

# Water Demand Management Study: Baseline Survey of Household Water Use (Part B)

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## FOREWORD

Water is fundamental to our quality of life, to economic growth and to the environment. With its booming economy and growing population, Australia's South East Queensland (SEQ) region faces increasing pressure on its water resources. These pressures are compounded by the impact of climate variability and accelerating climate change.

The Urban Water Security Research Alliance, through targeted, multidisciplinary research initiatives, has been formed to address the region's emerging urban water issues.

As the largest regionally focused urban water research program in Australia, the Alliance is focused on water security and recycling, but will align research where appropriate with other water research programs such as those of other SEQ water agencies, CSIRO's Water for a Healthy Country National Research Flagship, Water Quality Research Australia, eWater CRC and the Water Services Association of Australia (WSAA).

The Alliance is a partnership between the Queensland Government, CSIRO's Water for a Healthy Country National Research Flagship, The University of Queensland and Griffith University. It brings new research capacity to SEQ, tailored to tackling existing and anticipated future risks, assumptions and uncertainties facing water supply strategy. It is a \$50 million partnership over five years.

Alliance research is examining fundamental issues necessary to deliver the region's water needs, including:

- ensuring the reliability and safety of recycled water systems.
- advising on infrastructure and technology for the recycling of wastewater and stormwater.
- building scientific knowledge into the management of health and safety risks in the water supply system.
- increasing community confidence in the future of water supply.

This report is part of a series summarising the output from the Urban Water Security Research Alliance. All reports and additional information about the Alliance can be found at <http://www.urbanwateralliance.org.au/about.html>.



**Chris Davis**  
Chair, Urban Water Security Research Alliance

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## EXECUTIVE SUMMARY

This report is the second of a two-part series describing the results of a baseline survey aimed at understanding the determinants of household water conservation in South East Queensland (SEQ). A key platform of the recently formulated South East Queensland Water Strategy is to delay the need for new major water infrastructure through encouraging the community to use less water. As residential water use accounts for the bulk of urban water use in SEQ, achieving the goal of reducing water grid demand hinges on developing a comprehensive understanding of the social and behavioural aspects of household water use. There is a need to understand how people use water and how sustainable levels of water use can be achieved and maintained in the long-term.

The current research, the Residential Water Demand component of the UWSRA *Demand Management and Communication Research* project, aims to understand how householders use water in their daily lives and how water conserving behaviours may be supported as a “way of life” in SEQ through a mix of interventions. Specifically, the project aims to:

- identify the psycho-social and socio-demographic drivers of residential water using practices; and
- determine the effectiveness of targeted intervention strategies for achieving long term sustainable residential water use.

The Part A report presented results describing the key social and psychological predictors of householders’ water conservation intentions (Spinks, Fielding, Russell, and Mankad, 2010). The current report (Part B) describes analyses investigating the determinants of actual (i.e., objectively measured) household water use. This includes analyses of data where two members of each household responded to the survey in order to examine the extent to which conflict or consensus in water conservation attitudes and actions impacts on household water use.

The study was conducted within four local government areas in the SEQ region: Brisbane, Gold Coast, Ipswich and Sunshine Coast. Participants were owner occupiers of free-standing dwellings in the target regions and were recruited via a commercial list supplier ( $n = 1381$ ) or through an online research panel ( $n = 603$ ). Targeted households were connected to the central water supply and had an individual water meter attached to their premises. Participants completed The Household Water Use Survey (paper or online version), which consisted of 27 multi-item questions which were designed to elicit information about participants’ household water use and conservation, as well as standard demographic and household composition data.

The key determinants of household water use were:

### **Demographics:**

- Households on the Gold Coast and Sunshine coast used more water per person than those in Brisbane or Ipswich.
- Households with more adults and more children used more water per household.
- Single person households use more water per person than other household types, and households with young children use less water per person than other household types.
- Per person household water use was lower for households with younger (25 to 39 years) survey respondents than older survey respondents.

### **Water Efficiency Infrastructure:**

- Low-flow taps, dual flush toilets and plumbed rainwater tanks were associated with lower water use than other water-efficiency appliances. On average, households that had installed a plumbed rainwater tank saved approximately 40 litres of water per person per day compared to households that did not have a plumbed rainwater tank.

- Water-wise washing machines and trigger hose/timed watering systems were associated with higher water use.

#### **Psycho-Social Variables:**

- Households with a stronger water conservation culture - that is, they think of themselves as water conservers and are committed as a household to water conservation - used less water. Individual water conservation intentions did not predict actual household water use. This reflects the communal nature of water use in a household, and suggests the importance of water conservation campaigns that target the household as a whole.
- In contrast to past findings, respondents who perceived that other people in their community save water through everyday water saving actions, used more water in their household.

#### **Water Use Habits:**

- The more respondents reported only running washing machines when full and turning off taps when brushing teeth, the less water their household used.

#### **Households with Multiple Surveys Completed**

The total dataset included 176 households in which two members responded to the survey (352 individual responses). Results showed that there were greater differences between the two householders on responses to the questions about saving water through installing water efficient appliances than the questions about saving water through everyday actions. It was also evident that householders' responses diverged more when reporting how often they take shorter showers than when reporting about other water conservation behaviours. There were only small differences in how predictive female and male survey responses were of household water use.

#### **Conclusions**

The current study makes an important contribution to the literature on water conservation. It highlights that demographic, infrastructure, psycho-social and behavioural factors all contribute to household water use. The results suggest that, although water efficient infrastructure may be an important element of water conservation programs, behaviour and psychological factors are also key to achieving maximum outcomes. The research also makes an important contribution to the scientific literature on residential demand management. It overcomes many of the limitations of past research in this area, including distinguishing between different types of water conservation (everyday and efficiency) and linking survey data to objective measures of household water use.

# 1. INTRODUCTION

This report is the second in a two-part series describing the results of a baseline survey aimed at understanding the psycho-social and socio-demographic determinants of household water conservation in South East Queensland (SEQ). A key platform of the recently formulated South East Queensland Water Strategy is to delay the need for major water infrastructure through encouraging the community to use less water. As residential water use accounts for the majority of urban water use in SEQ, achieving the goal of reducing water grid demand hinges on developing a comprehensive understanding of the social and behavioural aspects of household water use. There is a need to understand how people use water, and how sustainable levels of water use can be achieved and maintained in the long-term.

The current research, the Residential Water Demand component of the UWSRA *Demand Management and Communication Research* project, aims to understand how households use water in their daily lives and how water conserving behaviours may be supported as a “way of life” in SEQ through a mix of interventions. Specifically, the project aims to:

- identify the psycho-social and socio-demographic drivers of residential water using practices;
- determine the effectiveness of targeted intervention strategies for achieving long term sustainable residential water use; and
- make a significant contribution to the scientific literature on water demand management.

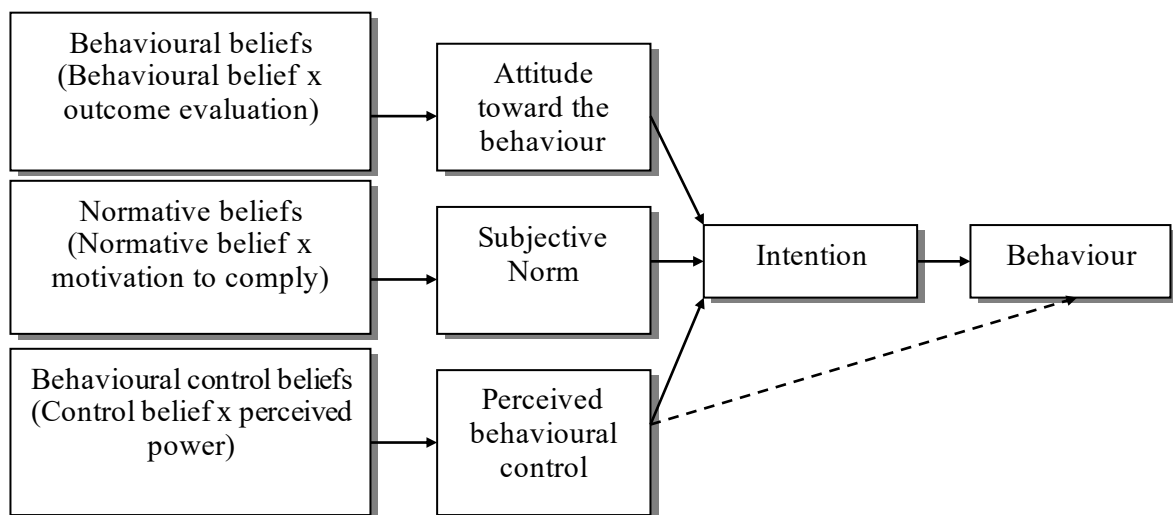
The research addressing these questions is proceeding in three stages. The first stage involved focus groups to identify the salient beliefs associated with household water conservation (Fielding, Russell, and Grace, 2010). The second phase—a survey of free-standing owner-occupied households from the SEQ community—identifies the psychosocial and socio-demographic drivers of residential water use. Three reports describe the results of the second phase of the research. The Part A report (Spinks *et al.*, 2011) describes the analyses that investigated the psycho-social and socio-demographic determinants of water conservation intentions. The current report (Part B) describes analyses investigating the psycho-social and socio-demographic determinants of actual (i.e., objectively measured) household water use and also describes the data for households where multiple residents of the household completed the survey. That data allows an examination of the extent to which consensus or conflict in water conservation attitudes and actions impacts on household water use. The third phase of the project involved testing interventions to promote long-term household water conservation (see Fielding *et al.*, 2012).

The project makes a significant applied and empirical contribution to the literature on residential water demand management. It provides concrete information to policy makers about the key drivers of household water use. Moreover, the rigorous theoretical approach combined with the collection of self-report *and* actual water use data ensures that the research addresses many of the limitations of previous research in this area (see Russell and Fielding, 2010) and, thus, makes a significant contribution to the scientific literature.

## 1.1. Conceptual Framework

The overarching theoretical framework adopted for the research is the Theory of Planned Behaviour (Ajzen, 1991). This model has been used extensively to understand a range of behavioural decision-making contexts, including household water conservation (Clark and Finley, 2007; Harland *et al.*, 1999; Kantola *et al.*, 1982; Lam, 1999, 2006). It should be noted, however, that previous research using this model to address household water conservation has been marked by methodological and measurement limitations (Russell and Fielding, 2010) including the failure to distinguish between different types of water conservation practices (e.g., everyday actions versus installing efficient appliances), failure to collect objective household water use data, and the tendency to link individual psycho-social drivers to a collective outcome (i.e., household water use). The current project is designed to overcome these past limitations.

The Theory of Planned Behaviour (Figure 1) is a parsimonious model of the informational and motivational influences that combine to predict behaviours. In the Theory of Planned Behaviour (TPB), the most immediate predictor of behaviour is an intention (i.e., a motivation or plan) to engage in the behaviour. The TPB proposes intention to be determined by the additive effects of attitude, subjective norm and perceived behavioural control. Attitudes refer to the overall positive or negative evaluation of performing the behaviour (e.g., water conservation). Subjective norms are based on individuals' perception of whether important other people in their life would want them to perform the behaviour. Perceived behavioural control reflects the extent to which individuals consider the behaviour to be within their control. Therefore, according to the TPB, individuals who hold positive attitudes toward water conservation, think that there is support from important others for engaging in water conservation, and who perceive that they can easily engage in this activity, should have strong intentions to conserve water in the household. In addition, to the extent that perceived behavioural control is a proxy for actual control, it may also directly impact on behaviour, such that a greater sense of control over conserving water around the house will be associated with higher levels of actual household water conservation.



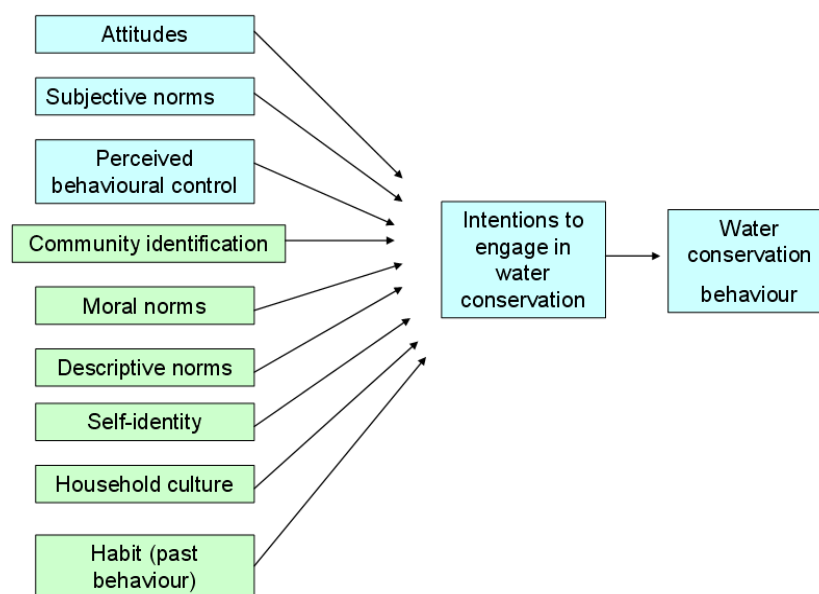
**Figure 1. Theory of Planned Behaviour model.**

The TPB is recognised as a parsimonious model of the drivers of people's behavioural decisions (e.g., decisions to engage in water conservation actions); however, there is also recognition that additional predictors may increase the predictive power of the model in certain behavioural contexts (Conner and Armitage, 1998). A review of the literature on household water conservation (Russell and Fielding, 2010) suggests the importance of a number of additional predictors of household water use. In addition to subjective norms, which capture people's sense that important others support a behaviour, we have also included measures of descriptive norms and moral norms. Descriptive norms describe typical or normal behaviour – what people actually do as opposed to what they ought to do (Cialdini, Kalgren and Reno, 1990). Cialdini and colleagues (1990) argue that descriptive norms motivate behaviour because they provide information about what is adaptive and effective in a given situation. Moral norms tap into a person's sense of personal obligation to engage in a behaviour. We reason, in accordance with past literature (Manstead and Parker, 1995), that if people have a sense that it is their moral duty to conserve water then they will be more likely to engage in water conservation behaviours. Note that moral norms are different from injunctive norms in that the former reflect social consensus about what is appropriate whereas the latter reflects a sense of personal moral obligation.

In accordance with recent theory development, we have also incorporated into the basic model measures of identity: community identification (i.e., as a member of the SEQ community), self-identification (i.e., as a water conserver), and household culture. We reason that people who are more identified with the SEQ community may be more aware of and concerned about water security issues, and therefore will be more committed to conserving water. Past research has also shown that self-identity, for example as a water conserver, is a powerful motivator of behaviour (Conner and Armitage, 1998). The logic for the relationship comes from identity theory (Stryker, 1968; 1980): identity motivates action, and to not engage in role-appropriate behaviour (e.g., water conservation) creates a state of internal tension due to conflict between identity and actions. Therefore, householders who have a strong sense of themselves as water conservers may be more likely to engage in water conservation actions.

We have also tried to capture the predominantly collective nature of water conservation through the inclusion of a measure of household culture. One of the limitations of past social and behavioural research on household water conservation is that it has primarily drawn on individual data (e.g., individuals' attitudes) to predict (what is usually) a collective outcome (i.e., household water use). In the current study we have sought to overcome this limitation in two ways: 1) by recruiting multiple participants from each household; and 2) by assessing the culture of the household in relation to water conservation. The latter variable assesses the extent to which the culture (i.e., the norms and identity) of the household supports water conservation. Thus, although an individual household member might be committed to water conservation, unless that person's attitudes and actions are shared by the rest of the household, there may be little relationship between reported individual attitudes and household water use.

Finally, in many cases our actions are determined not by reasoning but by automatic, habitual processes (e.g., Ouellette and Wood, 1998). For example, for actions that are performed on a regular basis (e.g., brushing teeth, showering), we do not necessarily weigh up the costs and benefits or think about whether others approve or disapprove. Rather we act automatically. In previous literature habit is usually measured by assessing the extent to which people have engaged in an action in the past. Where past behavioural engagement is high, this indicates that an action is likely a habit and that people are more likely to engage in that action in the future. Our expanded Theory of Planned Behaviour model incorporating descriptive norms, moral norms, community identification, self-identity, household culture and habits (i.e., past behaviour) is represented in Figure 2.



**Figure 2. Expanded Theory of Planned Behaviour Model.**

Findings from the focus group phase of the research (Fielding, Russell, and Grace, 2010) identified the perceived costs and benefits, barriers and facilitators, and influential people and groups related to everyday water conservation and installing water efficient appliances. The survey phase of the research (described in this report) tested the expanded theory of planned behaviour model. The TPB provided a systematic and rigorous framework to identify the predictors of two different types of household water conservation behaviours: 1) curtailment behaviours that refer to everyday water saving actions such as taking shorter showers, and only washing full loads of clothes; and 2) efficiency behaviours that refer to one-off installation of water efficient appliances such as water efficient washing machines and rainwater tanks (Gardner and Stern, 1996). It must be acknowledged that there may be some overlap between these two types of actions; for example, a person can only use a half flush option if they have installed a dual flush toilet. Nevertheless, this distinction exists in the conservation literature and is useful in delineating everyday, habitual conservation behaviours from more one-off actions that allow for ongoing efficiencies. Moreover, past research has shown that different factors may be related to water curtailment than water efficiency actions (Russell and Fielding, 2010).

Results from the Part A report (Spinks *et al.*, 2011) suggest that householders with stronger water conservation intentions were those who had more positive attitudes to water conservation, a greater sense of personal obligation to conserve water, and felt more able to undertake water conservation actions. Water conservation habits and identity - that is, whether householders think of themselves as water conservers - were also consistent positive predictors of water conservation intentions. There was also a positive link between a household's culture of water conservation and intentions to engage in everyday water conservation intentions. Intentions to install water efficient appliances were positively related to a stronger sense of being part of the SEQ community and a greater sense that others in the community were installing these types of appliances.

This report (Part B) describes analyses investigating the key predictors of households' actual water use which was measured through billing data obtained from water utilities. These analyses not only allow us to identify the key predictors of objective household water use, but also to examine whether householders' water conservation intentions translate into actual water conservation behaviour. This report also examines data where two respondents completed the survey from each household. The aim in examining these data is to identify whether congruence between household members' attitudes to water conservation affects household water use behaviour.

## **2. METHOD**

### **2.1. Setting and Study Period**

The study was conducted within four local government areas (LGAs) in the SEQ Region: Brisbane, Gold Coast, Ipswich and the Sunshine Coast. The main elements of the study were implemented in September 2009; however, data collection lasted from July 2007 until June 2010.

### **2.2. Ethics**

Ethical clearance for the study was provided by the University of Queensland Human Research Ethics Committee.

### **2.3. Study Design**

The study consisted of a cross-sectional Household Water Use Survey matched with historic and prospective water consumption data sourced from the water utility of each of the regional city councils. The Household Water Use Survey was designed to be answered by individuals; however it was recognised that the majority of households in the region (84% of free standing dwellings, ABS, 2006) are comprised of two or more people. Therefore, attempts were made to recruit two members from each participating household who would independently complete their own version of the survey. This was done to account for the fact that household water use is a collective activity that depends on the behaviour of all members of the household.

### **2.4. Study Population and Participants**

#### **2.4.1. Study Population Characteristics**

The targeted study population consisted of householders residing within the designated study region postcodes (See Appendix A). Due to the necessity of being able to access individual household water consumption data, targeted households were owner-occupiers of dwellings connected to the central water supply with an individual water meter attached to the premises (i.e., not a multiple-tenancy complex with shared / body corporate water records).

#### **2.4.2. Participant Recruitment Procedures**

Participants were recruited via two separate methods: either *Direct Mail* or through an *Online Research Panel*. Further details about the recruitment procedures are contained in Part A of the report (Spinks *et al.*, 2011). The purpose of using both recruitment strategies was to reduce the overall bias in participant recruitment that was likely to occur if one method only was used.

### **2.5. Data Collection**

#### **2.5.1. Instruments**

##### **2.5.1.2 Household Water Use Survey**

The Household Water Use Survey (Appendix B) consisted of 27 multi-item questions (103 items in total) which were designed to elicit information from participants about various aspects of household water use and conservation, as well as standard demographic and household composition data. The majority of questions used the Likert Scale response format; however, some open-ended and categorical multi-choice questions were also included.

### **2.5.1.3 Consent Form for Release of Water Data**

The Water Data Release Consent Form (See Appendix C) asked participants to provide details of their property account (including the name the account was held in, property assessment / ID number and property address) and to sign to provide permission for the relevant city council water utility to release water consumption data.

For the direct mail participants, the consent form was included in the Household Survey Booklet (the page was able to be removed via a perforated tear). The consent was mailed separately to participants who had been recruited via the Online Research Panel method.

## **2.5.2. Study Variables**

### **2.5.2.1 Household Water Use Survey Variables**

The Household Water Use Survey assessed variables from the expanded TPB (see Figure 2). Importantly, though, the survey also distinguished between *curtailment* and *efficiency* water-saving behaviours and their associated attitudes and intentions. All variables from the Household Water Use Survey fall into two categories: those either *directly measured* through participant self-report or from council water utility records and those *constructed* based on participant responses to one or more survey items. Details of the variables, including their format and construction are available in Appendix D.

## **2.6. Data Management and Analysis**

### **2.6.1. Scale Construction**

Scale construction was undertaken by combining the data items relevant to each constructed scale (See Appendix D). The internal consistency of each scale was tested by Cronbach's alpha, also shown in Appendix D. One of the scales relevant to the TPB: *Perceived Behavioural Control* did not display sufficient consistency among the three items, which indicated that it would be inappropriate to combine the items into a single scale. On closer examination, it was deemed that one of the items was worded in a confusing way and a decision was made to discard that item from further analysis because the responses were likely to be unreliable. The remaining two items of that scale were treated separately in all further analyses and not combined into a scale. These two items are referred to as *perceived control and self-efficacy* in the analyses.

### **2.6.2. Analytic Strategy**

In addition to presenting descriptive data about overall patterns of water use, three sets of analyses are presented in the Results section: 1) Analyses comparing household water use across socio-demographic categories and household water infrastructure categories (i.e., whether the infrastructure is installed or not); 2) Multiple regression analyses that assess the relative contribution of the model determinants as well as demographic and infrastructure determinants (Table 1); and 3) Multiple regression analyses to investigate whether higher average support from two people in a household on the psycho-social and self-reported behaviour measures influences household water use.

**Table 1. Regression model steps for predicting household water use.**

<b>Predicted Variable</b>	<b>Model Step</b>	<b>Variable</b>	<b>Specific Variables</b>
Total household water use six months post survey completion	Step 1	Region *	Gold Coast Ipswich Sunshine Coast
	Step 2	Household / Socio-demographic variables	Age Gender Education level No. children in the household No. adults in the household
	Step 3	Installed infrastructure	11 water-saving devices
	Step 4	Curtailment Intentions	Curtailment intentions
	Step 5	Expanded TPB variables	Curtailment attitudes Subjective norms Moral norms Descriptive norm Perceived behaviour control Self efficacy
	Step 6	Expanded TPB variables (Identity variables)	Community identity Household culture Self Identity
	Step 7	Past Behaviour	11 self-reported past curtailment behaviours (in past six months)**

\* The categorical variable of region was dummy coded to create three variables with Brisbane as the reference category (e.g., Gold Coast vs. Brisbane, Ipswich vs. Brisbane, Sunshine Coast vs. Brisbane); only those that are statistically significant predictors are included in the final model.

Due to the number of people (N = 159, 15% of total sample) who did not respond to the question about household income level, this variable is not included in the Regression analysis as it substantially reduces the sample size. Note that because not all past curtailment behaviours were applicable to participants, we only include in the final model those that are significant predictors of household water use.

### 3. RESULTS

#### 3.1. Baseline Survey: Survey Response

A total of 1179 households returned a Direct Mail survey (27% of those invited), while 570 households completed the survey online. Additionally, a second survey was received from 195 (16.5%) households. However, water consumption data were not available for all households completing the survey. A portion of surveys were completed by non-targeted households who had either shared water meters (i.e., multi-dwelling complexes) or were not connected to a central water supply. Additionally, not all participants returned a signed consent form to allow for the release of water consumption data by the city councils. The survey response statistics broken down by recruitment method, region and availability of water consumption data are shown in Table 3.

#### 3.2. Household Water Use

Descriptive statistics pertaining to the amount of water used by participating households from October 2009 to March 2010 are shown in Table 2. This table shows both the total household and per person values. It is likely that the extreme minimum and maximum values may be erroneous due to either faulty water meters or substantial leaks (or unoccupied dwellings, for the minimum).

**Table 2. Daily household water use, October 2009 – March 2010.**

	<b>Total Daily Household Water Use (Litres)</b>	<b>Per person Daily Household Water Use (Litres)</b>
<b>Mean</b>	428.48	174.43
<b>Standard deviation</b>	277.52	124.95
<b>Median</b>	371.95	142.30
<b>Inter-quartile range*</b>	245.35 – 540.51	104.46 – 201.11
<b>Minimum</b>	4.75	4.75
<b>Maximum</b>	2,540	1,535

\* Inter-quartile range is the 25<sup>th</sup>-75<sup>th</sup> percentile

**Table 3. Baseline Survey response.**

	Brisbane		Gold Coast		Ipswich		Sunshine Coast		Unknown region	Total	
	N		N		N		N		N	Households	Respondents
<b>Direct Mail Survey</b>											
<i>Surveys sent</i>	1,250		1,250		958		965		-	<b>4,423</b>	
Received											
Water use data available	232	(49)	203	(35)	197	(29)	260	(60)	-	<b>892</b>	<b>1,065</b>
No water data: tank water	-		28	(2)	4	(0)	28	(3)	-	<b>60</b>	<b>65</b>
No water data: other	67	(9)	91	(11)	26	(3)	21	(1)	22	<b>227</b>	<b>251</b>
Total postal surveys received	299	(58)	322	(48)	227	(32)	309	(64)	22	<b>1,179</b>	<b>1,381</b>
<b>Online Survey</b>											
<i>Targeted</i>	300		200		100		120			<b>720</b>	
Completed											
Water use data available	80	(11)	32	(6)	18	(3)	21	(2)	-	<b>163</b>	<b>185</b>
No water data: tank water	-		11	(2)	-		11	(1)	-	<b>22</b>	<b>25</b>
No water data: other	144	(5)	90	(2)	26	(1)	48	(0)	89	<b>385</b>	<b>393</b>
Total online surveys completed	224	(16)	133	(10)	44	(3)	80	(3)	89	<b>570</b>	<b>603</b>
<b>Total Surveys received / completed</b>	<b>523</b>	<b>(74)</b>	<b>455</b>	<b>(58)</b>	<b>271</b>	<b>(36)</b>	<b>389</b>	<b>(27)</b>	<b>111</b>	<b>1,749</b>	<b>1,984</b>

\*\* Not including 41 duplicate surveys –survey is counted as a Direct Mail survey when completed by recruitment methods  
Numbers in brackets indicate the number of second surveys received / completed within the household

### 3.2.1. Household Water Use: Temporal Variation

As Figure 3 shows, per person water use has increased by approximately 14 L per day from late 2008/early 2009 to the most recent water billing period of October 2009 to March 2010. When broken down across regions, the increases in water use per person are most evident in Brisbane and Gold Coast (Figure 4). Note that the scales (displayed on the y-axis) for Figure 3 and Figure 4 differ.

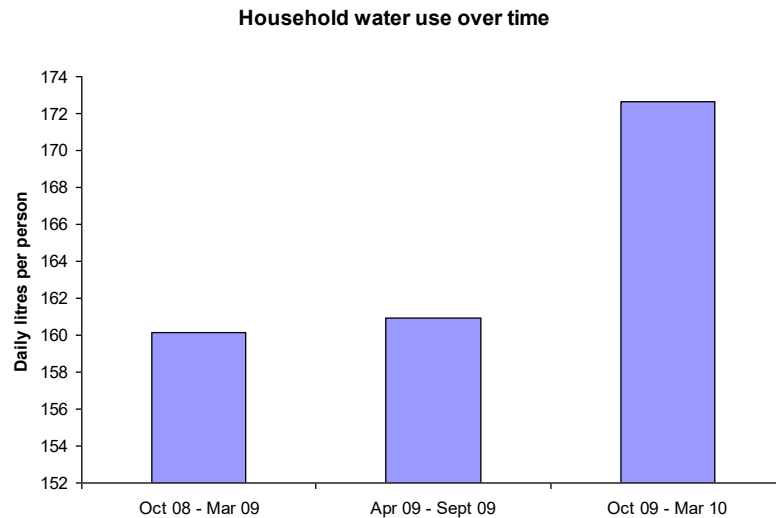


Figure 3. Average per person water use from October 2008 to March 2010.

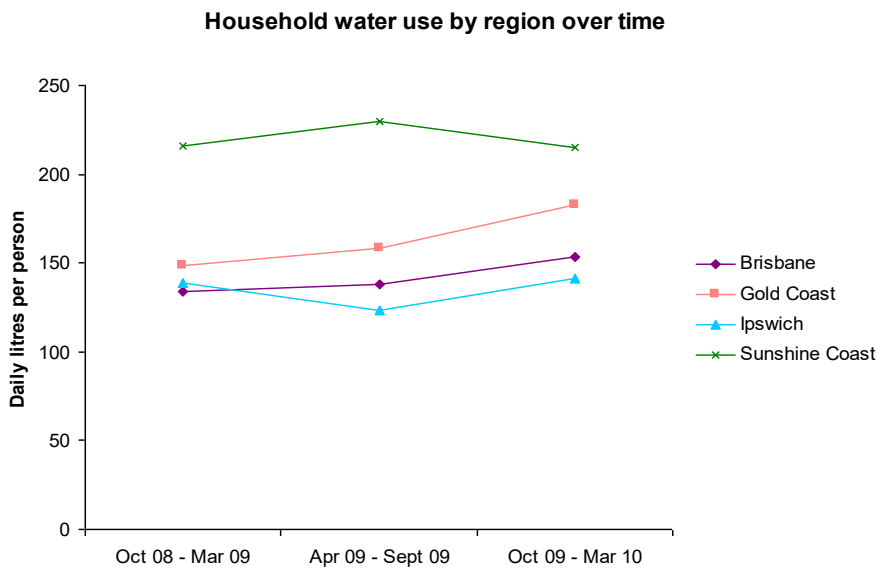


Figure 4. Average per person water use from October 2008 to March 2010 broken down across geographic region.

As shown in Table 4, regional differences occurred in the amount of daily per person water use in the October 2009 to March 2010 period following the completion of the Household Water Use Survey,  $F = 16.92, p < .001$ . Post-hoc analyses revealed that residents in Brisbane and Ipswich used less water per person than residents in the Gold Coast and Sunshine Coast, and that residents in the Gold Coast used less water per person than those in the Sunshine Coast.

**Table 4. Household water use (per person) by region, October 2009 – March 2010.**

Region	N	Mean	S.D.
Brisbane	305	155.28	85.03
Gold Coast	230	183.94	127.03
Ipswich	212	143.15	82.19
Sunshine Coast	254	214.91	172.60
<b>Total</b>	<b>1,001</b>	<b>174.43</b>	<b>124.95</b>

Daily per person household water use was also influenced by household type ( $F = 16.04$ ,  $p < .001$ ; Table 5). Post-hoc analyses showed that individuals living in single person households used more water per person than residents of all other household types. Families with young children and families with young children and teenagers used less water per person than all other household types.

**Table 5. Household water use (per person) by household type, October 2009 – March 2010.**

Household Type	N	Mean	S.D.
Single person household	149	234.74	205.88
Two person (adult) household	388	188.45	122.79
Multiple adult household	166	150.41	60.30
Family with young children	185	129.44	59.50
Family with teenagers	66	170.77	105.41
Family with young children and teenagers	47	134.54	89.20

Respondent age had a significant influence on the amount of water used per person ( $F = 6.76$ ,  $p < 0.001$ ; Table 6). Respondents aged 25-39 years used less water than respondents in all older age categories (40 years and above).

**Table 6. Household water use (per person) by respondent age, October 2009 – March 2010.**

Age Category	N	Mean	S.D.
15 - 24 years	14	142.77	57.27
25 - 39 years	165	134.30	62.96
40 - 54 years	292	170.33	107.33
55 - 64 years	246	185.71	127.11
$\geq 65$ years	260	193.63	161.84

As shown in Tables 7, 8 and 9, daily person household water use was not influenced by household income ( $F = 0.57$ ,  $p = .73$ ), cultural background ( $F = 2.76$ ,  $p = 0.06$ ) or respondent education level ( $F = 1.23$ ,  $p = .30$ ).

**Table 7. Household water use (per person) by household income, October 2009 – March 2010.**

Household Income	N	Mean	S.D.
< \$30,000	176	180.52	133.05
\$30,000-59,999	209	182.45	150.53
\$60,000-89,999	227	166.77	109.35
90,000-119,999	115	167.07	126.21
\$120,000-149,999	66	182.58	121.31
$\geq$ \$150,000	57	168.31	85.73

**Table 8. Household water use (per person) by cultural background, October 2009 – March 2010.**

Cultural Category	N	Mean	S.D.
Anglo-European	916	176.46	127.09
Asian / Middle Eastern	24	128.69	74.27
Other	40	146.10	85.78

**Table 9. Household water use (per person) by education level, October 2009 – March 2010.**

Education Level	N	Mean	S.D.
High school or lower	378	182.79	135.20
Trade / TAFE	260	170.24	121.14
Tertiary undergraduate	179	162.26	112.67
Tertiary postgraduate	173	173.69	119.54

### 3.2.2. Household Water Use Six Months Post Survey Completion: Influence of Installed Infrastructure

Table 10 shows the per person household water usage for households with and without eleven types of water-saving infrastructure devices. T-test comparisons showed significantly less per person water usage in households with low flow taps, pool covers (for those households with swimming pools), shower timers and plumbed rainwater tanks. The largest difference was found for plumbed rainwater tanks with households that had these installed saving approximately 40 litres of water per person per day compared to households that did not have these installed.

**Table 10. Household water use (per person) according to installation of water-saving infrastructure, October 2009 – March 2010.**

Infrastructure	Installed		Not Installed		t-value	p
	N	Mean (S.D)	N	Mean (S.D)		
Low flow taps	695	167.99 (115.46)	306	189.04 (143.34)	2.46	.014
Pool cover*	93	174.07 (104.59)	235	213.96 (162.93)	2.63	.009
Trigger hose / timed sprinkler	676	175.67 (117.02)	325	171.84 (140.18)	-.45	.650
Water-wise plants	602	169.64 (107.80)	399	181.64 (146.94)	1.40	.162
Dual flush toilet	854	172.72 (125.47)	147	184.33 (121.81)	1.04	.298
Shower timer	444	164.52 (101.92)	557	182.32 (140.22)	2.32	.020
Grey water system	161	169.35 (108.91)	840	175.40 (127.83)	.56	.574
Plumbed rainwater tank	130	137.23 (77.13)	871	179.98 (129.71)	5.30	.000
Non-plumbed rainwater tank	382	165.72 (103.46)	619	179.80 (136.34)	1.85	.065
Water-wise washing machine	452	175.20 (121.94)	549	173.79 (127.48)	-.18	.858
Water-wise dishwasher	632	169.27 (115.17)	369	182.25 (139.84)	1.71	.088

\* pool owners only

### **3.3. Household Water Use: Multivariate Analysis**

Results of the multiple regression analysis predicting household water use in the six months following the survey (October 2009 – March 2010) are shown in Table 11<sup>1</sup>. This analysis allows an examination of the relative importance of predictors of household water use (e.g., infrastructure) controlling for all other variables. The final model predicted 29% of the variance in total water use ( $R = .536$ ,  $F(30,769) = 10.33$ ,  $p < .001$ ). The variables that were significantly associated with more household water use were: region (Gold Coast and Sunshine Coast compared with Brisbane), more adults and children in the home, having a water-wise washing machine, and perceiving that others in the community save water. The variables that were significantly associated with less water use were having installed water-saving infrastructure (low flow taps, trigger hose / times sprinklers, dual flush toilets, plumbed rainwater tanks, household culture of water saving and previous self report of only running the washing machine with full loads and turning off the tap whilst brushing teeth.

### **3.4. Analyses of Households Returning Two Surveys**

In total, 195 households returned two surveys. Nineteen households were removed from this data set because of missing or incomplete data. The resulting sample included 176 households and 352 individual responses. An analysis of variance was conducted to check for any significant differences between the data of these households as compared to the households who returned only one survey. Results showed no significant differences between the groups on age, education, income or water use. There were significant differences between the two samples on demographic variables of household composition, sex, and culture of respondents. There was a larger proportion of two-person households represented in the sample where two respondents completed the survey. This over representation was expected given the request for multiple responses to the questionnaire. There was a higher proportion of Anglo-European respondents in the dual-respondent household sample than the main sample, and a higher proportion of male respondents in the sample of householders from dual-respondent households (See Appendix E).

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<sup>1</sup> Note that although a number of univariate and multivariate outliers were identified in the data set, exclusion of these outliers did not substantively change the results and therefore they are retained for the final analysis.

**Table 11. Regression coefficients predicting household water use, October 2009 – March 2010**

Variable	Standardised Coefficients (Beta)	p
<b>Region: Gold Coast *</b>	<b>.15</b>	<b>.000</b>
Region: Ipswich *	-.02	.574
<b>Region Sunshine C *</b>	<b>.19</b>	<b>.000</b>
Age	.06	.140
<b>Household size: adults</b>	<b>.28</b>	<b>.000</b>
<b>Household size: children</b>	<b>.29</b>	<b>.000</b>
Education category	-.01	.652
<b>Installed infrastructure: low flow taps</b>	<b>-.08</b>	<b>.024</b>
Installed infrastructure: Pool cover	.04	.254
<b>Installed infrastructure: trigger hose / timed sprinkler</b>	<b>.09</b>	<b>.012</b>
Installed infrastructure: water-wise plants	.02	.651
<b>Installed infrastructure: Dual flush toilet</b>	<b>-.08</b>	<b>.027</b>
Installed infrastructure: Shower timer	-.02	.488
Installed infrastructure: Grey water system	.04	.213
<b>Installed infrastructure: Plumbed rainwater tank</b>	<b>-.10</b>	<b>.001</b>
Installed infrastructure: Non-plumbed rainwater tank	-.01	.725
<b>Installed infrastructure: Water-wise washing machine</b>	<b>.09</b>	<b>.008</b>
Installed infrastructure: Water-wise dishwasher	-.02	.613
Scale: Curtailment General Intentions	.10	.052
Scale: Curtailment Attitudes	-.02	.573
Scale: Curtailment Subjective Norms	.02	.574
Scale: Curtailment Moral Norms	-.05	.364
Self Efficacy	.04	.274
Perceived Behavioural Control	.02	.511
<b>Curtailment Descriptive Norm</b>	<b>.11</b>	<b>.001</b>
Community Identification	.04	.208
<b>Household Culture</b>	<b>-.12</b>	<b>.004</b>
Self-identity	-.07	.084
<b>Past behaviour: run washing machine if full</b>	<b>-.09</b>	<b>.007</b>
<b>Past behaviour: turn off taps while brushing teeth</b>	<b>-.08</b>	<b>.019</b>

\*Brisbane is the reference category that other regions are compared against

### 3.4.1. Differences between Household Respondents Returning Two Surveys

To investigate the agreement and conflict between respondents within each household, absolute difference scores (i.e., the difference ignoring + or – signs) were calculated for each of the psychosocial variables and the self-reported behaviour questions. These scores reflect the level of agreement between the responses of the two household respondents on the psycho-social variables relating to water conservation as well as the level of agreement on self-reported water conservation behaviour. The mean difference scores are shown in Table 12. As the table shows, there was generally

less agreement amongst householders in responses to the questions about installing water efficient appliances than engaging in everyday water conservation actions. Amongst the self-reported behaviour, there was least agreement about taking shorter showers. One sample t-tests revealed that each of the difference scores is significantly different from 0 (i.e., no difference between responses) at the  $p < .001$  level.

**Table 12. Mean differences between householder responses in households returning two surveys.**

	<b>N</b>	<b>Minimum Difference</b>	<b>Maximum Difference</b>	<b>Mean Difference</b>
Household Culture	176	0.00	5.13	.76
Community Identification	176	0.00	4.67	1.50
Self-identity	176	0.00	4.00	.55
<b>Everyday water conservation</b>				
Curtailment Attitudes	176	0.00	2.75	.72
Curtailment Subjective Norms	175	0.00	4.00	.72
Curtailment Moral Norms	175	0.00	4.33	.90
Curtailment Self-efficacy	175	0.00	4.00	.55
Curtailment perceived control	175	0.00	5.00	.94
Curtailment General Intentions	176	0.00	5.00	.69
<b>Installing water efficient appliances</b>				
Efficiency Attitudes	175	0.00	3.50	.75
Efficiency Subjective Norms	176	0.00	5.00	1.16
Efficiency Moral Norms	176	0.00	5.00	1.47
Efficiency Self-efficacy	175	0.00	5.00	.79
Efficiency perceived control	176	0.00	6.00	.97
Efficiency General Intentions	175	0.00	5.34	1.75
<b>Self-reported actions</b>				
Running dishwasher when full	123	0.00	2.00	.31
Washing cars with minimal water	150	0.00	4.00	.58
Shorter showers	172	0.00	4.00	.75
Full washing load	160	0.00	4.00	.49
Water-wise in the garden	155	0.00	4.00	.59
Half-flush or don't flush each time	176	0.00	4.00	.43
Check and fix leaking taps	163	0.00	4.00	.50
Use minimal water in kitchen	174	0.00	3.00	.58
Collect grey water for garden	157	0.00	4.00	.62
Collect rainwater for garden	155	0.00	4.00	.38
Turn off taps when brushing teeth	173	0.00	4.00	.60

Note. Psycho-social variables were measured on 7-point scales whereas self-reported behaviour questions were measured on 5-point scales.

### 3.4.2. Predicting Water Use for Households Returning Two Surveys

In this section, we explored whether some household members have more influence over household water use than others. For example, women may have more responsibility for some water-related tasks than men and therefore their responses may be more predictive of household water use than males. To explore this possibility, the households with male and female respondents were selected for analysis (N = 165) and two multiple regression analyses were conducted: An analysis predicting household water use from male respondents' survey responses and an analysis predicting household water use from female respondents' survey responses. There were some small differences in the regression models run for these analyses and the whole sample because of the reduce sample size and the need to reduce the number of variables in the regression model. A water efficiency index reflecting the

number of water efficient appliances installed in the household was used (0 – 11). In addition, only those water conservation behaviours that applied broadly to all households (e.g., bathroom, kitchen, laundry conservation behaviour) were included in the analyses (note that none of the individual efficiency appliances or the excluded conservation behaviours were significant predictors of water use in these analyses).

There were no real differences (Table 13) between the predictive power of females' survey responses and males' survey responses. In total females' responses predicted 46% of the variance in household water use and males predicted 44% of the variance in household water use (Females  $R = .68$ ,  $F(24, 113) = 4.08$ ,  $p < .001$ ; Males  $R = .66$ ,  $F(24, 117) = 3.78$ ,  $p < .001$ ). Consistent with the results for the whole sample, across the male and female samples, region and household size continued to be important predictors of household water use. In addition, when male responses were used as predictors, greater frequency of shorter showers and running the washing machine when full were associated with lower household water use. When males reported greater perception that others in the community were engaging in everyday water conservation this was associated with higher household water use. When female householders reported great frequency of running the washing machine with a full load this was also associated with lower household water use.

**Table 13. Regression coefficients predicting household water use, October 2009 – March 2010 for male and female respondents in households returning two surveys.**

Variable	Males Standardised Coefficients (Beta)	Females Standardised Coefficients (Beta)
Region: Brisbane*	-.40***	-.21*
Region: Gold Coast *	-.10	-.03
Region: Ipswich C *	-.31***	-.24***
Age	.05	.08
Household size: adults	.34***	.38***
Household size: children	.36***	.44***
Education category	.04	-.01
Water efficiency index	-.00	.06
Scale: Curtailment General Intentions	.01	.13
Scale: Curtailment Attitudes	-.06	-.15
Scale: Curtailment Subjective Norms	-.03	-.08
Scale: Curtailment Moral Norms	.08	-.04
Self Efficacy	.05	.02
Perceived Behavioural Control	.04	.04
Curtailment Descriptive Norm	.16*	.07
Community Identification	.15	-.03
Household Culture	-.09	-.00
Self-identity	-.09	-.06
Past behaviour: shorter showers	-.30**	-.08
Past behaviour: run washing machine if full	-.15*	-.26***
Past behaviour: half flush or don't flush each time	.13	-.10
Past behaviour: check and fix leading taps	.00	-.07
Past behaviour: use minimal water in kitchen	.04	.12
Past behaviour: turn off taps while brushing teeth	-.03	-.15

Note. Brisbane, Gold Coast and Ipswich are compared to Sunshine Coast; \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$  \*

## 4. SUMMARY AND IMPLICATIONS

The aim of the current report was to identify the key determinants of household water use, as measured by water utility billing data. It is clear from the results that demographic variables, household water efficiency infrastructure, water using habits, and psychological variables all play a part in how much water is used in households. The key findings are summarised below.

### Demographic Determinants:

- Households on the Gold Coast and Sunshine coast used more water than those in Brisbane or Ipswich. One possible explanation for this is the differing restriction regimes experienced by the regions during the drought. Brisbane and Ipswich were on high level restrictions during the peak of the drought whereas the Sunshine Coast never experienced restrictions and Gold Coast moved in and out of water restrictions. These differing restriction regimes may have resulted in different habits and practices being developed by households in the different regions.
- Not surprisingly, households with more adults and more children used more water and household size was the strongest predictor of total household water use.
- Results of the analyses comparing different household types show that single person households use more water per person than other household types, and households with young children use less water per person than other household types.
- Per person household water use was lower for households with younger (25 to 39 years) survey respondents than older survey respondents.

### Water efficiency infrastructure determinants:

- In the regression analysis when all other variables were controlled for, households with low flow taps, dual flush toilets, and plumbed rain water tanks used less water than those that did not have these appliances. It is worth noting that non-plumbed rain water tanks did not influence water use.
- Drawing on the same set of analyses, interestingly, householders who reported having water-wise washing machines and trigger-hose / timed sprinklers used more water. Possible explanations for this are that residents with trigger-hoses and timed sprinklers were more likely to irrigate their gardens than those without such infrastructure features, and those with water-wise washing machines felt more able to use their washing machine because of its efficiency features, thereby, leading them to do more loads of washing.
- When households with and without this infrastructure are compared (but other variables are not controlled for), households who have installed low flow taps, pool covers, shower timers, and plumbed rainwater tanks use less water than those without these appliances. On average, households that had plumbed rainwater tanks installed saved more than 40 litres of water per person per day compared to households that did not have these installed. For those households with a pool, installing a pool cover also saved approximately 40 litres per person daily.

### Psycho-social determinants:

- Households with a stronger water conservation culture, that is, they think of themselves as water conservers and are committed as a household to water conservation, used less water. It is this variable, rather than the survey respondents' individual water conservation intentions that predicts actual household water use. This finding reflects the communal nature of water use and suggests the importance of water conservation campaigns that target the household as a whole.
- An unexpected finding is that the more respondents perceived that other people in their community save water through everyday water saving actions, the more water they used in their household. This is counter to theory and the findings of past research (Cialdini, Reno and Kallgren, 1990; Nolan, Schultz, and Knowles, 2009). Past research suggests that the positive behaviour of others is a powerful positive influence on our own behaviour. One possible

explanation is that knowledge that others are saving releases householders from the obligation to save themselves—essentially they can engage in some ‘free-riding’.

Water use habits:

- The more respondents reported only running washing machines when full and turning off taps when brushing teeth the less water their household used. This finding suggests the importance that water using habits can play in contributing to household water use. Past research has also shown that habits related to washing clothes influence household water use (Aitken, McMahon, Wearing, and Finlayson, 1994).

As noted in the results section, the analyses were conducted without the household income variable included because of the number of people who did not respond to this question. If this variable is included, the sample size for the analysis is substantially reduced. The analysis with household income included yields largely the same findings with the following differences: age emerges as a positive predictor of household water use, trigger-hose/timed sprinklers is no longer a significant predictor, and past behaviour of washing clothes becomes marginally statistically significant ( $p = .062$ ). In addition, household income is a positive predictor such that household with higher incomes use more water.

Two survey households:

- There was less agreement between householders on the psycho-social factors related to water efficiency than everyday water conservation behaviours. This is perhaps not surprising as everyday behaviours may be more reflective of household culture and habits whereas decisions to install efficient appliances are usually one-off decisions that may require negotiation and discussion. Survey responses of male and female respondents were essentially similar in their power to predict household water use. The factors that predict household water use were generally the same for both males and females although the more male householders perceive that others in the community are saving water, the more water the household uses. In addition, the more male householders reported having shorter showers the less water the household used.

#### **4.1. Methodological Strengths and Weaknesses**

An important strength of the current research is that it links social survey data with objective measures of water use. Much of the research that has investigated the relationship between psycho-social data and water conservation has relied on water conservation intentions or self-reported water use behaviour as the outcome (Russell and Fielding, 2010). This research therefore makes a significant contribution to the empirical literature in this area. In addition, the comprehensive measurement of demographics, household water use infrastructure, and past self-reported water using habits allows us to examine whether the psycho-social determinants contribute over and above these factors.

Despite the strengths of the current study, it must be acknowledged that self-selection biases are always an issue for survey research. In the current study, it is possible that people who are more concerned about water conservation were more likely to take part in the research. It should be noted, however, that there was a wide range of water use in the households participating in the study.

## APPENDIX A. Post Codes of Study Regions

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Local Government Area	Postal Codes
Brisbane	4000 - 4018, 4025 - 4113, 4115, 4116, 4120 - 4123, 4151 - 4156, 4169 - 4179
Sunshine Coast	4517 - 4519, 4550 - 4569, 4571, 4575
Gold Coast	4205 - 4287
Ipswich	4300 - 4305, 4340 but NOT 4306

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## APPENDIX B. Household Water Use Survey



### Household Water Use Survey

Please return completed survey in the envelope provided or mail to:

CSIRO Sustainable Ecosystems  
Water Demand Survey  
Reply Paid 84366  
St Lucia, Qld, 4067

**CONSENT FORM**

Title of Research Project: **Systematic Social Analysis of Residential Water Use**

**PLEASE NOTE: It is important you sign this form otherwise we cannot use your survey information**

Your involvement in the Systematic Social Analysis of Residential Water Use is highly valued. Please review the information below and sign in the box provided if you agree to participate in the study.

I acknowledge that:

- I agree to participate in the project.
- I will not be identified personally at any stage of the project and all data will be kept confidential and only seen by researchers involved in the research project.
- Questions in regards to my participation have been answered to my satisfaction.
- I can obtain further information from the research team at any time during the project.
- I understand that this study has been cleared in accordance with the ethical review processes of the University of Queensland. If I have any questions concerning my participation in the study I should feel free to contact the researchers involved. I understand that I can also speak to an officer of the University not involved in the study, by contacting the University of Queensland Ethics Officer on 3365 3924.
- I have been provided with the contact details of the investigating officers (see Information sheet).
- I understand that I can withdraw from this study at any time without penalty and without giving an explanation for my withdrawal.
- I understand that I may ask that part or all of my data be removed from the study without penalty or explanation. Data that is removed from the study will be deleted and will not be included in any of the further investigations.

By signing below, I confirm that I have read and understood the information package and note that my involvement in this research will include participation in the following activities:

- Completion of the initial survey by adults in the household
- Accessing my household water data from council for one year prior to July 2009 and two years subsequent to July 2009

<b>Name</b>		If you would you like to be informed of the results please tick what information you would prefer: <input type="checkbox"/> Summary of findings <input type="checkbox"/> Copy of final publications  Please provide your preferred contact details below.
<b>Signature</b>		
<b>Date</b>		
<b>Residential Address:</b>		
<b>Phone Number:</b>		
<b>Email:</b>		

**Thank you for your participation**

### CONSENT FORM FOR WATER DATA

Title of Research Project: **Systematic Social Analysis of Residential Water Use**

I authorise my local council to provide water consumption data for the address listed below to researchers from the above project. The specific information to be provided to the researchers is water consumption data for the year prior to July 2009 and for two years subsequent to July 2009 (i.e., to June 2011).

I understand that the data will be used to assist the researchers to better understand how people use water in their homes in South East Queensland and what factors determine their water use.

I understand that data from the household meter readings will be kept confidential and only used for the purposes of the research.

***PLEASE NOTE:** It is important you sign this form so that we are able to collect information related to your water usage. Obtaining your water data is an essential part of our study.*

### WATER ACCOUNT DETAILS

#### NAME ON THE ACCOUNT (AS SHOWN ON THE ACCOUNT)

First Name(s):	Family Name:
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#### PROPERTY NUMBER / ID (if available)\*

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\* for residents of Sunshine Coast, this is located on the top right hand corner of your rates notice

Unit:	Number:	Street:
Suburb/Town:	Postcode:	

#### ADDRESS OF DWELLING (AS SHOWN ON THE ACCOUNT)

I am the registered owner of the premise nominated above.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Printed name: \_\_\_\_\_

## WAYS TO CONSERVE WATER

In this survey, we will be asking you about two types of water conservation methods:

1. Engaging in everyday actions to save water around the house and garden
2. Installing water efficient appliances around the house and garden

The following are examples of the two different methods, so please refer to these when you are answering specific questions related to each:



### Everyday actions to save water around the house and garden:

The following actions are things that you and members of your household may do to conserve water:

- Check and fix leaking taps
- Collect rainwater to use on garden
- Only run dishwasher if it is full
- Have shorter showers (4 minutes or less)
- Use half flush or don't flush the toilet every time
- Wash cars with minimal water (e.g., with a bucket or at an efficient car wash)
- Turn off taps when brushing teeth
- Only run the washing machine if it is full
- Use minimal water in kitchen (e.g., for cooking, washing up, rinsing)
- Collect and use grey water on garden (e.g., from washing machine, sink, shower/bath)
- Be water-wise in the garden (only water at night, less watering, use a bucket, plant drought-tolerant plants)

### Installing water efficient appliances around the house and garden:

The following are examples of water efficient appliances that you or members of your household may install in order to conserve water:

- Low-flow taps and/or shower heads on all fittings
- Pool cover
- Hose with trigger or a timed sprinkler
- Water-wise plants and/or gardens
- Dual-flush or composting toilet
- Shower timer
- Grey water system
- A rainwater tank
- Water-wise washing machine
- Water efficient dishwasher

Although some of the questions in this survey are essentially the same, we are trying to get your opinions on *different types* of water conserving practices.

Please feel free to refer back to this page at any stage of the survey.

### INSTRUCTIONS FOR COMPLETING THE SURVEY

Please take the time to fill out this survey about water conservation around the house and garden.

Your responses will contribute to an overall picture of how people in the South East Queensland community feel about conserving water.

This survey will take approximately 20 minutes to complete.

Please be as open and honest as possible when you are answering each question. Some questions may seem similar, however please answer each question with care as they all provide important information.

All your responses will be kept confidential and your information will not be seen by anyone outside of the research team.

#### DIRECTIONS:

1. Please read each question carefully and then circle one response on each line:

*E.G. CORRECT METHOD*

*INCORRECT METHOD*

1 2 3 4 5 **6** 7

1 2 3 4 5 6 7

2. After completing the survey, please look through the whole document again and make sure that you have not accidentally missed any items or circled two responses for one question.

3. Return the survey to us in the Reply Paid envelope provided, or via the other methods outlined on the front page.

THANK YOU FOR YOUR TIME

**First, we would like to focus on everyday actions that you and others do around the house and garden that help to save water.**

**When we use the phrase *everyday actions to save water around the house and garden*, we are referring to those actions listed on the *Ways to Conserve Water* page (see previous page )**



**1. I think engaging in *everyday actions to save water around the house and garden* is:**  
(please circle one response on each line)

<i>Extremely bad</i> 1	<i>Quite bad</i> 2	<i>Slightly bad</i> 3	<i>Neither</i> 4	<i>Slightly good</i> 5	<i>Quite good</i> 6	<i>Extremely good</i> 7
<i>Extremely harmful</i> 1	<i>Quite harmful</i> 2	<i>Slightly harmful</i> 3	<i>Neither</i> 4	<i>Slightly beneficial</i> 5	<i>Quite beneficial</i> 6	<i>Extremely beneficial</i> 7
<i>Extremely worthless</i> 1	<i>Quite worthless</i> 2	<i>Slightly worthless</i> 3	<i>Neither</i> 4	<i>Slightly valuable</i> 5	<i>Quite valuable</i> 6	<i>Extremely valuable</i> 7
<i>Extremely unpleasant</i> 1	<i>Quite unpleasant</i> 2	<i>Slightly unpleasant</i> 3	<i>Neither</i> 4	<i>Slightly pleasant</i> 5	<i>Quite pleasant</i> 6	<i>Extremely pleasant</i> 7

**2. I expect I will engage in *everyday actions to save water around the house and garden* in the next six months**

<i>Strongly disagree</i> 1	<i>Disagree</i> 2	<i>Slightly disagree</i> 3	<i>Neither agree nor disagree</i> 4	<i>Slightly agree</i> 5	<i>Agree</i> 6	<i>Strongly agree</i> 7
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3

**3. The following questions ask your beliefs about *everyday actions to save water around the house and garden*.**

	<i>Slightly disagree</i>	<i>Disagree</i>	<i>Somewhat disagree</i>	<i>Neither agree or disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
a) It is expected of me that I save water around the house and garden	1	2	3	4	5	6	7
b) I feel like there is social pressure to save water around the house and garden	1	2	3	4	5	6	7
c) People who are important to me want me to save water around the house and garden	1	2	3	4	5	6	7
d) I feel a strong personal obligation to save water around the house and garden	1	2	3	4	5	6	7
e) I am willing to put extra effort into saving water around the house and garden	1	2	3	4	5	6	7
f) I would feel guilty if I didn't save water around the house and garden	1	2	3	4	5	6	7

**4. I intend to engage in *everyday actions to save water around the house and garden* in the next six months**

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

**5. People in my community:**

<i>Never save water around the house and garden</i>			<i>Neither</i>			<i>Always save water around the house and garden</i>
1	2	3	4	5	6	7

**6. How often do you, or someone in your household, intend to do each of the following in the next six months?**

	Never	Rarely	Sometimes	Almost always	Always	Not applicable
a) Check and fix leaking taps	1	2	3	4	5	N/A
b) Collect rainwater to use on garden	1	2	3	4	5	N/A
c) Only run dishwasher if it is full	1	2	3	4	5	N/A
d) Have shorter showers (4 minutes or less)	1	2	3	4	5	N/A
e) Use half flush or don't flush the toilet every time	1	2	3	4	5	N/A
f) Wash cars with less water (e.g., with a bucket or at an efficient car wash)	1	2	3	4	5	N/A
g) Only run the washing machine if it is full	1	2	3	4	5	N/A
h) Use minimal water in kitchen (e.g., for cooking, washing up, rinsing)	1	2	3	4	5	N/A
i) Collect and use grey water on garden (e.g., from washing machine, sink, shower/bath)	1	2	3	4	5	N/A
j) Turn off taps when brushing teeth	1	2	3	4	5	N/A
k) Be water-wise in the garden (only water at night, less watering, use a bucket, plant drought-tolerant plants)	1	2	3	4	5	N/A

**7. Please answer the following questions based on your opinions.**

	Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree
a) I am confident that I could save water around the house and garden if I wanted to	1	2	3	4	5	6	7
b) The decision to save water around the house and garden is beyond my control	1	2	3	4	5	6	7
c) Whether I save water around the house and garden or not is entirely up to me	1	2	3	4	5	6	7

5

**8. I want to engage in *everyday actions to save water around the house and garden* in the next six months**

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

**9. In the last six months, how often did you do each of the following?  
(If you choose N/A, please explain why this is the case)**

	<i>Never</i>	<i>Rarely</i>	<i>Sometimes</i>	<i>Almost always</i>	<i>Always</i>	<i>Not applicable</i>
	1	2	3	4	5	N/A
a) Only run dishwasher if it is full	1	2	3	4	5	N/A
b) Wash cars with minimal water (e.g., with a bucket or at an efficient car wash)	1	2	3	4	5	N/A
c) Have shorter showers (4 minutes or less)	1	2	3	4	5	N/A
d) Only run the washing machine if it is full	1	2	3	4	5	N/A
e) Be water-wise in the garden (only water at night, less watering, use a bucket, plant drought-tolerant plants)	1	2	3	4	5	N/A
f) Use half flush or don't flush the toilet every time	1	2	3	4	5	N/A
g) Check and fix leaking taps	1	2	3	4	5	N/A
h) Use minimal water in kitchen (e.g., for cooking, washing up, rinsing)	1	2	3	4	5	N/A
i) Collect and use grey water on garden (e.g., from washing machine, sink, shower/bath)	1	2	3	4	5	N/A
j) Collect rainwater to use on garden	1	2	3	4	5	N/A
k) Turn off taps when brushing teeth	1	2	3	4	5	N/A

**If you chose N/A, please explain why this is the case:**

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**Now we would like to move on and ask you the same set of questions about another aspect of water conservation: installing water efficient appliances in your house and garden.**

**When we use the phrase *installing water efficient appliances*, we are referring to those items outlined on the *Ways to Conserve Water* page**

**We know that these questions will seem repetitive, but please bear with us, as all information you provide is important to this study because two distinct aspects of water management are being studied.**

**10. I think *installing water efficient appliances* in the house and garden is:  
(please circle one response on each line)**

<i>Extremely bad</i> 1	<i>Quite bad</i> 2	<i>Slightly bad</i> 3	<i>Neither</i> 4	<i>Slightly good</i> 5	<i>Quite good</i> 6	<i>Extremely good</i> 7
<i>Extremely harmful</i> 1	<i>Quite harmful</i> 2	<i>Slightly harmful</i> 3	<i>Neither</i> 4	<i>Slightly beneficial</i> 5	<i>Quite beneficial</i> 6	<i>Extremely beneficial</i> 7
<i>Extremely worthless</i> 1	<i>Quite worthless</i> 2	<i>Slightly worthless</i> 3	<i>Neither</i> 4	<i>Slightly valuable</i> 5	<i>Quite valuable</i> 6	<i>Extremely valuable</i> 7
<i>Extremely unpleasant</i> 1	<i>Quite unpleasant</i> 2	<i>Slightly unpleasant</i> 3	<i>Neither</i> 4	<i>Slightly pleasant</i> 5	<i>Quite pleasant</i> 6	<i>Extremely pleasant</i> 7

7

**11. I expect to install water efficient appliances in my home within the next six months.**

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

**12. These questions may sound similar to those in Question 3, however this time we are asking about water efficient appliances, rather than everyday actions around the house and garden. Please read each question carefully.**

	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree or disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
a) It is expected of me that I should install water efficient appliances in the house and garden	1	2	3	4	5	6	7
b) I feel under social pressure to install water efficient appliances in the house and garden	1	2	3	4	5	6	7
c) People who are important to me want me to install water efficient appliances in the house and garden	1	2	3	4	5	6	7
d) I feel a strong personal obligation to install water efficient appliances in the house and garden	1	2	3	4	5	6	7
e) I am willing to put extra effort into installing water efficient appliances in the house and garden	1	2	3	4	5	6	7
f) I would feel guilty if I didn't install water efficient appliances in the house and garden	1	2	3	4	5	6	7

**13. I want to install water efficient appliances in my home within the next six months**

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

**14. Over the next six months, will your household install each of the following devices?**

	<i>Definitely will not install</i>	<i>May not install</i>	<i>Unsure</i>	<i>May install</i>	<i>Definitely will install</i>	<i>Already installed</i>	<i>Not applicable</i>
a) Low-flow taps and/or shower heads on all fittings	1	2	3	4	5	AI	N/A
b) Pool cover	1	2	3	4	5	AI	N/A
c) Hose with trigger or a timed sprinkler	1	2	3	4	5	AI	N/A
d) Water-wise plants and/or gardens	1	2	3	4	5	AI	N/A
e) Dual-flush or composting toilet	1	2	3	4	5	AI	N/A
f) Shower timer	1	2	3	4	5	AI	N/A
g) Grey water system	1	2	3	4	5	AI	N/A
h) A rainwater tank plumbed into the house	1	2	3	4	5	AI	N/A
i) A rainwater tank <u>not</u> plumbed into the house	1	2	3	4	5	AI	N/A
j) Water-wise washing machine	1	2	3	4	5	AI	N/A
k) Water efficient dishwasher	1	2	3	4	5	AI	N/A

If you chose N/A, please explain why this is the case:

**15. I intend to have water efficient appliances installed in the home within the next six months.**

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

**16. People in my community:**

<i>Never install water efficient devices in the house and garden</i>			<i>Neither</i>			<i>Always install water efficient devices in the house and garden</i>
1	2	3	4	5	6	7

**17. Please answer the following questions. These questions may sound similar to those in Question 8, however this time we are asking about *water efficient appliances*, rather than everyday actions around the house and garden. Please read each question carefully.**

	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
a) I am confident that I could save water around the house and garden if I wanted to	1	2	3	4	5	6	7
b) The decision to save water around the house and garden is beyond my control	1	2	3	4	5	6	7
c) Whether I save water around the house and garden or not is entirely up to me	1	2	3	4	5	6	7

**18. In this section, we would like to ask how you feel about being a member of the South East Queensland community.**

a) How important is it to you to be a member of your South East QLD community?	<i>Very unimportant</i> 1	2	3	<i>Moderately important</i> 4	5	6	<i>Very important</i> 7
b) How much do you feel strong ties with other residents in South East QLD?	<i>Not very much</i> 1	2	3	<i>Moderately</i> 4	5	6	<i>Very much</i> 7
c) How much do you see yourself belonging to your South East QLD community?	<i>Not very much</i> 1	2	3	<i>Moderately</i> 4	5	6	<i>Very much</i> 7

**19. In this section, we would like to ask about your personal beliefs regarding water conservation and water shortage, as a member of the South East Queensland community.**

a) How well informed do you consider yourself to be about water conservation and the risk of water shortages?

<i>Not at all informed</i>				<i>Moderately informed</i>			<i>Extremely informed</i>
1	2	3	4	5	6	7	

b) To what extent do you find information about water conservation to be personally relevant?

<i>Not at all personally relevant</i>				<i>Moderately relevant</i>			<i>Extremely personally relevant</i>
1	2	3	4	5	6	7	

c) How motivated are you to learn more about the connection between water conservation and preventing water shortages?

<i>Not at all motivated</i>				<i>Moderately motivated</i>			<i>Extremely motivated</i>
1	2	3	4	5	6	7	

d) How vulnerable do you feel about the possibility of water shortages affecting *you or your family*?

<i>Not at all vulnerable</i>				<i>Moderately vulnerable</i>			<i>Extremely vulnerable</i>
1	2	3	4	5	6	7	

e) How vulnerable do you feel about the possibility of water shortages affecting *your land and property*?

<i>Not at all vulnerable</i>				<i>Moderately vulnerable</i>			<i>Extremely vulnerable</i>
1	2	3	4	5	6	7	

f) How serious do you feel the negative consequences of water shortages are to you personally?

<i>Not at all serious</i>				<i>Moderately serious</i>			<i>Extremely serious</i>
1	2	3	4	5	6	7	

g) How severe would the impact of a water shortage be where you live?

<i>Not at all severe</i>				<i>Moderately severe</i>			<i>Extremely severe</i>
1	2	3	4	5	6	7	

**20. How effective is engaging in everyday actions to save water around the house and garden in reducing the risk of water shortages impacting the SEQ community?**

<i>Not at all effective</i>				<i>Moderately effective</i>			<i>Very effective</i>
1	2	3	4	5	6	7	

**21. How effective is installing water saving devices around the house and garden in reducing the risk of water shortages impacting the SEQ community?**

<i>Not at all effective</i>				<i>Moderately effective</i>			<i>Very effective</i>
1	2	3	4	5	6	7	

**22. How confident do you feel, in general, about your ability to conserve water?**

<i>Not at all confident</i>				<i>Moderately confident</i>			<i>Very confident</i>
1	2	3	4	5	6	7	

**23. Please indicate your agreement to the following statements.**

a) I personally think of myself as a water conserver .

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

b) Water conservation is important to me personally.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

**24. Please indicate your agreement with each of the following statements relating to your household.**

**NOTE: If you live alone, please move onto Question 25.**

a) Members of my household think that engaging in *everyday actions to save water around the house and garden* is a good thing

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

b) Members of my household engage in *everyday actions to save water around the house and garden*?

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

c) There is agreement amongst the members of my household that engaging in *everyday actions to save water around the house and garden* is a good thing to do.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

d) Most individuals in my household engage in *everyday actions to save water in the house and garden*.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

e) Members of my household think that *installing water efficient appliances* in the house and garden is a good thing.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

f) There is agreement amongst members of my household that *installing water efficient appliances* around the house and garden is a good thing to do.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

g) We think of ourselves as a water conserving household.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7

h) Water conservation is important in our household.

<i>Strongly disagree</i>	<i>Disagree</i>	<i>Slightly disagree</i>	<i>Neither agree nor disagree</i>	<i>Slightly agree</i>	<i>Agree</i>	<i>Strongly agree</i>
1	2	3	4	5	6	7



h) Are there any issues about the survey or the topic that you would like to comment on?

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**CONGRATULATIONS!  
YOU HAVE REACHED THE END OF THE SURVEY!**



**Thank you for taking the time to participate  
in this important study.**

This survey is part of a larger study about how South East Queensland households use water and what they think about water conservation. We will be conducting further research that requires the completion of short surveys and the provision of some additional information. Again, your involvement will remain completely confidential.

Please do not hesitate to contact the research team if you have any questions or concerns.

If you indicated that you would like to be involved in future surveys, we will be in touch in the near future.

Please tick this box if you are not interested in being involved in future research

## APPENDIX C. Consent Form for Release of Water Data

Please tick one of the options below:

- I / we authorise my local council to provide water consumption data for the address listed below to researchers from the above project. The specific information to be provided to the researchers is water consumption data for the year prior to July 2009 and for two years subsequent to July 2009 (i.e., to June 2011).

I understand that the data will be used to assist the researchers to better understand how people use water in their homes in South East Queensland and what factors determine their water use.

I understand that data from the household meter readings will be kept confidential and only used for the purposes of the research.

- I / we do not have an individual water meter connected to the residence.  
(Please provide your contact details below for our records)
- I / we rely solely on tank / bore water.  
(Please provide your contact details below for our records)

### WATER ACCOUNT DETAILS (if applicable)

#### NAME ON THE ACCOUNT (AS SHOWN ON THE ACCOUNT)

First name:	Family Name:
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#### ACCOUNT NUMBER (IF AVAILABLE)\*

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\* for Sunshine Coast Residents this information is available in the top right hand corner of your rates bill

#### ADDRESS OF DWELLING (AS SHOWN ON THE ACCOUNT)

Unit:	Number:	Street
Suburb/Town:	Postcode:	

I am /we are the registered owner/s of the premise nominated above

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Printed name: \_\_\_\_\_

If you would like to be informed of the results please tick what information you would prefer:

- Summary of findings  
 Copy of final publications

## APPENDIX D. Study Variables and Scale Construction

**Table D.1** Items assessing curtailment Theory of Planned Behaviour variables

Variable	Variable Format	Variable Source
<b>Directly measured variables (No. items)</b>		
Attitudes (4)	7 point Likert Scale	Participant reported
Subjective Norms (3)	7 point Likert Scale	Participant reported
Moral Norms (3)	7 point Likert Scale	Participant reported
Descriptive Norm (1)	7 point Likert Scale	Participant reported
Perceived Behavioural Control (PBC) (3)	7 point Likert Scale	Participant reported
Past Behaviour (11)	5 point Likert Scale plus 'NA' option	Participant reported
Overall Intentions (3)	7 point Likert Scale	Participant reported
Specific Intentions (11)	5 point Likert Scale plus 'NA' option	Participant reported
<b>Constructed variables</b>		
Curtailment Attitudes	Scale	Constructed from Curtailment Attitude items
Curtailment Subjective Norms	Scale	Constructed from Curtailment Subjective Norm items
Curtailment Moral norms	Scale	Constructed from Curtailment Moral Norm items
Curtailment Overall Intentions	Scale	Constructed from Curtailment Overall Intention items

**Table D.2** Items assessing efficiency Theory of Planned Behaviour variables

Variable	Variable Format	Variable Source
<b>Directly measured variables (No. items)</b>		
Attitudes (4)	7 point Likert Scale	Participant reported
Subjective Norms (3)	7 point Likert Scale	Participant reported
Moral Norms (3)	7 point Likert Scale	Participant reported
Descriptive Norm (1)	7 point Likert Scale	Participant reported
Perceived Behavioural Control (PBC) (3)	7 point Likert Scale	Participant reported
Past Behaviour (11)	5 point Likert Scale plus 'NA' and 'Already Installed' options	Participant reported
Overall Intentions (3)	7 point Likert Scale	Participant reported
Specific Intentions (11)	5 point Likert Scale plus 'NA' and 'Already Installed' options	Participant reported
<b>Constructed variables</b>		
Efficiency Attitudes	Scale	Constructed from Efficiency Attitude items
Efficiency Subjective Norms	Scale	Constructed from Efficiency Subjective Norm items
Efficiency Moral Norms	Scale	Constructed from Efficiency Moral Norm items
Past Behaviour Index	Scale	Constructed from Efficiency Past Behaviour items
Efficiency Overall Intentions	Scale	Constructed from Efficiency Overall Intention items

**Table D.3 Expanded Theory of Planned Behaviour variables**

Variable	Variable Format	Variable Source
<b>Directly measured variables (No. items)</b>		
Community Identification (3)	7 point Likert Scale	Participant reported
Self Identity (2)	7 point Likert Scale	Participant reported
Household Identity (8)	7 point Likert Scale	Participant reported
<b>Constructed variables</b>		
Community Identification Scale	Scale	Constructed from Community Identification items
Self Identity Scale	Scale	Constructed from Self Identity items
Household Culture	Scale	Constructed from Household Identity items

**Table D.4 Participant demographic and household variables**

Variable	Variable Format	Variable Source
<b>Directly measured variables</b>		
Year of birth	DD/MM/YYYY	Participant reported
Gender	1) male 2) female	Participant reported
Household income	1) < \$30 000 2) \$30 000-59 999 3) \$60 000-89 999 4) \$90 000-119 999 5) \$120 000-149 999 6) > \$150 000 7) prefer not to respond	Participant reported
Household occupants	1) adults 2) children	Participant reported
Education	1) primary school 2) high school 3) trade/TAFE 4) tertiary undergraduate 5) tertiary postgraduate	Participant reported
Cultural background	1) Aboriginal/Torres Strait Islander 2) Anglo-European 3) Asian/Sub-continental 4) Polynesian 5) Middle-Eastern 6) African 7) Other	Participant reported
Household water user type	1) High water user 2) Medium water user 3) Low water user 4) Don't know	Participant reported
<b>Constructed variables</b>		
Age	Years	Calculated from report of year of birth
Age Category	1) 15 – 24 years 2) 25 – 54 years 3) 54 – 64 years 4) 65 years and over	Calculated from report of year of birth
Household Size	Total number of occupants	Calculated from number of residents

**Table D.5 Scale construction for Expanded Theory of Planned Behaviour variables**

<b>Scale Name</b>	<b>Included Questionnaire Item *</b>	<b>Reliability</b>
<b>Curtailment Attitudes</b>	Question 1: Bad - Good	alpha .813
	Question 1: Harmful - Beneficial	Variable computed
	Question 1: Worthless - Valuable	
	Question 1: Unpleasant - Pleasant	
<b>Curtailment subjective norms</b>	Question 3A	alpha .632
	Question 3B	Variable computed
	Question 3C	
<b>Curtailment moral norms</b>	Question 3D	alpha .859
	Question 3E	scale computed
	Question 3F	
<b>Curtailment general intentions</b>	Question 2	Alpha .882
	Question 4	Variable computed
	Question 8	
<b>Efficiency Attitudes</b>	Question 10: Bad - Good	Alpha = .866
	Question 10: Harmful - Beneficial	Scale computed
	Question 10: Worthless - Valuable	
	Question 10: Unpleasant - Pleasant	
<b>Efficiency subjective norms</b>	Question 12A	alpha = .759
	Question 12B	scale computed
	Question 12C	
<b>Efficiency moral norms</b>	Question 12D	alpha = .888
	Question 12E	scale computed
	Question 12F	
<b>Efficiency general intentions</b>	Question 11	alpha = .890
	Question 13	scale computed
	Question 15	
<b>Community identification</b>	Question 18A	Alpha = .914
	Question 18B	Scale computed
	Question 18C	
<b>Self identity</b>	Question 23A	Correlation (r) = .789
	Question 23B	Mean calculated
<b>Household culture</b>	Question 24A	alpha = .955
	Question 24B	scale computed
	Question 24C	
	Question 24D	
	Question 24E	
	Question 24F	
	Question 24G	
	Question 24H	

## APPENDIX E. Demographic Differences between Dual Respondent Households and Single Respondent Households

**Table E1. Differences in Household Type**

Household type	Percentage of Single Respondent Households (N = 1504)	Percentage of Dual-Respondent Households (N = 176)
Single person household	15.2	0
Two person (adult) household	38.6	52.8
Multiple adult household	14	17.6
Family household (1 or more adults and children)	31.5	29.5

**Table E2. Differences in Cultural Categories**

Cultural Categories	Percentage of Single Respondents (N = 1445)	Percentage of Respondents from Dual-Respondent Households (N = 467)
Anglo-European	86.4	93.6
Asian / M eastern	3.6	2.1
Other	5.5	3.6

**Table E3. Differences in Sex**

	Percentage of Single Respondents (N = 1501)	Percentage of Respondents from Dual-Respondent Households (N = 470)
Male	41.4	48.9
Female	57.7	51.1

## REFERENCES

- Aitken, C., McMahon, T., Wearing, A. and Finlayson, B. (1994). Residential water use: predicting and reducing consumption. *Journal of Applied Social Psychology* 24(2), 136-158.
- Australian Bureau of Statistics. (2006). *Census of Population and Housing*.
- Ajzen, I.(1991).The theory of planned behavior, *Organizational Behavior and Human Decision Processes*, 50(2), 179-211.
- Armitage, C.J., and Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta -analytic review. *British Journal of Social Psychology*, 40, 471-499.
- Bates, B., Kundzewicz, Z.W., Wu, S., and Palutikof, J. (2008).*Climate Change and Water: IPCC Technical Report VI*, IPCC Secretariat, Geneva.
- Cialdini, R.B., Reno, R.R., and Kallgren, C.A. (1990). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58(6), 1015-1026.
- Clark, W. A., and J. C. Finley (2007). Determinants of water conservation intention in Blagoevgrad, Bulgaria, *Society and Natural Resources*, 20, 613-327.
- Conner, M., and Armitage, C.J. (1998). Extending the theory of planned behaviour: A review and avenues for further research. *Journal of Applied Social Psychology*, 28(15), 1429-1464.
- CSIRO, (2010). *Water overview*. Retrieved April 7, 2010 from <http://www.csiro.au/org/WaterOverview.html>.
- Fielding, K.S., Louis, W.R., Warren, C., and Thompson, A. (2009). *Environmental sustainability in residential housing: Understanding attitudes and behaviour towards waste, water, and energy consumption and conservation among Australian households*. Melbourne, Victoria: Australian Housing and Urban Research institute.
- Fielding, K.S., Russell, S., and Grace, R. (2010). *Residential Water Demand Management in South East Queensland: A Report on Water Conservation Beliefs*. Urban Water Security Research Alliance Technical Report No. 24.
- Fielding, K., Spinks, A., Russell, S., Mankad, A., McCrae, R. and Gardner, J. (2012). *Water Demand Management Study: Intervention Study to reduce household water use*. Urban Water Security Research Alliance Technical Report No. 94.
- Gardner, G. T., and P. C. Stern (1996). *Environmental problems and human behavior*, Allyn and Bacon, Boston.
- Holland, R.W., Aarts, H., and Langendam, D. (2006). Breaking and creating habits on the working floor: A field-experiment on the power of implementation intentions. *Journal of Experimental Social Psychology*, 42, 776-783.
- Kantola, S. J., Syme, G.J., and Campbell, N.A. (1982). The role of individual differences and external variables in a test of the sufficiency of Fishbein's model to explain behavioral intentions to conserve water, *Journal of Applied Social Psychology*, 12(1), 70-83.
- Lam, S.-P. (1999). Predicting intentions to conserve water from the theory of planned behavior, perceived moral obligation, and perceived water right, *Journal of Applied Social Psychology*, 29(5), 1058-1071.
- Lam, S.-P. (2006). Predicting intention to save water: Theory of planned behavior, response efficacy, vulnerability, and perceived efficiency of alternative solutions, *Journal of Applied Social Psychology*, 36(11), 2803-2824.
- Manstead, A.S.R., and Parker, D. (1995). Evaluating and extending the theory of planned behaviour. In W. Stroebe and M. Hewstone (Eds), *European Review of Social Psychology* (Vol. 6, pp. 69-96). Chichester: Wiley.
- Nolan, J M., Schultz, P. W., Cialdini, R B., Goldstein, N J., and Griskevicius, V. (2008). Normative Social Influence is Underdetected. *Personality and Social Psychology Bulletin*, 34, 913–923.
- Ouellette, J.A., and Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behaviour predicts future behaviour. *Psychological Bulletin*, 124, 54-74.
- Partridge, E. (2008). From ambivalence to activism: Young people's environmental views and actions. *Youth Studies Australia*, 27, 18-25.
- Russell, S., and Fielding, K. (2010). Water demand management research: A psychological perspective. *Water Resources Research*, 46, W05302, doi:10.1029/2009WR008408.
- Spinks, A., Fielding, K. Russell, S., Mankad, A. and Price, J. (2011). *Water Demand Management Study: Baseline Survey of Household Water Use (Part A)*. Urban Water Security Research Alliance Technical Report No. 40.
- Stryker, S. (1968). Identity salience and role performance: The importance of symbolic interaction theory for family research. *Journal of Marriage and the Family*, 30, 558-564.
- Stryker, S. (1980). *Symbolic interactionism: A social structural version*. Palo Alto CA: Benjamin/Cummings.
- Zelezny, L.C., Chua, P-P., and Aldrich, C. (2000). Elaborating on gender differences in environmentalism. *Journal of Social Issues*, 56(3), 443-457.

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