

**Phase 2 of the Evidence Base Project:**

**A Work Plan for the Augmentation of the  
Evidence Base for Large-Scale Water Efficiency  
in Homes**

May 2009

Waterwise is an independent, not-for-profit, nongovernmental organisation that promotes water efficiency in the UK. Our aims are to decrease water consumption in the UK by 2010, and to build an evidence base to support large-scale water efficiency initiatives. We are the leading authority on water efficiency in the UK. In England, we sit on the Environment Minister's Water Saving Group, and in Scotland, we convene the Saving Water in Scotland network.

To achieve our aims we work with water companies, governments, manufacturers, retailers, nongovernmental organisations, regulators, academics, retailers, consumers, the media, and other stakeholders.

We conduct our own research and occasionally undertake work as consultants. In addition to research, we are also involved in policymaking, advising, public relations, and other activities.

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## Executive Summary

The Evidence Base for Large Scale Water Efficiency in Homes, published in October 2008, brings together about twenty water efficiency trials carried out by water companies in the UK. It presents, in one place, the details of some of the largest water efficiency trials, clearly stating the water savings and evaluating the level of uncertainty in the savings. It has proved to be a useful tool in assisting water companies in their submissions for PR09 and has provided regulators with valuable guidance on assessing the benefits of water efficiency projects as part of the development of demand management; however, the study has posed almost as many questions as it has answered, which is why the UK Environment Minister's Water Saving Group agreed that it should be kept updated.

A review of the work published in October 2008 has been carried out, and this has highlighted some areas where more work is required. Points requiring further work include the treatment of uncertainty in reported water savings, ensuring cost data is made available, the robustness of the data included and whether or not water savings decay or are enhanced with time. In addition, we will question the use of the disaggregation method and try to make use of the results of consumer attitude and behaviour surveys. The review has resulted in this Work Plan consisting of five objectives, which should lead to an improved Evidence Base. The objectives are as follows:

Objective 1: Identifying opportunities to improve the Evidence Base

Objective 2: Building upon existing data and analysis.

Objective 3: Improving methodology and reporting of the Evidence Base

Objective 4: Working in collaboration to develop trials to fill knowledge gaps

Objective 5: Future Reporting to Guide Policy Regulation and Practice

Objective 1 has now been completed and work on Objective 2 is at an early stage. Work to update the methodology in Objective 3 can commence prior to completion of Objective 2 and will start as soon as re-analysis of the water efficiency trial datasets yields approaches which can be applied to best practice. The research work described in Objective 4 includes the aim of attaching carbon values to water savings, understanding better how to effect behaviour change that leads to long term water savings and gaining a better grasp of social, environmental and economic costs and benefits for water efficiency. Research to supplement the Evidence Base can only start once funding is in place following the establishment of suitable research collaborations.

Objective 5 aims to reinforce the role of the Evidence Base in guiding policy, regulation and practice in the UK. An updated Evidence Base - containing new, robust data as well as more rigorous analysis and an improved methodology - will provide an even sounder basis on which further government and regulatory policy development and delivery can be built. The Evidence Base is relevant in the context of the review of the Code for Sustainable Homes, the updating of the Water Supply (Water Fittings) Regulations and the Building Regulations, meeting the water industry's water efficiency targets, delivering the government's Future Water ambition of 130 litres per person per day by 2030, meeting government and the water industry's carbon emissions targets, and delivering government plans to retrofit hundreds of thousands of homes to reduce carbon emissions. The Walker Review of Household Charging for Water and Sewerage Services and the Cave Review of Competition and Innovation in Water Markets are also areas where the Evidence Base has provided a useful source of costs and benefits of retrofitting projects – illustrating ways to reflect the true value of water and for water companies to innovate.

There are a number of risks to being able to meet the schedule for updating the Evidence Base as proposed in this Work Plan. Data availability and quality, human resource and funding are all areas which may lead to constraints on project progress. Funding is currently available until September 2009: this has influenced the project schedule mainly by introducing a natural milestone. The aim is for the bulk of the analysis and the update to the best practice guide to be completed by this date. It is envisaged that, given funding, a report on Phase 2 of the Evidence Base for Large Scale Water Efficiency in Homes will be published in Q4 2009.

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## 1 Introduction

In October 2008, Waterwise published the Evidence Base for Large-scale Water Efficiency in Homes, which is now available at [www.waterwise.org.uk](http://www.waterwise.org.uk). This study was the first to bring together data from water company led large-scale water efficiency trials and analyse the data from these using a common methodology. This report aims to update the Evidence Base and to keep it 'live' by identifying opportunities to improve on the data content and analysis of the water efficiency trials contained in the report published in October 2008. Further collaboration with water companies will be important in building on the work which has been accomplished to date. It should also be mentioned that the WR25 series of reports, published by UK Water Industry Research<sup>1</sup> (UKWIR)<sup>2</sup>, has been helpful to date in guiding the methodology applied in evaluating the water savings from water efficiency trials.

An updated Evidence Base, containing new, robust data as well as more rigorous analysis and an improved methodology, will provide an even sounder basis on which further government and regulatory policy development and delivery can be built. With regard to the government per capita consumption ambition, the Evidence Base will seek to demonstrate how progress towards this is achievable by presenting robust estimates of water savings, costs of implementation and uptake rates from past water efficiency trials. Because the Evidence Base will provide an improved source of information about costs and benefits of retrofits, as well as advice on how best to carry these out, it may be of help to government in delivering its Future Water ambition of 130 litres per person per day by 2030, as well as ensuring that new homes are water efficient, through the review of the Code of Sustainable Homes<sup>3</sup>, the updating of the Water Fittings Regulations<sup>4</sup> and the addition of water efficiency in the Building Regulations<sup>5</sup>.

The Evidence Base will also be highly relevant to the government's plans to retrofit every home in the country for energy efficiency in the next two decades, and to make all homes zero carbon by 2050: these programmes will need to include water efficiency measures if they are to deliver their aims. The Walker Review of Household Charging for Water and Sewerage Services<sup>6</sup>, the Cave Review of Competition and Innovation in Water Markets<sup>7</sup>, and government responses to them, can also benefit from the Evidence Base, which illustrates ways to reflect the true value of water and for water companies and others to innovate. The Evidence Base will also help make progress towards the government's legally binding 80% greenhouse gas emissions reduction target, and contribute savings to its 5-yearly carbon budgets, as well as the water industry's own water efficiency and greenhouse gas emissions targets.

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<sup>1</sup> UKWIR Quantification of the Savings, Costs and Benefits of Water Efficiency (Report Ref. No. 03/WR/25/1)

<sup>2</sup> UKWIR Sustainability of Water Efficiency Measures report (Report Ref. No. 06/WR/25/2)

<sup>2</sup> UKWIR Sustainability of Water Efficiency Measures report (Report Ref. No. 06/WR/25/2)

<sup>3</sup>

<http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/englandwales/codesustainable/>

<sup>4</sup> <http://www.defra.gov.uk/environment/water/industry/wsregs99/>

<sup>5</sup> <http://www.communities.gov.uk/publications/planningandbuilding/buildingregulationsexplanatory>

<sup>6</sup> <http://www.defra.gov.uk/ENVIRONMENT/water/industry/water-charging-review/>

<sup>7</sup> Defra, 2008. Cave Review: competition and innovation in water markets, interim report.

<http://www.defra.gov.uk/environment/water/industry/cavereview/interim-report.htm>

The Evidence Base has proved to be a useful tool in assisting water companies in their submissions for PR09<sup>8</sup>, and the development of their Water Resource Management Plans, and has provided regulators with valuable guidance on assessing the benefits of water efficiency projects as part of the development of demand management; however, the study has posed almost as many questions as it has answered, which is why the UK Environment Minister's Water Saving Group agreed at its final meeting in November 2008 that it should be kept updated. Important issues still to be resolved include the following.

- Data Robustness - There continues to be a high degree of uncertainty around savings from individual water efficiency measures; why is there so much variation in savings and can we achieve greater certainty in predicted water savings?
- Cost Data - Sparse information of robust quality is available on the costs associated with implementing water efficiency trials, particularly on costs associated with installations; what are the least-cost water efficiency measures that generate the greatest water savings?
- Social, economic and environmental costs and benefits - Can we put a value on water efficiency that includes economic costs and benefits but also accounts for social and environmental costs and benefits?
- The Disaggregation method - The use of the disaggregation method to relate water savings to microcomponent data has to be confirmed as a process that adds to our understanding of how water savings are derived.
- Patterns of Water Savings - Little information on decay or enhancement of post-trial water savings exists; do water savings decay and if so what is the decay in savings due to behaviour, customer intervention (e.g. removal or replacement of the device) and/or device underperformance?
- Behaviour change and social research - There is a significant lack of understanding of how behaviour is changed by the installation of water efficient devices; what are the benefits of behaviour change initiatives (ranging from leafleting to door knocking to more intensive engagement techniques) and how can these be incorporated into the Evidence Base?

In order to understand these issues further and to build upon the work already carried out in the Evidence Base, Waterwise is launching a programme of work that will be structured around the following objectives:

Objective 1: Identifying opportunities to improve the Evidence Base

Objective 2: Building upon existing data and analysis.

Objective 3: Improving methodology and reporting of the Evidence Base

Objective 4: New Trials and Further Research

Objective 5: Future Reporting to Guide Policy Regulation and Practice

The schematic in Figure 1 contains a summary of the work, which constitutes each objective and is required to update the Evidence Base. The objectives are shown in a logical progression, but there is no obligation for work on a prior objective to be completed before commencing work on a subsequent one. For example, Objective 3 may commence prior to work having been completed on Objective 2 and the same is true of Objective 4 in relation to Objectives 2 and 3. Reporting, covered under Objective 5, is likely to follow completion of work on bringing together best practice as part of Objective 3. Finally, it is worth adding that, in order to keep the Evidence Base 'live', it will be necessary, after the initial update,

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<sup>8</sup> <http://www.ofwat.gov.uk/pricereview/>

to incorporate a review process whereby, after each publication, Waterwise will systematically seek to improve the contents of the Evidence Base and include any new trials.

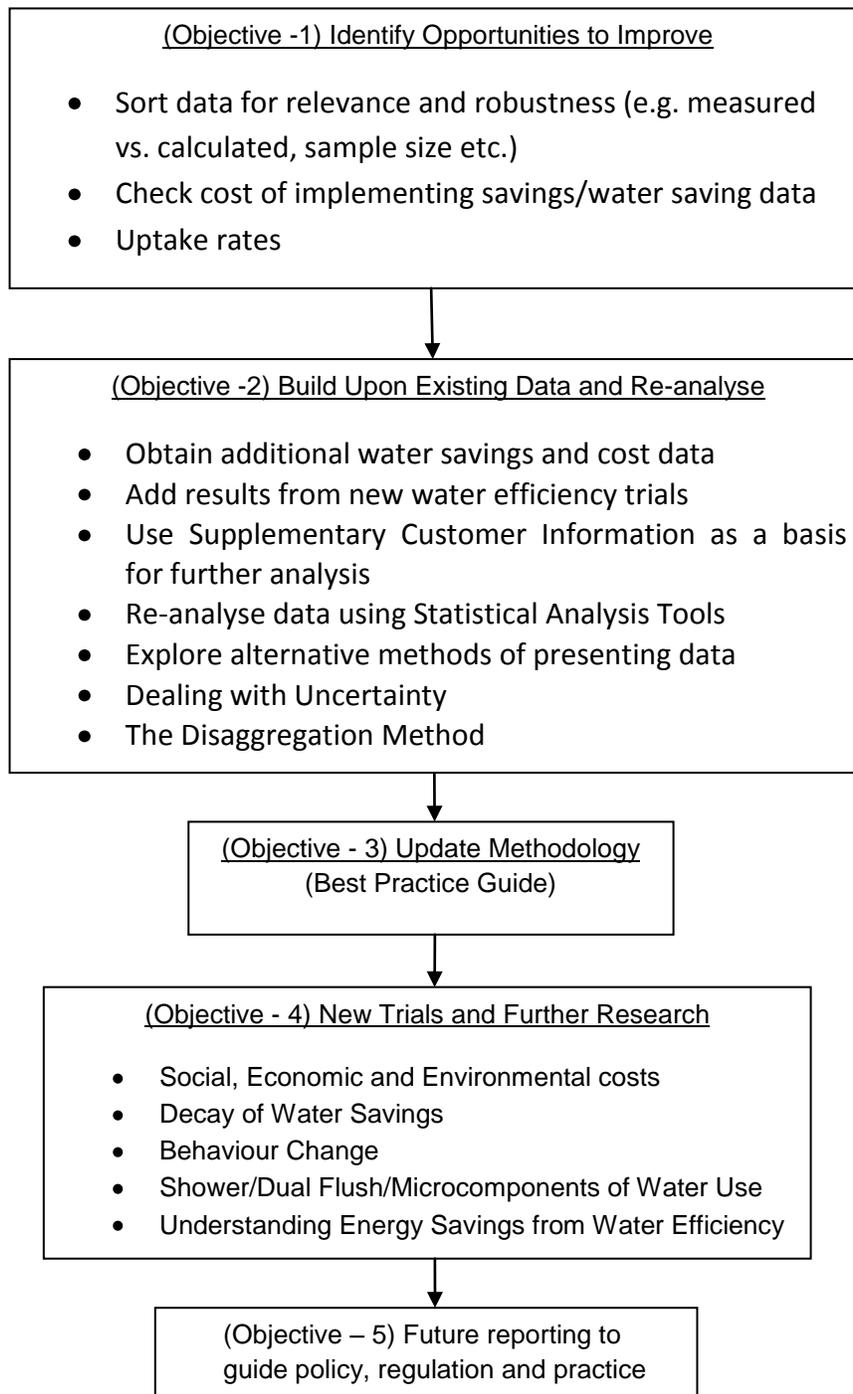
### **1.1 Goals and Benefits**

The Evidence Base seeks to improve the transfer of the experience from several large scale water efficiency trials into informed guidance of industry practice, regulation and government policy. It is envisaged, therefore, that an improved Evidence Base will lead to the following benefits:

- An improved policy framework.
- Better guidance for water companies on water efficiency project rollout
- Availability of better information will enable better industry regulation
- More informed project scenarios allowing for better water efficiency project repeatability for water companies and other stakeholders.
- Improved guidance on water efficiency investment decisions, particularly during price reviews.

This Work Plan will initially focus on ensuring that the data and resulting water savings, cost data and uptake rates, from each of the water efficiency trials included in the Evidence Base are as robust and accurate as possible. This would represent, in itself, useful guidance for industry practice, policy and regulation. However, our goals go further than this, and are to demonstrate the true value of water efficiency and to gain a deeper understanding of both how to maximise water savings from projects and how consumers might best be engaged in water efficiency.

## Waterwise Evidence Base – Next Steps



**Figure 1 - Flow chart showing the objectives which constitute Evidence Base Phase 2 and the key issues**

## 2 Objective 1: Identifying opportunities to improve the Evidence Base

### 2.1 The Current Dataset

A review has been carried out to assess the suitability of the methods used during the first phase of the Evidence Base project and to identify the gaps which currently exist in the data from the water efficiency trials. The original dataset was assessed against some basic criteria with the intention of gauging whether information on uptake, water savings, cost of implementation and how water savings were calculated could be extracted from the individual trial dataset as presented in the trial reports. These basic criteria were:

- Number of properties initially approached to take part in the water efficiency trial
- Number of properties included in the final sample
- Number of individually metered properties
- Number of properties with a data logger fitted.
- Volume of water saved
- Cost of implementing the water efficiency trial
- Whether the water savings were calculated or measured

Table 1 shows the result of evaluating the current set of 17 water trials against these criteria. The shaded parts of the table show the instances where a piece of data which contributes to fulfilling these criteria is not included in the water company report. These shaded areas designate priority areas for filling gaps in the existing dataset.

### 2.2 Opportunities to Improve the Dataset

The initial assessment of the existing datasets highlighted several opportunities for improving it. This section will present the findings of the review on the following issues which relate to the quality and robustness of the dataset, namely:

- Calculated versus Measured Data
- Data Robustness
- Cost Data
- Uptake rates
- Sample size
- Length of Monitoring Period
- Behaviour Change and Social Research
- Supplementary Customer Data
- Attaching Carbon Values to Water Savings

Each of these issues will be considered individually below in addition to proposing next steps to make improvements in these areas.

### 2.2.1 Calculated versus Measured Data

To date there has been only vague distinction made between whether water savings are derived from calculation via the microcomponents or by direct measurement from domestic meters or flow loggers. There are a number of issues with using water savings calculated from microcomponents:

- The fact that no account is taken of human interaction with the Water Efficiency Measure (WEM) means that the major variable which influences water consumption is excluded from the whole process.
- Evidence exists from previous trials<sup>9</sup> that predicted results calculated from microcomponent data and measurements of water savings, by meter or logger, do not agree. This shows us that there are factors which affect water consumption that we do not currently understand. An example of this could be the extent to which customer behaviour and attitudes can be influenced through engagement during water efficiency trials.
- Water savings calculated from microcomponents are unlikely to be given the same level of credibility by water companies as savings which are measured. Especially if this information is to guide investment decisions.

It is proposed in Phase 2 to present water efficiency trial results which offer water savings measured by meter or logger equipment, with greater prominence compared to results from trials where water savings are calculated from microcomponent data or estimated from other data. However, there are valuable lessons to be learned from every aspect of a water efficiency trial, from the design and execution through to the methods used to analyse and present the results. Each of the water efficiency trials which have been included in the first phase of the Evidence Base has something to offer, particularly from a behavioural research viewpoint. Hence, each trial will be analysed to extract elements that can be applied to best practice.

### 2.2.2 Data Robustness

To date, all the trials included in the Evidence Base have been subjected to an assessment of uncertainty as defined in the UKWIR Sustainability of Water Efficiency Measures report (Report Ref. No. 06/WR/25/2)<sup>10</sup>. This method places the data into one of three bands with regard to both accuracy and reliability.

The reliability bands are based on whether household water savings were derived from any measured consumption data:

- Band A for measured micro-component data that requires no disaggregation;
- Band B for measured consumption data based on before and after comparison at DMA or household meter readings. This category includes partial measurement of savings where consumption per device (e.g. shower flow rates) is measured for each household and savings are built up using assumptions on frequency and duration of use. Measurements may involve only a sample of the properties; or,
- Band X for savings based on judgement only, with no measured consumption data.

<sup>9</sup> Essex and Suffolk Water & Mouchel, H2eco Water Efficiency Trial Report, 2008

<sup>10</sup> UKWIR Sustainability of Water Efficiency Measures report (Report Ref. No. 06/WR/25/2)

The accuracy bands are based on 95 percent or 90 percent confidence intervals around the water savings for each trial:

- Band 1 for trials that give confidence limits (upper and lower) and in which all limits are less than or equal to 25 percent of the water savings;
- Band 2 for trials that give confidence limits (upper and lower) and at least one limit (upper or lower) exceeds 25 percent of the water savings; or,
- Band X for trials that give no confidence limits or only one-sided limits (either upper or lower).

The UKWIR method is a valid method for assessment of data robustness in terms of reliability and accuracy. However, Phase 2 of the Evidence Base is to consider the use of other methods of estimating uncertainty such as applying confidence intervals. The aim is to make the uncertainty involved in the water efficiency trials as easily comprehensible as possible. One argument in favour of confidence intervals is that they allow uncertainty in the data to be taken into account in models to which Evidence Base data may be applied such as in UKWIR's Economics of Balancing Supply & Demand (EBS) framework.<sup>11</sup> It would be difficult to take uncertainty into account in such models if reliability and accuracy bands were used. Nevertheless, there remains some concern that if confidence intervals are used they might be extremely large. However, it is important to have an understanding of what level of uncertainty exists in the results if this is to be improved in the future. This issue will be dealt with more fully once we have a clearer idea of the data that we will be obtainable to supplement the existing dataset.

### **2.2.3 Cost Data**

It is essential that the Evidence Base presents data that allows the cost of implementation of water efficiency trials to be evaluated. The cost of water savings is something which is clearly defined in only a few of the trials included in the Evidence Base to date. Including cost analysis of the trials in the Evidence Base will help us harness the experience gained from budgeting for different sizes and types of water efficiency trial which will be invaluable when upscaling to large scale water efficiency projects. Social and environmental costs also need to be better understood. This is one of the priorities for further research under Objective 4. During Objective 2, however, the gaps which exist in economic cost data in the Evidence Base will need to be filled with actual or estimated data from the water companies or consultants who carried out the water efficiency trials.

### **2.2.4 Uptake rates**

Only a few of the trials included in the Evidence Base currently contain sufficient data to be able to fully understand the uptake rates observed when WEMs are offered. There is also a need to understand, of those who initially agree to take part in a trial, how many actually end up having their homes retrofitting. There appears to be great enthusiasm for improving domestic water efficiency, evidenced by the thousands of customers who have participated in water company trials to date. However, an important responsibility of the Evidence Base is to gauge the level of this enthusiasm as this will provide guidance for future water efficiency projects on the numbers of customers they will need to approach to achieve the desired participation. Where the data is incomplete, additional data will be sought from the water companies, who have executed the trials, to understand exactly how many customers were

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<sup>11</sup> UKWIR, The Economics of Balancing Supply & Demand (EBS) Guidelines (02/WR/27/4)

approached and how many actually participated in the trials and how best to achieve higher uptake rates.

### **2.2.5 Sample size**

The sample size needs to be large enough to ensure that it can be considered representative of the population of interest. This really needs to be an important consideration during the design of the water efficiency trials. During Phase 2 we will seek to assess this retrospectively for the work that has already been done. Once additional data has been obtained, an assessment will be carried out to gauge how representative of the population the results of the water trials can be considered to be. The specific items necessary to achieve this are better water savings data and some idea of the size of the population.

### **2.2.6 Monitoring Period**

The advantage of measured data over calculating water savings has already been discussed above. Where measured data is concerned, the length of the monitoring period is crucial in understanding:

- the pre-water efficiency trial consumption behaviour of the customers
- how the water savings are maintained after the water trial
- the external factors which affect water consumption in households such as the weather and holiday periods

Increasing the number of pre and post-trial consumption measurements taken will provide greater accuracy in the calculated average consumption levels before and after the trials. This then leads to reduced uncertainty in the water savings results. In addition, where control groups are used, this is a way of ensuring that external factors are compensated for. Control groups involve monitoring some homes during the trial period, which are not included in the trial itself, as a way of determining whether water saving observed in homes in the trial can be attributed solely to the water efficiency trial or to external factors.

## EVIDENCE BASE GAP ANALYSIS

Water Trial	No of props approached	No of props included	No of metered props as indicated in the trial report	No of logged props as indicated in the trial report	Water Saved (l/d)	Cost of Trial (£)	Cost of Water Savings (£/l/d)	Calculated or Measured Savings
5.1 ESW Moulsham May 97	1862	1375	0	0	55000	73237	1.33	Both
5.2 ESW Chelmsford		164		136				Both
5.3 ESW Home Surveys in Brentwood and Romford	84953	21271			240190	424652	1.77	Calculated
5.4 ESW: Water Saving Toolkit	5378	1073	235	144		156776		Measured
5.5 SWW 'Water Efficiency Trial'	6000	430	430	0	13878	123325	8.89	Measured
5.6 Thames Water (2008) "Liquid Assets, Phase 1"								Measured?
5.7 Environment Agency (2004) "Retrofitting of variable flush devices"		136	136	0	2829			Measured
5.8 ESW: home surveys in Witham	11881	4207	1250	0	57557			Calculated
5.9 ESW (2006) "Thurrock home surveys"	11578	8705	2931	0	86615	248872	2.87	Calculated
5.10 ESW (2008) "H2eco water audits"	7524	1495	621	193		205914		Both
5.11 ESW (2007) "ecoBETA study in Chelmsford"	4866	1007	103	12		66953		Both
5.12 Preston Water Efficiency Initiative		365						Measured
5.13 United Utilities Water Efficient Showerhead Offer	2002	155	2002	0	79079	5915	0.07	Calculated
5.14 United Utilities: Home Audit.	4642	393	313	0	22849	61114	2.67	Measured
5.15 Yorkshire Water Saving Trial	5000	986	640	0				Measured
5.16 Severn Trent Water (2008) "Domestic water efficiency trial"		805	679	0	20528			Measured
5.17 Anglian Water (2008) "Ipswich water efficiency audit trial"			60	0	2400			Measured

## KEY

 Data may be available but is not included in trial report

 Report not available at time of review

Table 1 – Identification of gaps in the current Evidence Base dataset

During Phase 2 of the Evidence Base we will seek, where possible, to supplement data already included in the trial reports with additional water consumption data from the water company databases. In this way, we may be able to increase monitoring periods retrospectively. For future trials it is important that a sufficiently long monitoring period is a primary issue (e.g. two measurements prior to the trial are insufficient). The use of control groups should be promoted as a method for taking external factors on water trial savings into account.

### **2.2.7 Behavioural Change and Social Research**

One of the areas in which the current Evidence Base report could be improved is in its ability to harness information from surveys carried out before and after water trials. These surveys tell us much about how customers experience water efficiency trials and how they perceive their behaviour may have changed as a result of being involved in a trial. The reports of the majority of water trials which are currently included in the Evidence Base include some assessment of the change in customer behaviour achieved above and beyond immediate water savings. Table 2 summarises the consideration given to behaviour change in each of the Evidence Base water efficiency trials.

The Evidence Base will help us gain a better understanding of microcomponent data. Consumer habits determine the frequency of use and the volume of water per use for WEMs, which are major factors in determining impact on microcomponent figures for baths, showers, toilets and taps. It would be a huge step forward, therefore, to gain a better understanding of how consumer behaviour and attitudes influence water consumption in the home. This is something that it is hoped the Evidence Base may shed some light upon, either making use of existing water efficiency trial data, new trials or through further research.

Phase 2 will seek to broaden the scope of the Evidence Base by including analysis of behaviour change surveys which have already been carried out as part of many of the seventeen trials. It is envisaged that the information relating to customer behaviour change from each trial will be analysed on a case by case basis and presented in future Evidence Base reporting.

### **2.2.8 Supplementary Customer Data**

It is proposed to make use of supplementary customer information in order to try to gain a better understanding of whether there are customers with any particular traits (e.g. occupancy, type of property, age, ACORN group, etc.) who are more likely than others to take up the offer of water efficient devices, or furthermore, whether they are likely to save more water than others if approached to take part in a water trial. The extent to which this analysis will be possible will depend on the quantity and quality of the supplementary customer data.

### **2.2.9 Attaching Carbon Values to Water Savings**

Also of importance are the carbon savings attached to specific water efficiency measures. The recently-announced government schemes for retrofitting every single home in the country in the next two decades offer a significant opportunity to include water efficiency measures (WEMs). There seems to be appetite to include WEMs in this initiative, but a clear definition of carbon savings for each measure is

needed. In addition, in the context of the target to make all existing homes zero carbon in the next few decades, it would also be useful to be able to define exactly how much carbon WEMs save depending on the scale they are implemented. It is envisaged that other environmental and social costs and benefits will be included in the assessment following additional research into these areas, which is yet to be fully defined.

A method of estimating carbon savings associated with individual water measures will be devised and applied pending further research to be carried out under Objective 4 of the Evidence Base Phase 2.

**Table 2 - Summary of behaviour change content in Evidence Base water efficiency trials.**

<b>Water Trial</b>	<b>Water Trial - Behaviour Change and Social Research Content</b>
<b>5.1 Essex and Suffolk Water (ESW) Moulsham May 97</b>	An independent telephone survey was carried out which concentrated on customer perceptions of their water company and water efficiency. It would be useful to obtain the full survey results to gauge the numbers of customers who had particular views.
<b>5.2 ESW Chelmsford</b>	A yearlong education trial was carried out but this only included 20 properties. Not clear what improvement in water efficiency was obtained from this trial.
<b>5.3 ESW Home Surveys in Brentwood and Romford</b>	As part of this trial 21,271 customers returned trial forms which asked about their water use habits related to toilets, taps, brushing teeth, showers and trigger hoses. This info was used to estimate water use using the microcomponent data. However there was no explicit assessment of before and after trial attitudes to water efficiency.
<b>5.4 ESW: Water Saving Toolkit</b>	Approx 550 customers were asked the same 'general' questions, focusing on the introductory information pack, why they participated in the trial, whether they would have preferred to have been offered groups of products and their water use since having participated. Each customer was asked a range of questions depending on the specific products and services they received. These questions aimed to discover what customer thought about the products and services, whether they continued to use the devices, and, if appropriate, why the products were not being used.
<b>5.5 South West Water 'Water Efficiency Trial'</b>	A survey was carried out to assess the occupancy and specific water using device ownership in each property. It would be interesting to obtain the full dataset for both the sample and the control group to understand whether anything else deduced from it through further analysis. Approx 430 customers were part of the sample and 109 formed the control.
<b>5.6 Thames Water (2008) "Liquid Assets, Phase 1"</b>	It is not yet clear what data is available as the report has yet to be published.
<b>5.7 Environment Agency (2004) "Retrofitting of variable flush devices"</b>	271 customers participated in a post trial survey which sought to gauge any change of behaviour achieved as a result of the water efficiency trials.

<b>5.8 ESW: home surveys in Witham</b>	A survey was run to assess customers' reasons for participating and also not taking part in the trial. The questionnaire, completed by 173 customers, also looked at customer perceptions of water efficiency.
<b>5.9 ESW (2006) "Thurrock home surveys"</b>	The trial started in August 2005 and finished in 2006. Of the 31,571 properties contacted, 11,578 agreed to take part and were delivered a home survey pack. Of these, 8,707 (75%) used the contents of the pack and returned their forms. In March 2006, a follow-up questionnaire was sent to a random selection of customers. One of the aims of the follow up questionnaire was to gain a detailed understanding of the way in which customer's water use changed as a result of completing the survey.
<b>5.10 ESW (2008) "H2eco water audits"</b>	A questionnaire was sent out to customers but its main purpose was more to assess their requirements for water efficiency devices than to gauge the effect of the trials on awareness and behaviour.
<b>5.11 ESW (2007) "ecoBETA study in Chelmsford"</b>	A survey was carried out but this did not seek to gauge customer attitudes to water efficiency either before or after the trials. It was more focused on dwellings and experiences of flushing and drainage.
<b>5.12 Preston Water Efficiency Initiative</b>	The full report had not been published at the time of the review
<b>5.13 United Utilities Water Efficient Showerhead Offer</b>	A survey focused more on the customer experience of the shower itself. Therefore, it will be difficult to extract any general lessons about behaviour change as a result of water efficiency trials from this trial
<b>5.14 United Utilities: Home Audit.</b>	It may be possible to gain further insight from this trial about how water efficiency trials can change customer behaviour. 144 of the 243 respondents (59%) indicated that they had changed their water use habits since the trial. Interestingly, the average water savings for metered respondents claiming to have changed their water use was higher than the average savings achieved by those who felt their usage had not changed.
<b>5.15 Yorkshire Water Saving Trial</b>	Some attempt was made to assess customers' attitudes to water efficiency. The results of this assessment are not presented in the report which is currently available.
<b>5.16 Severn Trent Water (2008) "Domestic water efficiency trial"</b>	There was no survey carried out as part of this trial.
<b>5.17 Anglian Water (2008) "Ipswich water efficiency audit trial"</b>	Need to confirm whether a survey was carried out.

### 3 Objective 2: Obtain Additional Data and Reanalyse

Following the review, carried out in Objective 1, of the data from the seventeen trials Objective 2 will be concerned with proceeding with actions to obtain additional data and finding new ways to improve our analysis of water efficiency trials. This section will discuss areas which will contribute to bolstering the current dataset and analysing it in a more rigorous fashion.

- Obtaining additional water savings and cost data
- Using Supplementary Customer Information as a basis for further analysis
- Adding results from new water efficiency trials
- Re-analysing data using Statistical Analysis Tools
- Exploring alternative methods of presenting data
- Dealing with Uncertainty
- The Disaggregation Method

#### 3.1 Obtaining additional water saving and cost data.

Following the review of Evidence Base Phase 1, there are a number of specific actions that have been defined relating to the individual water trials that have been carried out. A general theme of the actions is the need to work closely with the water companies in order to identify exactly what is available in terms of data and to match this as closely as possible with what is needed ideally to allow maximum insight to be gained from the trials.

#### 3.2 Using Supplementary Customer Information as a basis for further analysis

In addition to obtaining further data from meters and data loggers, there is the possibility of obtaining information such as age, gender, level of education or type of dwelling for water efficiency trials already carried out. However, the feasibility of this depends on the cost of obtaining the data. There is a possibility that individual water companies or consultants may have already obtained such data, but another option is to try to obtain the data independently.

Pursuing supplementary analysis of this type would enable the Evidence Base to relate water savings to consumer characteristics and thus to build a more detailed picture of consumer behaviour. This would help add depth to the analysis presented in the Evidence Base and may lead to further insight.

#### 3.3 Adding results from new water efficiency trials

It is our intention to add new water efficiency trials to the Evidence Base on a regular basis. As results become available for these trials, we will seek to obtain results from them and then data will be analysed to reinforce the trials already included in the Evidence Base. Seven such trials, which were planned to start after October 2008 are:

- Folkestone and Dover visit-and-fix trial
- Folkestone and Dover tariff trial
- Severn Trent single-measure self-fit trial
- South East / Kent County / EA multi-measure visit-and-fix trial

- Southern Water single measure toilet retrofit
- Thames Water multi-measure visit-and-fix
- Wessex social housing study

### **3.4 Re-analysing data using Statistical Analysis Tools**

An important aspect of the next phase of the Evidence Base will be the focus on improving the level of rigour applied in the analysis of data. To this end, Waterwise will use SPSS (Statistical Package for the Social Sciences) to analyse the replenished dataset from the water trials in Phase 1 and present it in the most suitable format for each of the trials. SPSS will allow sophisticated analysis of the data and presentation of results, in addition to analysis of any behavioural surveys that we chose to include.

### **3.5 Exploring alternative methods of presenting results**

In Phase 1, the Evidence Base relied exclusively on presenting results in tabular form. Hence, all the data is presented but it is very often difficult for readers to draw conclusions from looking at it. During Phase 2, we will explore the use of additional methods of presenting results, such as charts and graphs, and focus on trying to make it as easy as possible for readers to extract the relevant information from the results.

### **3.6 Dealing with Uncertainty**

In section 2.2.2, we discussed the use of the UKWIR method as a means of assessing data robustness in terms of reliability and accuracy. Phase 2 of the Evidence Base is to consider the use of other methods of estimating uncertainty such as applying confidence intervals. The aim is to make the uncertainty involved in the water efficiency trials as easily comprehensible as possible. There is some concern that if confidence intervals are used they might be extremely large, rendering the data less useful when making investment decisions. Nonetheless, it is important to have an understanding of what level of uncertainty exists in the results if this is to be improved in the future. This issue will be dealt with more fully once we have a clearer idea of the data that we will be obtainable to supplement the existing dataset.

### **3.7 The Disaggregation Method**

The Disaggregation Method has been employed by Waterwise and some water companies in order to relate savings from water efficiency trials to the micro-component values which are defined for water efficiency devices. In cases where the observed savings from a water trial are higher than the micro-component values, using the Disaggregation Method would simply reallocate savings back to the devices which may have occurred as a result of behaviour change or some other external factor. Where observed savings are less than estimated using micro-component data, using this method may conceal the fact that devices have been installed incorrectly or that microcomponent data is inaccurate.

Disaggregation attaches great importance to micro-component data as a means of evaluating the results of water efficiency trials. One of the outcomes of Objective 2 will be a decision on whether to proceed with the Disaggregation Method after comparing it to other ways of evaluating data. One option could be simply to use the measured water savings results without disaggregating, but to sense check these results with the best available microcomponent data.

## 4 Objective 3 – Update Methodology

Having reviewed the water efficiency trials which form part of the Evidence Base, re-analysed the existing data and supplemented this with new data from the water companies, we will be in an excellent position to update the best practice guide and to include this within Phase 2 of the Evidence Base. There are a number of areas within current water efficiency trial methodology where problems exist. These include:

- assumptions on the “decay rate” of efficiency trials
- combining data from measured and unmeasured trials
- the treatment of uncertainty in the results
- the use of the disaggregation method

Waterwise has previously, in conjunction with the water companies, produced a best practice guide entitled “Water Efficiency Audits: Best Practice Guide”. The work was funded by Defra and involved reviewing the trials that were at that point in time being undertaken by the water companies and selecting the most effective and practical methodology for carrying out this work. Much has been learnt since this report was written and a review of these lessons will enable us to greatly enhance the Evidence Base.

There are currently some useful references for those seeking guidance on designing and implementing water efficiency trials, such as the UKWIR WR/25 <sup>12</sup>documents.<sup>13</sup> These documents will be referred to during Objective 3 as it will be important to take account of previously applied approaches to water efficiency trials. The aim of Objective 3 will be to update the methodology based on our most recent experience and to apply this best practice to subsequent water efficiency trials.

## 5 Objective 4 – New Trials and Further Research

Whilst the review of existing data, the addition of new data and the improvement in methodologies will help complete the Evidence Base, it is certain that new studies will have to be designed in order to fill in some knowledge gaps. Some areas in which more work is certainly needed are:

- Social, Economic and Environmental costs and benefits
- Pattern of Water Savings
- Consumer Behaviour and Social Research
- Showers, Dual Flush and Microcomponents
- Understanding Energy Savings from Water Efficiency
- Conceptual Model for the Predicting the Performance of Water Efficiency Projects

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<sup>12</sup> UKWIR Quantification of the Savings, Costs and Benefits of Water Efficiency (Report Ref. No. 03/WR/25/1)

<sup>13</sup> UKWIR Sustainability of Water Efficiency Measures report (Report Ref. No. 06/WR/25/2)

### **5.1 Social, Economic and Environmental costs and benefits**

There is a need for further research to allow us to carry out a thorough cost benefit analysis of improving water efficiency in homes. This will need to cover the economic aspects of implementing water efficiency trials, for which we do not yet have a complete picture. However the social and environmental costs and benefits, including aspects such as creating a framework for attaching carbon values to water savings and evaluating any wider environmental benefit from reducing water wastage, also need attention in order to ensure that the case for water efficiency is made with consideration paid to the full array of societal costs and benefits.

### **5.2 Pattern of Water Savings**

There is a long held assumption in the water industry quoted in the Evidence Base that water savings decay with time in an exponential fashion. To the best of our knowledge, this assumption has only been tested against empirical data from one trial, which had a very small sample size<sup>14</sup>. Our understanding of how well water savings endure post-water efficiency trial is one of the single most important influences on the cost benefit analysis for water efficiency. Hence, further research is planned which will help us to arrive at a fuller understanding of the factors which determine the pattern of water savings post water efficiency trial.

### **5.3 Consumer Behaviour and Social Research**

Further research on consumer behaviour and social research will enable us to form a better understanding of customer attitudes to water efficiency and what the factors are which determine these attitudes. This is potentially a huge piece of work but it is hoped that this improved appreciation of what determines consumer attitudes to water efficiency will help us to understand how best to engage consumers with a view to improving uptake rates of water efficiency trials and ensuring that any behaviour change is sustained over the long-term.

### **5.4 Showers, Dual Flush and Microcomponents**

Whilst good work has been carried out in this area, shower usage has been identified as the component of domestic demand with the greatest growth. Particular gaps in our knowledge relate to the user habits associated with showering. What dictates shower duration and frequency of use? Is a pressurised, short shower better than a low flow longer shower? A study of user requirements and habits is required as well as definitive data on shower and bath usage. This study would be formulated with the water companies and a trial specified. Waterwise has already analysed the available data in this area and is about to publish a research report documenting this. The new trial will draw on this to identify the weakest areas of our knowledge and design a study to fill this gap.

Valve toilets present a very different challenge from showers. First of all, the potential for leakage in valve toilets is still a major concern as we seek to improve water efficiency. Whilst we are relatively comfortable with our understanding of toilet use behaviours, we are much less comfortable with our understanding of technology. Dual flush toilets are one area in which further research is required to fully understand user behaviour. For example, the ratio of short flushes to long flushes is not current well understood.

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<sup>14</sup> Essex and Suffolk Water (2008) "Retrofitting of variable flush devices to existing toilets: analysis of sustained savings, 2004-8", WE/0026/06

## **5.5 Understanding Energy Savings from Water Efficiency**

Currently of particular importance on the UK policy agenda, and relevant to government plans to retrofit every home for energy efficiency, is the link between water and energy. The benefit of carrying out combined water and energy retrofitting is considerable. However, to quantify this, there is a need to understand how household energy bills are affected by improved water efficiency as energy saving is potentially a very significant benefit from managing household water demand. In a similar vein, it is also important to be able to apply carbon savings to specific water efficiency measures so that they can be compared side by side with energy efficiency measures. If this can be done, there is great potential to have water efficiency measures included in the huge new government schemes for retrofitting every single home in the country in the next two decades.

Further research on this area will focus on understanding energy saving achievable from managing water demand. The work needs to take care not to confuse savings in energy costs (which matter to the economy as a whole) with savings in energy bills (which matter to individual households). It also needs to consider whether consumers' water savings are spread evenly across different types of water use.

## **5.6 Conceptual Model for Predicting the Performance of Water Efficiency Projects**

A conceptual model for predicting the performance of water efficiency projects is a long term research goal which will become ever more feasible as our understanding of consumer behaviour with regard to water consumption, microcomponents, the cost benefit analysis and patterns of water savings improves. It may be possible for water companies to predict water savings from retrofitting homes, the overall cost/benefit outcome and assess the optimal combination of water efficient devices to install in any given home. This will be extremely desirable when we move to water efficiency projects on the scale of tens of thousands of homes. This is a long term possibility for further research and its pursuit will depend on how our understanding of the other areas, particularly consumer behaviour and microcomponents, evolves.

## **6 Objective 5 – Future Reporting to Guide Policy, Regulation and Practice**

The Evidence Base has already been useful as a means of guiding policy regulation and practice in Scotland and Northern Ireland as well as in England and Wales – and has to date been welcomed by various government officials, and Ministers, as a useful contribution - but there remain many areas of policy and practice that it can be used to influence in the future. It is highly relevant to many current strands of government policy. With the introduction of Ofwat's minimum water efficiency targets for the water companies starting in 2010/11, the improved Evidence Base will provide valuable experience from previous trials which will assist the companies in planning how to meet this challenge in the years to come.

There has already been strong collaboration between Waterwise and the water companies on the work contained in the Evidence Base and as it develops, we need to ensure that the links with the water companies are strengthened to maintain their valued input to the Evidence Base. It is our intention, therefore, to set up an Evidence Base Peer Group that will meet on a regular basis to ensure regular communication on the contents of the Evidence Base, to ensure alignment on the approach and to facilitate the application of best practice to industry water efficiency trials. The Evidence Base has been

used by the water companies in their preparations for PR09<sup>15</sup>, and their Water Resource Management Plans, and is also being used by Ofwat in PR09 and as the water efficiency targets are further developed.

Current government policy to which the Evidence Base is relevant includes the following.

- Homes and people

The government is taking steps to ensure that new homes are water efficient: these include through the review of the Code of Sustainable Homes<sup>16</sup>, the updating of the Water Fittings Regulations<sup>17</sup> and the Building Regulations<sup>18</sup>. The Government has also set an ambition to reduce per capita consumption of water in England to an average of 130 litres per person per day (lppd) by 2030 or even 120 lppd depending on new technological developments and innovation. The Evidence Base will seek to demonstrate that progress can be made towards this ambition by presenting robust estimates of water savings, costs of implementation and uptake rates from past water efficiency trials.

- Water and energy

Climate change is now well-established as a policy and economic driver, and further and deeper climate change impacts are predicted which will affect not only the economy as a whole but specifically the availability of water. The government has set itself a legally binding target to reduce greenhouse gas emissions by 80% on 1990 levels by 2050, and is committed to 5-yearly carbon budgets. Water efficiency can help meet these targets. For example, pumping water to and from the house, and treating it at water treatment plants, accounts for 1% of the UK's total energy consumption. In addition domestic hot water accounts for 5% of UK greenhouse gas emissions, which compares very closely with the UK airline industry which accounts for 5.5%. By improving the efficiency with which we use hot water we can significantly reduce our carbon footprints and help reverse the current trend of climate change.

The water companies have recently been brought within the scope of the Carbon Reduction Commitment which sets targets for industry. Illustrating as it does how water efficiency measures can best be carried out on a large-scale, the Evidence Base will help the government and the water industry meet their carbon reduction targets. In addition, there is a significant opportunity to include water efficiency measures in government plans to retrofit every home in the country for energy efficiency by 2030, and to make all homes zero carbon by 2050: if these policies are to deliver their aims, they will need to include water efficiency.

- Value of water

The Evidence Base seeks to make the case for water efficiency on a very large scale (tens of thousands of homes) to allow such projects to compete with large scale supply-side measures in relation to its impact

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<sup>15</sup> <http://www.ofwat.gov.uk/pricereview/>

<sup>16</sup>

<http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/englandwales/codesustainable/>

<sup>17</sup> <http://www.defra.gov.uk/environment/water/industry/wsregs99/>

<sup>18</sup> <http://www.communities.gov.uk/publications/planningandbuilding/buildingregulationsexplanatory>

on the supply-demand balance. The Walker Review of Household Charging for Water and Sewerage Services<sup>19</sup> is very relevant to the work being planned in the Evidence Base. Retrofits, in particular of toilets and showers, may help customers reduce their water (and energy) bills; however, published data on reductions in bills following retrofits are limited and inconclusive. The most recent data available are from a 2007 Defra study, which showed that retrofits and meter installations benefited vulnerable customers by reducing bills, but that no statistically significant impact was found for those who were already metered.<sup>20</sup> The Waterwise Evidence Base provides the best source of information about costs and benefits of retrofits. There is still some way to go to fully understand the social and environmental costs and benefits of water efficiency, but this will be the subject of further research. Nonetheless, by improving the quality of the data and analysis it is planned to make the Evidence Base an even more valuable source of information for policymakers. In these ways, the Evidence Base can support moves to reflect the true value of water.

- Innovation

The Cave Review<sup>21</sup>, which highlighted in its interim and final reports, the potential for the sustainable use of water offered by changing approaches to competition and innovation, provides an opportunity for water efficiency to move up the agenda. The measures and figures outlined in the Evidence Base show clearly how the water industry can innovate, especially because of its role in mitigating and adapting to climate change, responding to environmental directives and meeting customer expectations.

- Water and the environment

In November 2006, Waterwise, working with nine other non-governmental organisations, representing 6 million members, launched the Blueprint for Water. The Blueprint sets out ten steps needed for the government, regulators and water industry to meet the objectives of the Water Framework Directive, which aims to restore the ecology and quality of our waters to health by 2015. The Blueprint sets out ten steps needed for the government, regulators and water industry to meet this target. The Blueprint asks include reducing water consumption by at least 20% by 2015 through more efficient homes, buildings and businesses, and a water meter in every home in England by 2020 (supported by tariffs to protect vulnerable groups). The Evidence Base complements the Blueprint for Water by seeking to make the case for large-scale water efficiency which would lead to reduced water consumption and help take off some of the pressure that pollution and excessive abstraction have placed on our wetlands, rivers and lakes.

Another initiative, Rivers on the Edge, is an innovative project, a partnership between WWF-UK and Waterwise, aiming to restore rivers on the edge of ruin. The project focusses on England's unique chalk

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<sup>19</sup> <http://www.defra.gov.uk/ENVIRONMENT/water/industry/water-charging-review/>

<sup>20</sup> Defra. 2007. "South West Water pilot affordability trial":  
<http://www.defra.gov.uk/environment/water/industry/affordability/pdf/final-wrc-report.pdf>.

<sup>21</sup> Defra, 2008. Cave Review: competition and innovation in water markets, interim report.  
<http://www.defra.gov.uk/environment/water/industry/cavereview/interim-report.htm>

streams to demonstrate how our individual water use can impact on the unique ecosystems that exist in and around our rivers. Working with water companies, the project will help thousands of homes, schools and businesses reduce their water use and return millions more litres of water to their rivers. In turn, Rivers on the Edge calls on the government, as part of its ambitious strategy to make all homes zero carbon by 2050, to make every home water-efficient by 2050, linking water efficiency with energy efficiency retrofit schemes. The Evidence Base will be valuable in gathering best practice from the water company-led water efficiency trials carried out to date which will then help to influence best practice in future retrofitting trials. An important addition to the Evidence Base in Phase 2 will be to reinforce the link between water and energy efficiency by attaching carbon values to water savings from all water efficiency trials.

## **7 Risks and Constraints**

There is a large amount of work laid out in this Work Plan and it is worthwhile to consider the risks involved with this project. The most significant risk factors are data, human resources and funding.

### **7.1 Data**

Objective 2 relies on the quality and quantity of data that can be obtained from the water companies to supplement existing data. There is the possibility that this data either may not be available at all or may be available in a format that may not be easily manipulated. To date water companies have been extremely open about sharing data on their water efficiency trials. This is despite the fact that queries to retrieve data from water company databases may be time consuming and they may find it difficult to free people for this type of task. There may also be concerns from the water companies over commercial confidentiality although there have not been any such issues to date.

It is difficult, therefore, to quantify how much time the work in Objective 2 is likely to take. However, Waterwise, as it has done in the past, will continue to foster close working relationships with the water companies in order to ensure they support the overall direction of the Evidence Base project. In addition, the UKWIR database is a very useful tool that we can make use of as a central point from which data on water company trials may be accessed.

### **7.2 Funding and Human Resources**

Currently, funding has only been made available for one person to work for six months on updating the Evidence Base project. Hence, if no additional funding is made available the work described in this Work Plan cannot continue past September 2009. For this reason a milestone will be included at the end of six months. We are currently seeking research collaborations with partners which may provide additional resources through research funding to tackle issues in Objective 4 or donation of consultancy time; however the timeframe on this is not clear. There may be a need to seek additional human resource at certain points of the Work Plan, especially if there is a large amount of data to be dealt with. Any additional resources will likely have to be obtained without additional project spend, and possibly through partnerships with other organisations.

## **8 Project Schedule**

Objective 1, the identification of opportunities to improve the existing dataset, has already been completed. Work has begun on Objective 2 and the plan is to contact the water companies that have carried out the water efficiency trials currently contained in the Evidence Base on an individual basis.

Updating of the methodology will commence once Objective 2 has progressed sufficiently to start yielding new insight on the existing trials. Steps toward starting work on Objective 4 have already been taken as we continue to develop research collaborations with other organisations such as consultancies and universities. However, actual research can only commence once the funding is in place.

It has been decided not to produce a detailed project plan until there is better visibility on the scope of work involved in Objective 2. The ease of access to data and the amount of data available are critical factors which will impact project progress, and these are still unknowns. Funding is currently available until September 2009; this constraint has influenced the project schedule mainly by introducing a natural milestone by which time it is envisaged that sufficient progress will have been made on obtaining and analysing data. It is envisaged that the report for Phase 2 of the Evidence Base will be available in Q4 2009.

## 9 Communication

Communication is vital to the success of the Evidence Base and Waterwise understands that it is essential that all key stakeholders are kept updated throughout the duration of the project. This will help to ensure that implications for how we understand water efficiency which emerge from the project, as well as any lessons learned, are shared as widely as possible in the water industry, among policy makers, regulators, manufacturers, retailers and social housing groups. The Waterwise Technical Research Manager, who is responsible for the Evidence Base Project, will communicate with stakeholders to ensure they are aware of project progress and major developments.

Key supporters will be updated on project progress on a quarterly basis. These key supporters include the water companies, the Environment Agency, Ofwat, DEFRA, CLG, and the Consumer Council for Water. It is also planned to meet with water company representatives regularly throughout the duration of the project to ensure that their input is incorporated into the process and that they are kept up to date with its status. Close collaboration with the water companies is fundamental to the success of this project.

There are a number of stakeholders who will also receive updates on Evidence Base project developments. These stakeholders include Housing Associations, BERR, The Scottish Executive, The Treasury, The Northern Ireland Assembly, The Welsh Assembly Government, UKWIR, Regional Development Agencies, Manufacturers, Retailers and the Local Government Association. In addition, companies such as Entec UK, Artesia Consulting and CACI are supporting the work presented in this Work Plan through collaboration and as such they will be included in any project communication.

The Work Plan for the Augmentation of the Evidence Base will be published on the Waterwise website in the Evidence Base section under:

[http://www.waterwise.org.uk/reducing\\_water\\_wastage\\_in\\_the\\_uk/research/the\\_evidence\\_base.html](http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/research/the_evidence_base.html)

It is envisaged that in Q4 2009 an update to the Evidence Base for Large Scale Water Efficiency in Homes will also be presented on the website.

## 10 References

1. UKWIR Quantification of the Savings, Costs and Benefits of Water Efficiency (Report Ref. No. 03/WR/25/1)
2. UKWIR Sustainability of Water Efficiency Measures report (Report Ref. No. 06/WR/25/2)
3. Code for Sustainable Homes Website:  
<http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/englandwales/codesustainable/>
4. Water Supply (Water Fittings) Regulations Website:  
<http://www.defra.gov.uk/environment/water/industry/wsregs99/>
5. Buildings Regulations Website:  
<http://www.communities.gov.uk/publications/planningandbuilding/buildingregulationsexplanatory>
6. Walker Review Website:  
<http://www.defra.gov.uk/ENVIRONMENT/water/industry/water-charging-review/>
7. Defra, 2008. Cave Review: competition and innovation in water markets, interim report.  
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8. Ofwat 2009 Price Review Website:  
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9. Essex and Suffolk Water & Mouchel, H2eco Water Efficiency Trial Report, 2008
10. Op. cit. 2
11. UKWIR, The Economics of Balancing Supply & Demand (EBSA) Guidelines (02/WR/27/4)
12. Op. cit. 1
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14. Essex and Suffolk Water, Retrofitting of variable flush devices to existing toilets: analysis of sustained savings 2004-8, 2008
15. Op. cit. 8.
16. Op. cit. 3.
17. Op. cit. 4.

18. Op. cit. 5.

19. Op. cit. 6.

20. Defra. 2007. "South West Water pilot affordability trial":  
<http://www.defra.gov.uk/environment/water/industry/affordability/pdf/final-wrc-report.pdf>

21. Op. cit. 7.

### **10.1 List of Other Water Efficiency Trials Referenced in this Report**

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Essex and Suffolk Water Chelmsford ecoBETA Trial (2008)

Essex and Suffolk Water Home Surveys in Brentwood and Romford (2004)

Essex and Suffolk Water: Water Saving Toolkit Trial (2007)

South West Water 'Water Efficiency Trial' (2007)

Thames Water, "Liquid Assets, Phase 1" Trial (2008)

Environment Agency, "Retrofitting of Variable Flush Devices" (2004)

Essex and Suffolk Water: Home Surveys in Witham (2002)

Essex and Suffolk Water, "Thurrock Home Surveys" (2006)

Essex and Suffolk Water, "H2eco water audits" (2008)

Essex and Suffolk Water, "ecoBETA study in Chelmsford" (2007)

Reigate and Banstead Borough Council, Raven Housing Trust, Sutton and East Surrey Water, the Environment Agency, Surrey County Council and Waterwise, Preston Water Efficiency Initiative Interim Report (2008)

United Utilities Water Efficient Showerhead Offer (2008)

United Utilities: Home Audit Project (2008)

Yorkshire Water Saving Trial Draft Report (2008)

Severn Trent Water “Domestic Water Efficiency Trial” (2008)

Anglian Water “Ipswich Water Efficiency Audit Trial” (2008)

## Glossary

**BERR** – the Government Department for Business, Enterprise and Regulatory Reform

**CLG** - Communities and Local Government, which sets policy on local government, housing, urban regeneration, planning and fire and rescue

**Confidence Interval** - confidence intervals are used to indicate the reliability of an estimate; instead of estimating the parameter by a single value, an interval likely to include the parameter is given

**DEFRA** – the Government Department for Environment, Food and Rural Affairs

**District Metered Area** - An area within the water supply network that is permanently defined by closed valves or other physical constraints in which distribution losses are measured and managed.

**Dual Flush** –this term refers to toilets that provide a choice of two flushing mechanisms; one which makes a full flush available and the other which uses a reduced amount of water.

**Logger** - an electronic device that records water use data over time either with a built in instrument or sensor or via external instruments and sensors. Loggers are useful because they can help provide a better resolution measurement of water consumption than is possible with a water meter alone.

**Microcomponent** – overall domestic water use in the home can be broken down into components which represent water used by individual appliances and equipment in the home such as showers, toilets, washing machines, dishwashers, kitchen and bathroom taps as well as an outside supply. These components that make up water use in the home are known as microcomponents.

**Ofwat** - The Water Services Regulation Authority which is the economic regulator of the water and sewerage companies in England and Wales.

**PR09** - Periodic Review 2009; the Ofwat periodic review of price limits to be completed in 2009 to set prices for 2010-2015.

**Retrofitting** - this term describes the measures taken to allow new or updated parts, for example cistern displacement devices, low-flow showerheads or tap fittings that reduce tap flow rates, to be fitted to old or outdated equipment through which we use water in the home.

**UKWIR** – UK Water Industry Research was set up by the UK water industry in 1993 to provide a framework for the procurement of a common research programme for UK water operators on 'one voice' issues. UKWIR's members comprise 24 water and sewerage undertakers in England and Wales, Scotland and Northern Ireland

**Water Efficiency Project** – A project, which has as its main purpose to reduce water consumption as a means of water demand management. This involves the implementation in homes of one or more water

efficiency measures such as dual flush devices in toilets, aerated showerheads, tap fittings, shower timers, self-audit questionnaires, plumber audits, or customer engagement through education in the need for water efficiency.

**Water Efficiency Trial** – A study carried out to ascertain the willingness of those approached to participate and improve their water efficiency, the reduction in water consumption achievable through application of the water efficiency measures and any change in behaviour on the customers' part due to engagement during the study. This involves the offer to customers of one or more water efficiency measures such as dual flush devices in toilets, aerated showerheads, tap fittings, shower timers, self-audit questionnaires, plumber audits, or customer engagement through education in the need for water efficiency and the subsequent assessment of the efficacy of the measures.