumers	18
Understanding and promoting change among the water sector	19
Importance and usefulness of potential behaviour change activities	20
5. Reflections and Recommendations	23
6. Conclusion	26
Funding statement	27
References	27
Appendix 1: Full research and action agenda	30

EXECUTIVE SUMMARY

Background

It is estimated that, if no action is taken, England will face a 5bn litre daily freshwater deficit by 2055. Until longer-term supply-side options are available, an estimated 60% of the deficit must be recovered through demand management. Government and industry are focusing heavily on smart metering to reduce domestic consumption, but metering alone will not eliminate the deficit. Behaviour change approaches are needed.

The UK water sector is keen to harness behavioural science to reduce domestic water use, but has historically lacked the skills, knowledge and experience needed to systematically develop, deliver and assess behaviour change initiatives. Customer-facing water efficiency initiatives have tended to focus on providing information on the importance of saving water. This approach prioritises motivation, which will not be effective if people lack the capability or opportunity to change their daily water use activities.

Behaviour change initiatives are most likely to be successful when they are informed by high-quality evidence regarding which specific behaviours to target and among whom, the barriers to changing those behaviours, and the most suitable strategies for targeting those barriers. Yet, such evidence is scarce.

In this project, we set out to identify key knowledge gaps within the water sector, and thereby develop an agenda to guide water efficiency behaviour change research and impact activity.

Aim

The aim of this project was to work with water sector stakeholders to co-create a list of key unanswered questions. These questions reflect perceived gaps in knowledge that hinder the development and implementation of evidence-based behaviour change solutions for improving domestic water efficiency.

Methods

We worked with over 100 individuals from 60 organisations within the UK water sector to identify behaviour change priorities.

Three sequential co-creation activities with UK water sector stakeholders were undertaken in 2024-25: an in-person workshop (Activity 1), a survey (Activity 2), and a webinar (Activity 3).

Activity 1: Workshop

Thirty-six people, representing 21 water sector organisations, attended an in-person workshop at University of Surrey in October 2024. Small group and plenary discussions were run to identify which water-use behaviours were of most interest, key questions regarding domestic water-use behaviour change, and potential indicators of success arising from behaviour change. Points raised in plenary discussions, and content of online whiteboards, were analysed.

Activity 2: Survey

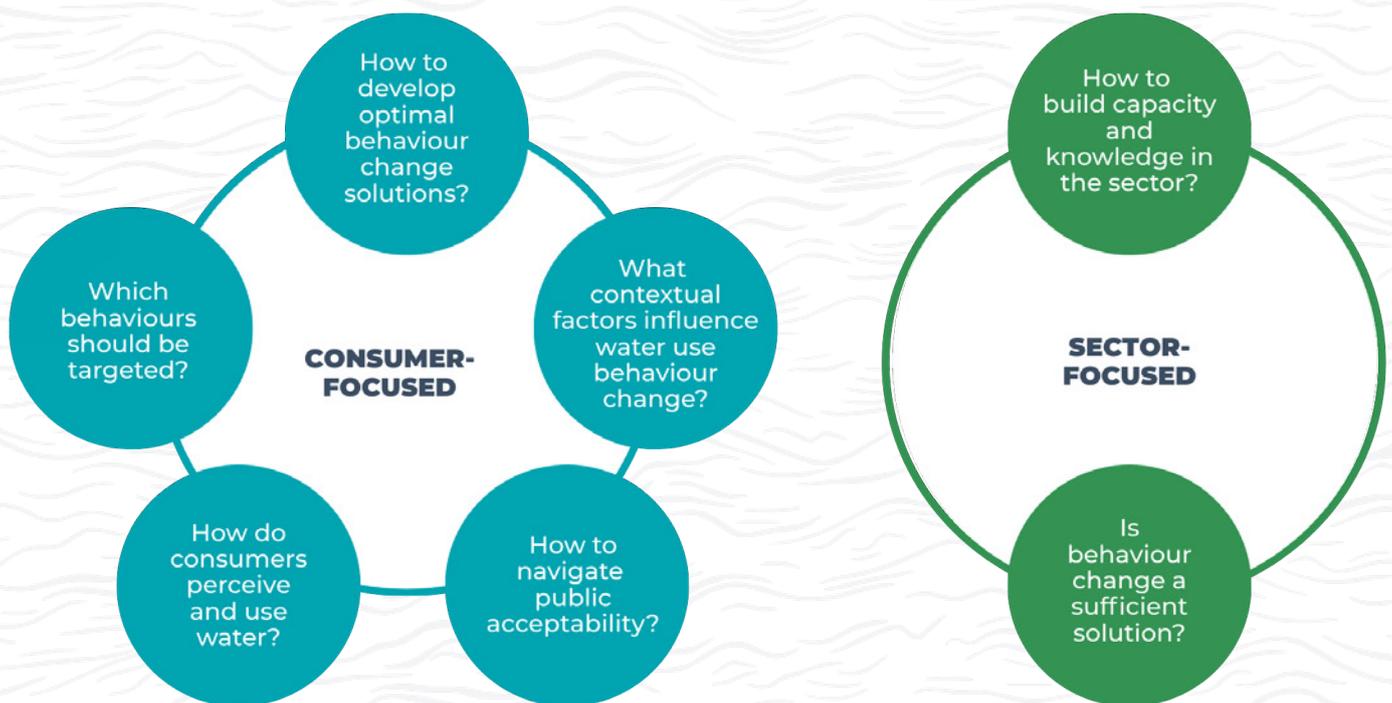
Forty-two people, representing at least 23 water sector organisations, completed an online survey between October 2024 and January 2025. The survey recorded quantitative ratings of the usefulness of targeting behaviour change activities identified through a preliminary analysis of Activity 1 discussions.

Activity 3: Webinar

Seventy-five people, representing at least 49 water sector organisations, attended a webinar hosted in April 2025, in which preliminary analyses of Activities 1 and 2 were presented. Attendees were invited to share their views via live chat, online whiteboards, or email.

Integration and development

Written inputs from Activities 1 and 3 were inductively thematically analysed, producing a hierarchical structure with granular, 'Specific Questions' distilled into higher-order 'Key Questions', which in turn were clustered into thematic 'Areas of Uncertainty'. Survey data from Activity 2 was descriptively analysed to quantify the prioritisation of questions.



Results

We constructed seven areas of uncertainty, capturing 24 key questions, which in turn summarised 117 specific questions. Five themes focused on understanding and promoting change among water consumers, and two themes targeted change within the water sector.

Areas of Uncertainty: Consumer-focused

1. Which behaviours should be targeted?
2. How do consumers perceive and use water?
3. How to navigate public acceptability?
4. How to develop optimal behaviour change solutions?
5. What contextual factors influence water use behaviour change?

Areas of Uncertainty: Sector-focused

6. How to build capacity and knowledge in the sector?
7. Is behaviour change a sufficient solution?

The perceived importance of behaviour change activities

The three behaviours deemed most important to target were:

- reporting or fixing in-home leaks
- showering
- flushing toilets

Recommendations

We encourage stakeholders to use this agenda to shape future water efficiency behaviour change research and action. Our recommendations are:

1. Water sector stakeholders should collaborate with behavioural scientists.
2. To develop more effective behaviour change strategies, water sector stakeholders should seek to better understand how people use water.
3. Water efficiency interventions should focus on breaking habits.
4. The sector should engage in more knowledge exchange activities, to better share existing insights.
5. The sector should recognise that behaviour change is only one of multiple approaches to promoting water efficiency.

All documentation relating to this report is available at <https://osf.io/6wn7y>.

Work with us

The Surrey Water Efficiency ARC (Action, Research and Collaboration) Lab offers expertise in technology-assisted behaviour change for water efficiency, and world-leading insights into the psychology of real-world habit change. To work with us, contact Prof Benjamin Gardner (benjamin.gardner@surrey.ac.uk). Find us online at www.waterefficiencyarc.co.uk.

1. BACKGROUND

The water scarcity challenge

If no action is taken, England faces a 5bn litre daily freshwater deficit by 2055 [1]. UK households rely solely on freshwater, and use an estimated 135-150 litres per person daily [2-4]. Government and industry aim to cut this to 110L/person/day, with yet greater reductions targeted in water-stressed areas [5, 6]. To secure resilient water resources for England and Wales, the Environment Agency's National Framework for Water Resources [1] proposes both supply-side solutions, such as building desalination plants, and demand-side reduction. The Framework suggests that, until longer-term resource options are available, 60% of the projected deficit must be recovered through demand management.

UK demand-side reduction strategy is heavily focused on smart metering [7, 8], which has been shown to reduce domestic consumption to 122L/person/day, compared to 171L/person/day in non-metered households [3]. Yet, smart metering is projected to save only 450m litres by 2050 [9]. Substantial additional savings will need to come from changing householders' water consumption behaviours [10].

The UK water sector is keen to draw on behavioural science to reduce domestic water use, but has historically lacked the skills, knowledge and experience needed to develop, deliver and assess change [11]. Aside from Temporary Use Bans ['hosepipe bans'] to mandate reductions in consumption [12], sector-led non-metering behaviour change solutions have tended to focus on providing information to householders around the importance of water conservation, during periods of acute water scarcity [13]. Reliance on messaging and awareness-raising assumes that consumers lack motivation to save water, and that increasing understanding will enhance motivation. This is a reasonable assumption, because people typically underestimate their water usage [14], and raising awareness of true consumption can motivate change [15, 16]. Yet, motivated people may still lack knowledge of where their household water is consumed, or how best to act to reduce consumption. Such barriers will greatly limit the impact of increased motivation: if consumers do not know *how* to save water, supporting them to *want* to save water will of relatively little benefit.

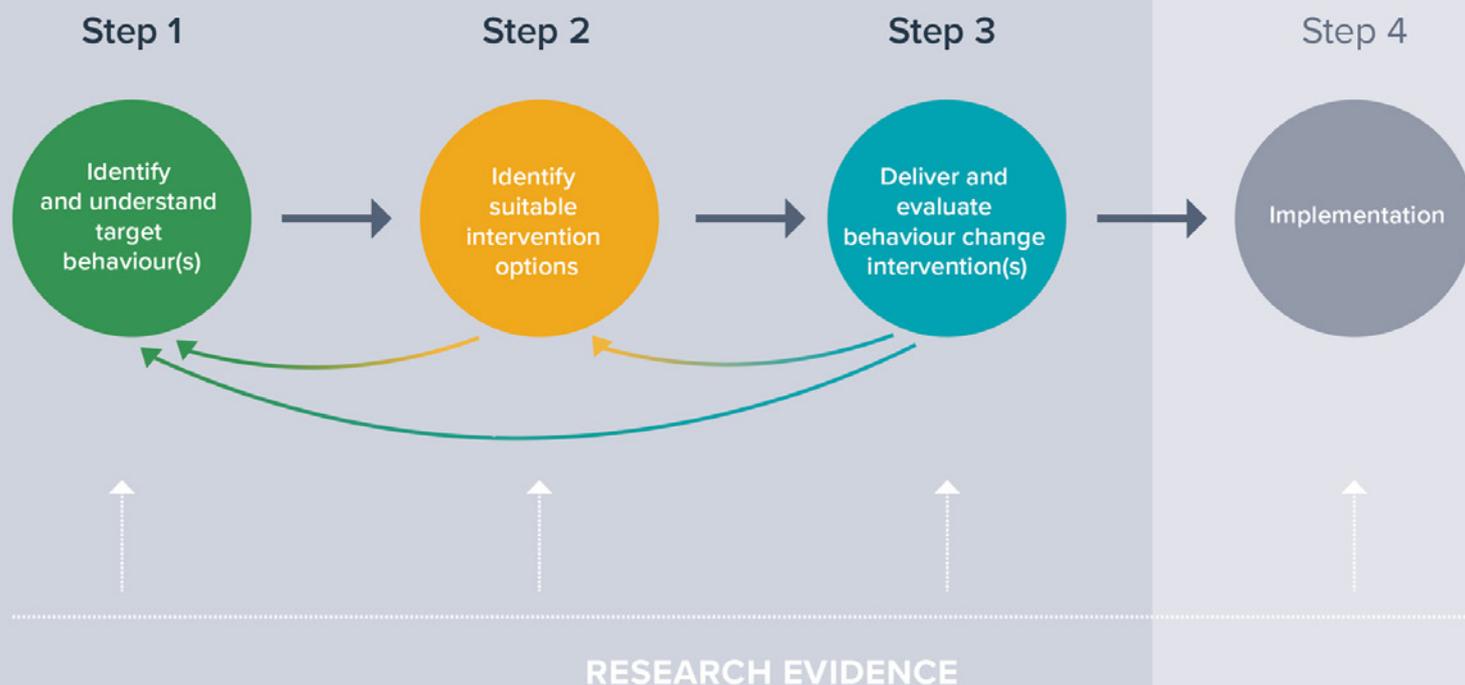
The benefits of behavioural science

To reduce domestic water consumption through behaviour change, the sector must draw on behavioural science perspectives and principles. All behaviour change approaches have the potential to be effective, but their success depends on their fit to the context.

Behaviour change initiatives are most likely to be successful when they have been informed by a thorough assessment of which behaviours to target and among whom, which barriers obstruct change, and which strategies are most suited to overcoming those barriers [17, 18]. Research evidence should be used throughout this process to ensure all intervention development decisions are built on knowledge rather than intuition. **Figure 1** shows the systematic process through which behaviour change interventions should be developed.

Figure 1

A systematic approach to developing water efficiency behaviour change interventions
(Adapted from [17,18])



Documenting knowledge gaps in the water sector is crucial for developing water efficiency initiatives. By articulating what we do not yet know, activity can be undertaken to fill those knowledge gaps, and so provide the evidence needed to develop effective behaviour change initiatives.

2. AIM

The aim of this project was to co-create, with key stakeholders, an agenda to guide domestic water efficiency research and impact activity.

Agenda-setting can identify knowledge gaps, so allows for the development of evidence to support the design and implementation of new interventions and policy [19]. This agenda is aimed at research and impact commissioners, industry and academia stakeholders, and policy makers.



3. METHOD

Overview

To co-create the agenda, we hosted three sequential collaborative activities with UK water sector stakeholders in 2024-25: an in-person workshop (Activity 1), a survey (Activity 2), and a webinar (Activity 3). Activities 1 and 3 involved eliciting questions of importance to stakeholders surrounding domestic water efficiency behaviour change, and Activity 2 focused on quantifying the prioritisation of emerging questions.

All partners were notified that their contributions would be incorporated into a published document. Materials used in the three activities – including written accounts of partner input, akin to ‘data’ – can be accessed at <https://osf.io/6wn7y>.

Table 1

Organisations and individuals involved in co-creation activities

Organisation type	Any activity		Activity 1: In-person workshop		Activity 2: Survey		Activity 3: Webinar	
	Organisations Number (%)	Individuals Number (%)	Organisations Number (%)	Individuals Number (%)	Organisations Number (%)	Individuals Number (%) <i>All individuals ('Confident' non-academic individuals only)</i>	Organisations Number (%)	Individuals Number (%)
Total	60*	107-125**	21	36	23*	42 (34)	49**	75***
Academic	10 (17%)	In academic roles: 21 (17%) In non-academic roles: 5 (4%)	4 (19%)	In academic roles: 6 (17%) In non-academic roles: 3 (8%)	2 (9%)	In academic roles: 5 (12%) (5; 15%) In non-academic roles: 0	9 (18%)	In academic roles: 17 (23%) In non-academic roles: 3 (4%)
Charities	2 (3%)	3 (2%)	-	-	1 (4%)	2 (5%) -	1 (2%)	1 (1%)
Consultancies	10 (17%)	20 (16%)	4 (19%)	6 (17%)	2 (9%)	4 (10%) (3; 9%)	8 (16%)	13 (17%)
Customer/public representatives	1 (2%)	2 (2%)	-	-	1 (4%)	1 (2%) (1; 3%)	1 (2%)	1 (1%)
Engineering and design	1 (2%)	1 (1%)	-	-	-	-	1 (2%)	1 (1%)
Government departments or agencies	6 (10%)	11 (9%)	1 (5%)	1 (3%)	1 (4%)	3 (7%) (3; 9%)	5 (10%)	7 (9%)
Innovators	7 (12%)	8 (6%)	3 (14%)	3 (8%)	4 (17%)	4 (10%) (4; 12%)	5 (10%)	5 (7%)
Water-related product manufacturers	3 (5%)	11 (9%)	3 (14%)	9 (25%)	2 (9%)	6 (14%) (4; 12%)	-	-
Market Operator	1 (2%)	2 (2%)	-	-	1 (4%)	1 (2%) (1; 3%)	1 (2%)	1 (1%)
NGOs	2 (3%)	3 (2%)	-	-	1 (4%)	1 (2%) 1 (3%)	2 (4%)	2 (3%)
Trade association	1 (2%)	2 (2%)	1 (5%)	1 (3%)	1 (4%)	2 (5%) (2; 6%)	-	-
Utilities	4 (7%)	7 (6%)	1 (5%)	1 (3%)	1 (4%)	2 (5%) -	4 (8%)	6 (8%)
Water companies (Regions, where reported)	10 (17%)	20 (16%)	4 (19%) (North East England = 1, South England = 1, South East England = 1, Wales = 1)	6 (17%) (North East England = 1, South England = 1, South East England = 1, Wales = 3)	5 (22%) (North East England = 1, South England = 1, South East England = 2, Wales = 1)	6 (14%) (5; 15%) (North East England = 1, South England = 1, South East England = 2, Wales = 1, Unknown [not confident] = 1)	10 (20%) (East England = 1, East Midlands = 1, North East England = 1, South England = 1, West Midlands = 1, South East England = 3, Scotland = 1, Wales = 1)	14 (19%) (East England = 2, East Midlands = 1, North East England = 1, South England = 1, West Midlands = 2, South East England = 4, Scotland = 2, Wales = 1)
Other	2 (3%)	3 (2%)	-	-	1 (4%)	1 (2%) (1; 3%)	2 (4%)	2 (3%)
Unknown / not reported	(Unknown)	6 (5%)	-	-	(Unknown)	4 (10%) (4; 12%)	(Unknown)	2 (3%)





NB: Authors BG and PPD hosted Activities 1 and 3 so are not represented in the table. Authors IW, JD, and SV took part in Activities 1 and 3 and are represented in the table. Author JB did not take part in any of the three co-creation activities, so is not represented in the table.

* Total number of organisations excludes an unknown number of unknown organisations, due to individuals not indicating the name of their organisation.

** The stated total number of individuals across all activities may erroneously double-count 16 individuals who took part in Activity 2, and two who took part in Activity 3, who did not provide an identifiable email address. The minimum total number of unique individuals involved in at least one co-creation activity was 107, assuming all 18 identifiably took part in at least one other co-creation activity. Percentages in this column relate to a total sample of 125 individuals.

*** Webinar partners included 74 individuals (across 48 organisations) who attended the webinar and one partner (from one new organisation) who did not attend but provided post-webinar feedback on an online whiteboard.

We recruited stakeholders from our existing network, which expanded as emergent results were shared. Co-creation partners included representatives of water companies, academics, manufacturers of water-related products, government departments, consumer organisations, charities and NGOs. As Table 1 shows, at least 107 different individuals, representing more than 60 unique organisations, participated in one or more activities - though the exact number is unknown due to anonymised responses in Activities 2 or 3. Of the 107 individuals, 18 engaged in two activities, and five individuals took part in all three.

Activity 1: Workshop

A one-day, in-person workshop was held at University of Surrey in October 2024. The aim was to brainstorm priorities for UK domestic water efficiency behaviour change research and action.

Co-creation partners

We recruited partners via direct emails to 51 people in our prior network of water stakeholders, representing 40 unique organisations. Thirty-six people, representing 21 organisations, attended the workshop.

Activity structure

After we presented our ongoing showering and toilet-flushing behaviour change research, attendees were split into seven pre-designed groups of 5-6 people, mixing representatives from different types of organisations, for discussions.

Three rounds of group discussions focused on identifying the water-use behaviours of most interest, key questions regarding domestic water-use behaviour change, and potential indicators of success arising from behaviour change.

Co-creation input capture

Partner input was captured via notes made by BG during plenary discussions, and online whiteboards used by each group during discussions. Authors BG, PPD, IW and JD convened after the workshop to construct preliminary themes from these inputs.

Activity 2: Survey

An online survey was run between October 2024 to January 2025, to gather quantitative ratings of the perceived importance and usefulness of possible behaviour change activities arising from interim analyses of Activity 1.

Co-creation partners

We emailed the survey URL to the 51 people invited to the Activity 1 workshop, and encouraged them to share it with colleagues. Survey respondents were asked to indicate their organisation type. We did not require respondents to name their organisation, but we invited them to provide their email address, from which we identified host organisations where possible.

Forty-two people took part. At least 23 discrete organisations were represented, though the organisations of four respondents could not be identified.

Activity structure

The survey centred on two questions. One focused on the perceived importance of targeting 13 water-use behaviours identified in Activity 1:

‘How important is it for UK domestic water conservation initiatives to target...’: e.g., ‘...using a dishwasher’, ‘...washing vehicles’ (very unimportant [1] – very important [7])

The second question focused on perceived usefulness of developing knowledge in 11 areas:

‘How useful would it be for your organisation to know more about...’: e.g., ‘...how, why or when people take showers’, ‘...which behaviour change strategies are most or least publicly acceptable’ (not at all useful [1] – extremely useful [6])

Respondents were asked to answer questions ‘based on [their] organisation’s priorities around water use, rather than [their] personal views’, though academics were requested to report personal views. Respondents completed a separate item reporting their confidence in articulating organisational priorities:

‘How confident are you that you fully understand your organisation’s priorities around water use?’ (very unconfident [1] – very confident [6])

Co-creation input capture

Survey responses were descriptively analysed to inform Activity 3. We excluded responses from eight non-academics who were self-reportedly ‘slightly unconfident’, ‘unconfident’ or ‘very unconfident’ in understanding their organisation’s priorities. The remaining 34 people were three academics and 31 non-academics who were ‘confident’ (15 people) or ‘very confident’ (16 people) that they knew their organisation’s priorities.

Activity 3: Webinar

A webinar was held in April 2025 to share results from Activities 1 and 2 and seek feedback from additional stakeholders.

Co-creation partners

We recruited partners in two ways. First, we sent direct, personalised emails to those people who engaged in Activities 1 or 2. Second, we published LinkedIn posts that advertised the event as an opportunity to hear more about ‘priorities and challenges in water conservation behaviour change’ and to ‘share views and help shape a comprehensive research and impact agenda for water conservation’. Attendee information (organisation name and type) was recorded during online registration.

Seventy-five people participated, of whom 74 attended the webinar and one provided post-webinar comments on an online whiteboard. At least 49 organisations were represented, though two respondents did not state their organisation.

Activity structure

The webinar comprised a presentation summarising our relevant research and priorities emerging from Activities 1 and 2, followed by a live discussion.

Co-creation input capture

Partner input was captured using the Chat function during the webinar, and via email or an online whiteboard up to one week after the webinar.

Comments requesting clarification, offering observations or questions about our research (e.g., ‘how did you control for contamination in your studies?’), or seeking our opinions, were removed prior to integration.

Cross-activity integration and development

After all activities were completed, all input generated across Activities 1 and 3 was collated, pooled and reviewed by author BG.

Developing a research and impact agenda (Activities 1 and 3)

Where necessary, qualitative inputs from these activities (e.g., statements, observations) were reformulated as questions. These were organised into a hierarchical structure in which granular questions (*‘Specific Questions’*) were distilled into higher-order questions (*‘Key Questions’*), which in turn were clustered into themes (i.e., *‘Areas of Uncertainty’*; [20]).

We present a narrative overview of the areas of uncertainty and key questions, as underlying topics of shared interest across the UK water sector. A comprehensive account of the specific questions, key questions, and areas of uncertainty is available in Appendix 1.

Quantifying importance and usefulness of potential behaviour change knowledge gains (Activity 2)

We descriptively analysed survey responses. Although the survey was undertaken prior to finalising the agenda, we retrospectively mapped survey items to Key Questions from the agenda.



Photo: Surrey Water Workshop, October 2024 © Paul Stead

4. RESULTS

A research and action agenda

We constructed seven Areas of Uncertainty, comprising 24 Key Questions (**Table 2**), which in turn summarised 117 Specific Questions (see **Appendix 1**). Five Areas of Uncertainty focused on understanding and promoting change among water consumers, and two themes targeted change within the water sector.

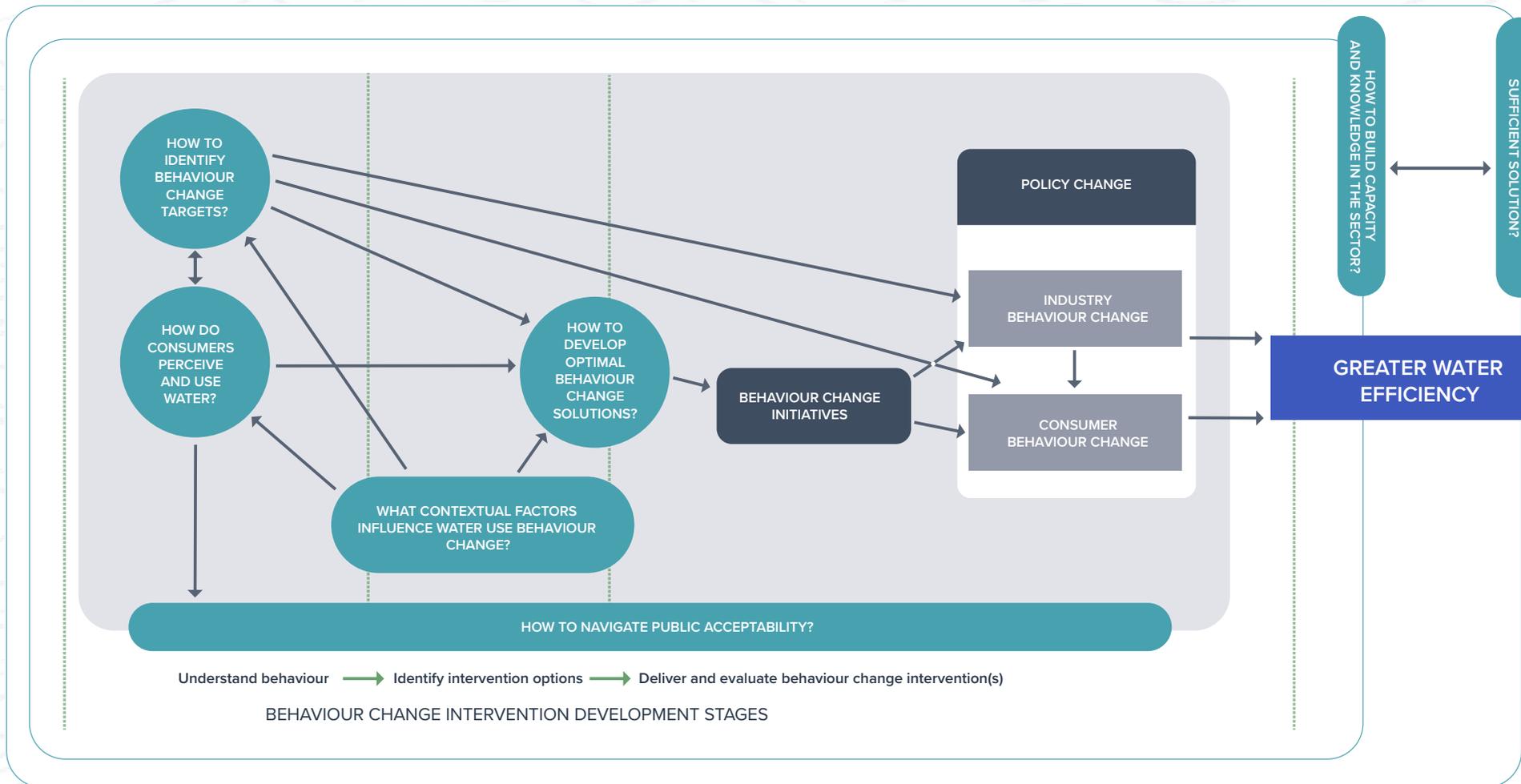
Table 2

Activities 1 and 3: Questions to guide water efficiency behaviour change research and impact activity

Target	Areas of Uncertainty	Key questions
Targeting consumers	Which behaviours should be targeted?	1. Which behaviours should be targeted, and why?
		2. Whose behaviour should be targeted, and why?
	How do consumers perceive and use water?	3. How do consumers perceive water, and why?
		4. How aware are consumers of their water use, and why?
		5. How and why do consumers take showers?
		6. How and why do consumers flush toilets?
		7. Why do consumers (not) detect or address leaks?
		8. How and why do consumers (not) engage with water efficiency information?
	How to navigate public acceptability?	9. How acceptable is the idea of water efficiency through behaviour change among the public, and why?
		10. How does the public perceive UK water efficiency stakeholders, and how does this affect the acceptability of water efficiency?
		11. How acceptable are water efficiency behaviour change initiatives among the public, and why?
	How to develop optimal behavioural solutions?	12. Which determinants of behaviour should be targeted?
		13. What are the optimal behaviour change intervention approaches, and why?
		14. What are the optimal behaviour change solutions for specific water use behaviours, and why?
	What contextual factors influence behaviour change?	15. How should effectiveness be defined?
16. When are consumers most receptive to water efficiency initiatives, and why?		
17. How and why do physical environmental factors determine consumers' receptiveness to water efficiency initiatives?		
18. How and why do socio- and geo-demographic factors determine consumers' receptiveness to water efficiency initiatives?		
Targeting the water sector	How to build capacity and knowledge in the sector?	19. How can we best embed behavioural science thinking into the water sector?
		20. How can we best capitalise on existing insights and expertise within the water sector?
		21. How and what can the water sector learn from other sectors and settings?
	Is behaviour change a sufficient solution?	22. How effective are water efficiency behaviour change initiatives, and how effective could they be?
		23. What other approaches could be used instead of, or alongside, water efficiency behaviour change initiatives?
		24. How can water companies best balance behaviour change against other priorities?

Figure 2

Mapping Areas of Uncertainty to the Intervention Development Process



Understanding and promoting change among consumers

Area of Uncertainty 1: Which behaviours should be targeted?

This theme centred on defining which water efficiency behaviours to change, among whom, and why.

A recurrent question was whether to prioritise behaviours according to potential impact or ease of change (Key Question 1; KQ1). Further questions asked which behaviours are most water- and energy-intensive, which are most costly or easiest to change, which changes are most likely to be maintained, and how to avoid widening inequalities. Questions were asked around whether targeting the behaviour of domestic water stakeholders other than consumers – e.g., landlords, housing developers, housing providers – would be more fruitful (KQ2).

Area of Uncertainty 2: How do consumers perceive and use water?

This theme focused on learning how consumers think about and use water.

Partners felt they knew little about how consumers perceive different types of water (e.g., clean water, rainwater, grey water), and their suitability for domestic water-use activities (KQ3). Awareness was viewed as an important precursor of water conservation, yet partners felt there was insufficient knowledge around consumers' awareness and understanding, and how to communicate water consumption meaningfully (KQ4).

Four specific water-use activities were of especial interest. Many questions were asked about showering (KQ5), including why people shower, what they do when showering, what prompts the end of a shower, and what determines an 'optimal' showering experience. Toilet-flushing questions focused on how consumers understand and use dual-flush buttons, and how to reduce flushing (KQ6). Partners also sought to understand whether and why consumers recognise and fix leaks (KQ7), and whether and how consumers digest and respond to water efficiency information (KQ8). For all four behaviours, questions were posed regarding the potential influence of sociodemographics.

Area of Uncertainty 3: How to navigate public acceptability?

This theme centred on understanding public receptiveness to water efficiency behaviour change initiatives.

Partners sought to understand how best to communicate about water efficiency behaviour change to promote public buy-in (KQ9), and the extent to which a perceived lack of trust in UK water companies might affect receptiveness to initiatives (KQ10). Questions were asked about which organisations are viewed as most credible, trustworthy and persuasive when delivering behaviour change guidance. Interest was expressed in gauging whether and why the public would accept behaviour change initiatives such as alternative water pricing models, water-efficient appliances, taking shorter or fewer showers, and flushing toilets less often (KQ11).

Area of Uncertainty 4: How to develop optimal behaviour change solutions?

This theme captured questions regarding which initiatives to deploy, and summarised the greatest number of granular questions.

Several questions were raised regarding whether and how to increase water efficiency motivation, and the utility of harnessing awareness, costs, emotions, social influences, habits and decision-making as behaviour change mechanisms (KQ12). Partners wanted to know whether an ‘optimal’ approach could be identified that would encourage water efficiency across multiple water-use activities, and the effectiveness of specific strategies including messaging, feedback, gamification, and design-based initiatives (KQ13). Questions were also posed around how best to modify core behaviours of interest, including reducing showering, fixing leaks, and engaging with water efficiency messages (KQ14).

There was uncertainty around what should constitute ‘successful’ water efficiency behaviour change, such as whether water consumption should be the sole outcome or whether adjacent outcomes (e.g., carbon savings) should be viewed as outcomes of interest, and the importance of short-term versus long-term effectiveness (KQ15).

Area of Uncertainty 5: What contextual factors influence water use behaviour change?

This theme centred on potential contextual factors determining consumers’ receptiveness to water efficiency behaviour change initiatives. These included questions around ‘windows of opportunity’ during which consumers may be most open to behaviour change (KQ16), and factors that may shape the effectiveness of initiatives, such as environmental, geographical and structural factors (KQ17), and demographics such as age and culture (KQ18).

Understanding and promoting change among the water sector

Area of Uncertainty 6: How to build capacity and knowledge in the sector?

This theme focused on supporting the sector to develop the skills, knowledge and expertise needed to design and evaluate optimally effective behaviour change initiatives.

Partners wanted to know how best to ensure the sector adopts behavioural science thinking (KQ19) and shares existing knowledge and expertise (KQ20). Questions were raised regarding how to learn from experiences and initiatives in other settings (e.g., non-domestic settings, water scarce countries), and how to ensure knowledge exchange with other sectors (e.g., the energy sector) (KQ21).

Area of Uncertainty 7: Is behaviour change a sufficient solution?

This theme captured uncertainty around the effectiveness and sufficiency of a behaviour change approach to water efficiency.

Partners sought to understand the maximum potential effectiveness of behaviour change initiatives relative to non-behavioural solutions (KQ22). Questions were also asked around whether a systems-based approach, focusing on a broader range of initiatives and stakeholders surrounding water efficiency (e.g., policy change), might be more beneficial, or might heighten the effectiveness of behaviour change initiatives – and if so, how to support the sector to adopt systems thinking (KQ23). There was also uncertainty around how best to reconcile behaviour change with potentially competing priorities, such as maximising revenue, minimising sector costs, and minimising water inequality (KQ24).

Importance and usefulness of potential behaviour change activities

Data from Activity 2 showed that the three behaviours deemed most important were reporting or fixing in-home leaks, showering and flushing toilets. Four of the six behaviours rated most important were bathroom-based (i.e., showering, flushing toilets, taking baths, using the bathroom sink).

The three behaviours deemed of least importance were washing vehicles, brushing teeth, and preparing food, though the former two had an above-midpoint score, indicating that respondents deemed them important overall.

Table 3

Activity 2: Water sector perceptions of the importance of behaviours (corresponds to Key Question 1)

“How important is it for UK domestic water conservation initiatives to target...”	Number of responses	Mean (1 = very unimportant, 7 = very important)	Standard deviation
Reporting or fixing in-home leaks	34	4.85	1.16
Showering	34	4.82	1.19
Flushing toilets	33	4.64	1.19
Gardening	33	4.58	1.39
Taking baths	33	4.58	1.00
Using bathroom sink	33	4.27	1.07
Washing dishes by hand	34	4.26	1.11
Washing clothes	33	4.18	1.19
Using a dishwasher	33	4.18	1.01
Using kitchen sink	33	4.15	1.20
Washing vehicles	33	4.09	1.21
Brushing teeth	33	4.03	1.33
Preparing food	34	3.74	1.21

As Table 4 shows, all 11 potential knowledge gains were perceived to be useful, scoring above the midpoint (3.5) on the 1-6 scale, where 6 indicated highest usefulness. The three knowledge gains deemed most useful centred on understanding which behaviours to target to maximise impact (KQ1), which behaviour change strategies would be most or least acceptable (KQ11), and what makes an effective motivational water conservation message (RQ13). The three knowledge gains rated least useful focused on understanding how to ensure equality when changing behaviour (KQ24), and motivations underlying showering (KQ5) and flushing toilets (KQ6).

Table 4

Activity 2: Perceived usefulness of potential behaviour change activities (from 29 responses)

“How useful would it be for your organisation to know more about...”	Corresponding Key Question(s)	Mean (1 = not at all useful, 6 = extremely useful)	Standard deviation
Which behaviours to target to most effectively reduce domestic water consumption	KQ1	5.55	0.78
Which behaviour change strategies are most or least publicly acceptable	KQ11	5.34	0.86
What makes an effective message for motivating people to save water	KQ13	5.31	0.89
How to maintain water conservation behaviours over time	KQ1, KQ15	5.24	1.15
To what extent can water conservation be encouraged through voluntary behaviour change	KQ22	5.24	1.02
To what extent can water conservation be encouraged through design or changing environments	KQ13, KQ22	5.21	0.98
How to contribute to behaviour change initiatives while also achieving organisations’ other priorities	KQ24	5.14	1.09
How best to communicate importance of saving water to water users	KQ13	5.03	1.09
How to ensure social justice or equality when attempting to change behaviour	KQ24	4.48	1.30
How, why or when people take showers	KQ5	4.31	1.65
How, why or when people flush toilets	KQ6	4.31	1.65

* Of 34 respondents, five did not complete this set of questions.



5.

REFLECTIONS AND RECOMMENDATIONS

Working with over 100 individuals from over 60 organisations in the water sector, we identified five Areas of Uncertainty relating to understanding and promoting acceptable changes to consumers' domestic water consumption, and two Areas of Uncertainty focused on whether and how the sector might best adopt a behaviour change approach. Survey data established that bathroom-based behaviours were of highest priority for change, and that the knowledge gains deemed most useful focused on understanding which behaviours to target and how to change them.



Recommendation 1: Collaborate with behavioural scientists.

Water sector stakeholders should collaborate with behavioural scientists to address key knowledge gaps.

Partnering with behavioural scientists will enhance the range of theory- and evidence-based tools to address these questions, and improve the sector's understanding of water use and choice of theory- and evidence-based behaviour change tools.

Showering and flushing toilets were deemed high-priority behaviour change targets, yet co-design partners placed relatively little value on understanding showering or flushing toilets. Interest in these behaviours is unsurprising; showering is one of the most water- and energy-intensive in-home activities, consuming 15 litres per minute on average [2], and toilets use around 25% of all UK household drinking water [21]. However, the lack of prioritisation of understanding these behaviours is unexpected from a behavioural science perspective. Intervention development frameworks propose that understanding why a behaviour occurs and in which context is key for developing effective methods to change that behaviour [17, 18]. Conversely, the knowledge gains that partners rated as most potentially useful tended to focus on identifying what makes for the most effective intervention, which assumes a 'one size fits all' initiative that is uniformly effective in reducing domestic water consumption. This assumption overlooks the complex motivations and values that shape how water is used, by whom, why, and in what settings, which in turn will inform the acceptability and feasibility of domestic water efficiency initiatives. For example, people take showers and baths not only for cleanliness and hygiene, but also as 'me-time' [22]. Different messages may be needed to tackle showering for hygiene versus for restorative purposes. Recognising why people use water will aid development of value-congruent water efficiency initiatives deemed acceptable by consumers.





Recommendation 2: Understand behaviour before trying to change behaviour. To develop more effective behaviour change strategies, the water sector should prioritise understanding the motives, values and meanings underpinning water use in everyday routines, and contextual factors that frame these behaviours.

Understanding household water use will require a move beyond self-report data, especially for bathroom behaviours, which may be especially prone to social desirability biases [23-25]. Smart technology can generate reliable data on bathroom water use; smart sensors can detect shower duration from temperature, humidity, sound and movement, and pipe and sink sensors can deliver time-stamped water flow data [26].

Several questions were raised around how to enhance the effectiveness of behavioural strategies such as messaging, feedback provision, and gamification. These strategies are notable because they seek to motivate people. While such interventions can be effective [27], many water use activities are performed repetitively and with little conscious thought; that is, habitually [28-30]. Habitual actions can persist even when people are motivated to stop doing them, because everyday stressors, distractions or fatigue often prevent people from actively monitoring and adjusting behaviour done without thinking [31]. Habitual behaviours are not reliably disrupted by educating consumers about the advantages of water efficiency [32]. Notably few questions were raised about the importance of habit for water efficiency behaviour change; this may reflect a broader human tendency to overlook the role of automaticity in everyday action [33].



Recommendation 3: Use habit-breaking strategies. We recommend the water sector makes more use of techniques to disrupt automatic ['habitual'] water activities, such as the provision of salient stimuli to raise in-the-moment awareness (e.g., shower timer feedback; [26]).

Partners raised questions around whether there may be particularly opportune moments for intervention. Habit theory predicts that delivering water efficiency support during or immediately following important context changes, such as when people refit their kitchens or bathrooms, will be most effective [34]. In such instances, water use habits performed in old contexts may be disrupted, such that water activities become less habitual and more consciously driven. Context changes can offer a 'window of opportunity' during which people are more receptive to behaviour change guidance, before they settle into new patterns [35, 36].

Workshop and webinar discussions suggested that many water companies had already undertaken work that could potentially address many of the key questions raised around effective water efficiency behaviour change. Yet, few had shared findings with others, reportedly due to commercial sensitivity. Similarly, existing academic research could help to plug perceived knowledge gaps in the sector, such as reviews highlighting the most effective information-based motivational messaging strategies [16], and the comparative water savings typically obtained through different demand management strategies [37].

Considerable progress towards addressing our agenda could be made, at relatively little cost, by developing policies, incentives and structures to facilitate knowledge exchange. The existential nature of the water scarcity crisis demands urgent work to encourage sharing data and knowledge within commercial constraints. Behavioural science tools are available that provide standardised terminology that can describe interventions in relatively abstract terms, and so facilitate consolidation of knowledge without sharing sensitive details [38].



Recommendation 4: More knowledge exchange. The water sector should boost its knowledge-sharing activity.

The sector already holds insights into many of the questions raised in this agenda, but fails to share this knowledge. Policymakers should incentivise knowledge exchange within the sector. Behavioural scientists can advise on how best to communicate and learn from behaviour change insights.

In keeping with current priorities in the UK water sector [1], our agenda prioritises behavioural approaches to water efficiency. Individual-level behaviour change approaches have been criticised for detracting from upstream, systemic solutions, such as developing policy and technology to encourage water-saving with minimal consumer burden [39]. Some behavioural scientists conceive of policy change as the outcome of behaviour change among policymakers [17], but this downplays the need for systems-based thinking. From a system perspective, water-use activities must be understood as one component within a complex and interrelated system of behaviours, actors, and surrounding social structures. Individual-level behaviour change is one of many water efficiency tools.



Recommendation 5: Recognise that behaviour change is one of several approaches. Individual-level behaviour change must be seen as only one tool within the broader water efficiency toolbox.

Other, potentially complementary approaches, such as structural changes or technological developments, may be more feasible to implement, or otherwise have greater impact on water consumption, than individual-level strategies such as ‘nudging’.

6.

CONCLUSION

Our agenda represents a collaborative attempt to identify knowledge barriers that the water sector believes impedes progress in domestic water efficiency behaviour change. The agenda may not be comprehensive, and many depicted knowledge gaps could potentially already be plugged through better sharing of existing knowledge in the sector and the academic literature. Nonetheless, we encourage water sector stakeholders to use this agenda to shape future research and impact activity, with a particular emphasis on better understanding behaviours, selecting the most appropriate tools to change behaviours according to their determinants, and sharing existing knowledge more openly with the sector.



Funding statement

This work was supported by an Economic and Social Research Council Impact Acceleration Account grant (ref RN0632R). The funder had no involvement in study design, collection, analysis or interpretation of data, writing of the report, or the decision to submit the article for publication.

References

1. Environment Agency. (2025, June 26). *National Framework for Water Resources 2025: Water for growth, nature and a resilient future*. <https://www.gov.uk/government/publications/national-framework-for-water-resources-2025-water-for-growth-nature-and-a-resilient-future>
2. Consumer Council for Water. (2025). *How much water do you use?* <https://www.ccw.org.uk/save-money-and-water/averagewateruse/>
3. Discover Water. (undated). *Find out how water companies in England & Wales are performing: The amount we use*. <http://discoverwater.co.uk>
4. Waterwise. (2019). *PR19 Challenge Report #5: Water consumption*. <https://database.waterwise.org.uk/knowledge-base/wwt-pr19-challenge-report-5-water-consumption/>
5. Department for Environment, Food & Rural Affairs. (2019). *Water conservation: Measures to reduce personal water use*. <https://www.gov.uk/government/consultations/water-conservation-measures-to-reduce-personal-water-use>
6. Department for Environment, Food & Rural Affairs. (2023). *Environmental Improvement Plan 2023*. <https://www.gov.uk/government/publications/environmental-improvement-plan>
7. Environment Agency. (2023). *A review of England's revised draft regional and water resources management plans*. <https://www.gov.uk/government/publications/a-review-of-englands-draft-regional-and-water-resources-management-plans>
8. Independent Water Commission. (2025). *Independent Water Commission: Final Report*. <https://www.gov.uk/government/publications/independent-water-commission-review-of-the-water-sector>
9. Waterwise. (2025b). Support the planned smart water meter roll-out in England and Wales | Policies. *Waterwise*. <https://waterwise.org.uk/policy-work/support-the-planned-smart-water-meter-roll-out-in-england-and-wales/>
10. Department for Environment, Food & Rural Affairs. (2023). *Plan for Water: Our integrated plan for delivering clean and plentiful water*. <https://www.gov.uk/government/publications/plan-for-water-our-integrated-plan-for-delivering-clean-and-plentiful-water/plan-for-water-our-integrated-plan-for-delivering-clean-and-plentiful-water>
11. Artesia. (2023). *Opportunities and Challenges for Behaviour Change via the Water Efficiency Fund: A scoping exercise* (No. AR1553). Artesia Consulting. <https://www.ofwat.gov.uk/wp-content/uploads/2024/05/Opportunities-and-Challenges-for-Behaviour-Change-via-the-WEF.pdf>
12. Water UK, & UK Water Industry Research. (2013). *Managing through drought: Code of practice and guidance for water companies on water use restrictions—2013*. <https://www.water.org.uk/managing-through-drought-code-practice-and-guidance-water-companies-water-use-restrictions-2013>

13. Larbey, R., & Weitkamp, E. (2020). Water Scarcity Communication in the UK: Learning From Water Company Communications Following the 2018 Heatwave. *Frontiers in Environmental Science*, 8. <https://doi.org/10.3389/fenvs.2020.578423>
14. Water UK. (2025). *Water you thinking? Brits way off on daily usage* | Water UK. <https://www.water.org.uk/news-views-publications/news/water-you-thinking-brits-way-daily-usage>
15. Cialdini, R. B., & Jacobson, R. P. (2021). Influences of social norms on climate change-related behaviors. *Current Opinion in Behavioral Sciences*, 42, 1–8. <https://doi.org/10.1016/j.cobeha.2021.01.005>
16. Ehret, P. J., Hodges, H. E., Kuehl, C., Brick, C., Mueller, S., & Anderson, S. E. (2021). Systematic Review of Household Water Conservation Interventions Using the Information–Motivation–Behavioral Skills Model. *Environment and Behavior*, 53(5), 485–519. <https://doi.org/10.1177/0013916519896868>
17. Fernandez, M. E., Ruitter, R. A. C., Markham, C. M., & Kok, G. (2019). Intervention Mapping: Theory- and Evidence-Based Health Promotion Program Planning: Perspective and Examples. *Frontiers in Public Health*, 7. <https://doi.org/10.3389/fpubh.2019.00209>
18. Michie, S., Atkins, L., & West, R. (2014). *The Behaviour Change Wheel: A guide to designing interventions*. Silverback Publishing.
19. World Health Organization. (2020). Shaping the research agenda. <https://www.who.int/our-work/science-division/research-for-health/optimizing-research-processes/shaping-the-research-agenda>
20. Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, 18(3), 328–352. <https://doi.org/10.1080/14780887.2020.1769238>
21. Waterwise. (2025). *How to save water*. <https://waterwise.org.uk/how-to-save-water/>
22. Quitzau, M.-B., & Røpke, I. (2009). Bathroom transformation: From hygiene to well-being? *Home Cultures*, 6(3), 219–242.
23. Davies, R., Mowbray, F., Martin, A. F., Smith, L. E., & Rubin, G. J. (2022). A systematic review of observational methods used to quantify personal protective behaviours among members of the public during the COVID-19 pandemic, and the concordance between observational and self-report measures in infectious disease health protection. *BMC Public Health*, 22(1), 1436. <https://doi.org/10.1186/s12889-022-13819-0>
24. Gramigna, R. (2013). Toilet cultures: Boundaries, dirt and disgust. In *Things in Culture, Culture in Things* (Vol. 3, pp. 256–279). University of Tartu Press.
25. Kormos, C., & Gifford, R. (2014). The validity of self-report measures of proenvironmental behavior: A meta-analytic review. *Journal of Environmental Psychology*, 40, 359–371. <https://doi.org/10.1016/j.jenvp.2014.09.003>
26. Pereira-Doel, P., Font, X., Wyles, K., & Pereira-Moliner, J. (2025). Reducing Shower Duration in Tourist Accommodations: A Covert True Experiment of Continuous Real-Time Eco-Feedback and Persuasive Messaging. *Journal of Travel Research*, 64(5), 1100-1120. <https://doi.org/10.1177/00472875241245045>
27. Grilli, G., & Curtis, J. (2021). Encouraging pro-environmental behaviours: A review of methods and approaches. *Renewable and Sustainable Energy Reviews*, 135, 110039. <https://doi.org/10.1016/j.rser.2020.110039>
28. Adeyeye, K., She, K., & Meireles, I. (2020). Beyond the flow rate: The importance

- of thermal range, flow intensity, and distribution for water-efficient showers. *Environmental Science and Pollution Research*, 27(5), 4640–4660. <https://doi.org/10.1007/s11356-019-07235-y>
29. Dean, A. J., Kneebone, S., Tull, F., Lauren, N., & Smith, L. D. G. (2021). ‘Stickiness’ of water-saving behaviours: What factors influence whether behaviours are maintained or given up? *Resources, Conservation and Recycling*, 169, 105531. <https://doi.org/10.1016/j.resconrec.2021.105531>
 30. Garcia-Valiñas, M. A., Athukorala, W., Wilson, C., Torgler, B., & Gifford, R. (2014). Nondiscretionary residential water use: The impact of habits and water-efficient technologies. *Australian Journal of Agricultural Resources*, 58, 185–204. <https://doi.org/10.1111/1467-8489.12030>
 31. Gardner, B., Lally, P., & Rebar, A. L. (2020). Does habit weaken the relationship between intention and behaviour? Revisiting the habit-intention interaction hypothesis. *Social and Personality Psychology Compass*, 14(8), e12553. <https://doi.org/10.1111/spc3.12553>
 32. Verplanken, B., Aarts, H., & Knippenberg, V. (1997). Habit, information acquisition, and the process of making travel mode choices. *European Journal of Social Psychology*, 27(5), 539–560.
 33. Mazar, A., & Wood, W. (2022). Illusory Feelings, Elusive Habits: People Overlook Habits in Explanations of Behavior. *Psychological Science*, 33(4), 563–578. <https://doi.org/10.1177/09567976211045345>
 34. Walker, I., Thomas, G., & Verplanken, B. (2015). Old Habits Die Hard: Travel Habit Formation and Decay During an Office Relocation. *Environment and Behavior*, 47(10), 1089–1106. <https://doi.org/10.1177/0013916514549619>
 35. Verplanken, B., Roy, D., & Whitmarsh, L. (2018). Cracks in the wall: Habit discontinuities as vehicles for behaviour change. In B. Verplanken (Ed.), *The Psychology of Habit* (pp. 189–206). Springer.
 36. Whitmarsh, L., Mitev, K., Nash, N., Hoolohan, C., Poortinga, W., Whittle, C., Haggard, P., Tipping, C., Dudley, H., Turner, L., Carr, D., Felder, L., Verplanken, B., & Graham, H. (2025). “Moments of Change” and Low-Carbon Behaviors: A Multidisciplinary, Systematic Review. *WIREs Climate Change*, 16(4), e70014. <https://doi.org/10.1002/wcc.70014>
 37. Inman, D., & Jeffrey, P. (2006). A review of residential water conservation tool performance and influences on implementation effectiveness. *Urban Water Journal*, 3(3), 127–143. <https://doi.org/10/dr6rh6>
 38. Marques, M. M., Wright, A. J., Corker, E., Johnston, M., West, R., Hastings, J., Zhang, L., & Michie, S. (2024). The Behaviour Change Technique Ontology: Transforming the Behaviour Change Technique Taxonomy v1 [version 2; peer review: 4 approved]. *Wellcome Open Research*, 8, 308. <https://doi.org/10.12688/wellcomeopenres.19363.2>
 39. Chater, N., & Loewenstein, G. (2023). The i-frame and the s-frame: How focusing on individual-level solutions has led behavioral public policy astray. *Behavioral and Brain Sciences*, 46, e147. <https://doi.org/10.1017/S0140525X22002023>

Appendix 1: Full research and action agenda

TARGETING CONSUMERS

Areas of Uncertainty	Key Questions	Specific Questions
Which behaviours should be targeted?	1. Which behaviours should be targeted, and why?	<ul style="list-style-type: none"> · Should we prioritise changing behaviours with most impact on water consumption, or behaviours that can most feasibly be changed? · Which behaviours consume most water? · Which behaviours consume most energy? · Which behaviours are most costly to change? · Which behaviours are easiest to change? · Which behaviour changes are most likely to be maintained? · Which behaviours can be changed in the most socially equitable way?
	2. Whose behaviour should be targeted, and why?	<ul style="list-style-type: none"> · Should we target high-consumption users or others? · Should we target end-users or others? · Should we target attitude and behaviour change among children, as consumers of the future?
How do consumers perceive and use water?	3. How do consumers perceive water, and why?	<ul style="list-style-type: none"> · How water-literate are consumers? · Do consumers value water? · How do consumers perceive clean water vs grey water vs rainwater vs wastewater? · How do consumers perceive the suitability of grey water and rainwater for water activities, and why?
	4. How aware are consumers of their water use, and why?	<ul style="list-style-type: none"> · Do consumers know how much water they use through everyday domestic activities? · How can we communicate water consumption to consumers in a meaningful way?
	5. How and why do consumers have showers?	<ul style="list-style-type: none"> · Why do consumers take showers? · How do consumers use showers and showerheads? · What are the main tasks undertaken in the shower? · What prompts consumers to finish showering? · What makes for an optimum showering episode for consumers? · Do consumers accurately perceive their shower time? · Does showering behaviour vary across socio-demographics (e.g., age) and by health status, and if so, how and why? · Does culture influence showering, and if so, how and why?
	6. How and why do consumers flush toilets?	<ul style="list-style-type: none"> · How do consumers understand and use dual-flush systems? · How many toilet flushes could be prevented, and why? · Does toilet-flushing behaviour vary across socio-demographic groups (e.g., age) and health status, and if so, why? · Does culture influence toilet-flushing behaviour, and if so, how and why?

	<p>7. Why do consumers (not) detect or address leaks?</p>	<ul style="list-style-type: none"> · What prompts consumers to detect and address toilet leaks, and why? · Does detecting or addressing leaks vary across socio- and geo-demographic groups, and if so, how and why?
	<p>8. How and why do consumers (not) engage with water efficiency information?</p>	<ul style="list-style-type: none"> · What prompts consumers to engage with communications (e.g., open emails, read messages) regarding water efficiency? · Does engaging with communications regarding water efficiency vary across socio- and geo-demographic groups, and if so, how and why?
<p>How to navigate public acceptability?</p>	<p>9. How acceptable is the idea of water efficiency through behaviour change among the public, and why?</p>	<ul style="list-style-type: none"> · How can water efficiency behaviour change initiatives be communicated to the public in the most acceptable way? · How can we ensure the public buys in to the idea of water efficiency through behaviour change?
	<p>10. How does the public perceive UK water efficiency stakeholders, and how does this affect the acceptability of water efficiency?</p>	<ul style="list-style-type: none"> · To what extent does distrust of UK water companies influence consumers' willingness to save water? · Can distrust of UK water companies be overcome, and if so, how? · Can we challenge perceptions that water companies are to blame for water scarcity, and if so, how? · Are customers of nationalised water companies more willing to save water than customers of privatised water companies, and if so, why? · Which stakeholders/organisations would the public view as most credible and trustworthy if they were to deliver water efficiency messages, and why?
	<p>11. How acceptable are water efficiency behaviour change initiatives among the public, and why?</p>	<ul style="list-style-type: none"> · How acceptable or unacceptable are different water pricing models/tariffs, and why? · How acceptable or unacceptable is a water use cap, and why? · How acceptable or unacceptable is showering at a lower temperature, or for less time, and why? · How acceptable or unacceptable is showering less often? · Are consumers willing to move from water-intensive showers to lower-water showers, and why? · How acceptable or unacceptable is not flushing the toilet, and why? · How acceptable or unacceptable are water-efficient appliances that compromise user experience, and why?
<p>How to develop optimal behavioural solutions?</p>	<p>12. Which determinants of behaviour should be targeted?</p>	<p>Awareness of water efficiency</p> <ul style="list-style-type: none"> · How can we best build awareness of water scarcity and the need for water efficiency? · What is the best metric to depict and explain water scarcity and the need for water efficiency? · What makes an effective water efficiency message?

General motivation

- How can we motivate consumers to voluntarily save water?
- How can we motivate non-end-users (e.g., landlords) to save water in the absence of personal benefits?
- How can we motivate consumers to voluntarily adopt technology to enable water efficiency?
- How can we motivate consumers who do not want to use technology-based solutions to save water?

Cost

- How important is cost as a motivator for water efficiency behaviour change?
- Can we incentivise water efficiency despite the low financial cost of water to the consumer, and if so, how?
- How can we promote behaviour change at minimal financial cost to the consumer?

Emotions

- What are the emotional triggers that prompt engagement in water-efficient behaviours?

Social influences

- Can we create or harness social norms to drive consumers to save water, and if so, how?

Habits

- Can we break ingrained water-use habits, and if so, how?

Decision-making

- How do heuristics and biases affect consumers' willingness to reduce water use?

13. What are the optimal behaviour change intervention approaches, and why?

Generic solutions

- Is there a 'best strategy' for encouraging consumers to change their behaviour, and if so, what is it?
- Can we encourage consumers to change their behaviour without using messaging, and if so, how?

Messaging solutions

- What makes an effective water efficiency behaviour change message, and why?
- How can water efficiency messages best communicate the benefits of using less water?

Feedback-based solutions

- What is the most meaningful data to feed back to consumers to ensure they recognise and understand their water consumption, and why?
- Should feedback be based on water savings, energy savings, money savings, or some other outcome, and why?

Gamification solutions

- How effective would a water efficiency gamification approach be, and why?
- If gamification were used, at what point within a water use event should it be deployed, and why?

Design solutions

- Would making 'eco' settings the default on appliances reduce water (and energy) consumption?
- How do consumers interpret 'eco' settings on appliances, and why?
- How can we better communicate the meaning and benefits of 'eco' settings on water-use machines?

14.

What are the optimal behaviour change solutions for specific water use behaviours, and why?

Showering solutions

- To achieve most leverage over showering water use, should we target consumers who take longer showers, or those who wait for the shower to warm up?
- Where are the opportunities for behaviour change within a showering episode?
- What are the main barriers to consumers turning off showers midway through?

Leak-focused solutions

- How should we encourage consumers to check for and address leaks, and why?
- Which behaviours should we target to prevent leaks?

Water efficiency message engagement solutions

- Can we motivate consumers to engage with data from a water meter, and if so, how?

15.

How should effectiveness be defined?

- How should we measure behaviour change?
- Can the effectiveness of behaviour change initiatives be sustained over time, and if so, which initiatives, how and why?
- Should an initiative that has only short-term benefits be deemed effective?
- Should effectiveness be based on water consumption only, or on related outcomes (e.g., carbon emissions)?
- How should we measure impact beyond behaviour change?
- Does increased water efficiency in domestic settings spillover to non-domestic settings?

What contextual factors influence behaviour change?

16.

When are consumers most receptive to water efficiency initiatives, and why?

- Are consumers more receptive to water efficiency initiatives following life transitions, and why?
- Are consumers more receptive to water efficiency initiatives after moving on to a water meter, and why?
- Which moments of change shape receptiveness to water efficiency initiatives, and why?
- Around which moment(s) of change are consumers most receptive to water efficiency initiatives, and why?
- Are consumers more receptive to water efficiency initiatives in certain seasons, and if so, why?

17.

How and why do physical environmental factors determine consumers' receptiveness to water efficiency initiatives?

Geographical

- Are consumers less receptive to water efficiency initiatives when they perceive greater water availability (e.g., from rainfall, living in wetter areas, importing water from other areas), and if so, why?
- Do consumers in different regions respond differently to water efficiency initiatives, and if so, why?

Structural and related

- Are consumers more receptive to water efficiency initiatives when they are on a water meter or rateable value tariffs, and if so, why?
- Are water efficiency initiatives more or less effective in certain housing stock, and if so, why?

18.

How and why do socio- and geo-demographic factors determine consumers' receptiveness to water efficiency initiatives?

- Are consumers from certain socio- and geo-demographic groups (e.g., age) more receptive to water efficiency initiatives, and if so, why?
- Does culture affect receptiveness to water efficiency initiatives, and if so, how and why?

TARGETING THE WATER SECTOR

Areas of Uncertainty	Key Questions	Specific Questions
How to build capacity and knowledge in the sector?	19. How can we best embed behavioural science thinking into the water sector?	<ul style="list-style-type: none"> · How can the sector best be supported to adopt a behavioural science perspective on water efficiency? · How can water companies be encouraged to engage in more behaviour change experimentation, testing and implementation?
	20. How can we best capitalise on existing insights and expertise within the water sector?	<ul style="list-style-type: none"> · How can we best facilitate exchange of existing knowledge (e.g., from relevant research and impact activity) among water sector stakeholders? · How should water stakeholders work together in the most mutually beneficial way?
	21. How and what can the water sector learn from other sectors and settings?	<ul style="list-style-type: none"> · How and what can we learn from people who are highly effective at minimising water use? · How and what can we learn from water efficiency experiences in non-domestic settings? · How and what can we learn from other, water-scarce countries? · How and what can we learn from the energy sector? · How can we ensure cross-pollination of behaviour change ideas between the water and energy sectors?

Is behaviour change a sufficient solution?

22. How effective are water efficiency behaviour change initiatives, and how effective could they be?

- Is behaviour change the best approach to promoting water efficiency?
- How effective are behaviour change initiatives?
- Is there an upper limit to the effectiveness of behaviour change initiatives?

23. What other approaches could be used instead of, or alongside, water efficiency behaviour change initiatives?

- Is mandatory regulation required to encourage water efficiency behaviour change?
- Would a systems-based approach be more beneficial than focusing on behaviour change?
- How can a behaviour change approach be reconciled with a systems-based approach?
- How can the sector best be supported to adopt a systems-based perspective on water efficiency?
- If a systems-based approach were adopted, who would be responsible for systems-based change?

24. How can water companies best balance behaviour change against other priorities?

- How can water companies promote behaviour change without increasing cost or decreasing revenue?
- Is the assumption that behaviour change may compromise revenue justified?
- Would water companies be more or less willing to prioritise water efficiency if volumetric tariffs were adopted (instead of fixed charges)?
- Who should bear the financial costs of delivering behaviour change initiatives?
- How to promote behaviour change without compromising customer experience/feedback scores?
- Can water efficiency behaviour change be successfully promoted without increasing social inequalities, and if so, how?



Contact

Prof Benjamin Gardner
benjamin.gardner@surrey.ac.uk