Mandated versus Retrofitted Tank Owners: Psychological Factors Predicting Maintenance and Management

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The Urban Water Security Research Alliance (UWSRA) is a $50 million partnership over five years between the Queensland Government, CSIRO's Water for a Healthy Country Flagship, Griffith University and The University of Queensland. The Alliance has been formed to address South East Queensland's emerging urban water issues with a focus on water security and recycling. The program will bring new research capacity to South East Queensland tailored to tackling existing and anticipated future issues to inform the implementation of the Water Strategy.

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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.

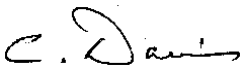
As the largest regionally focused urban water research program in Australia, the Alliance is focused on water security and recycling, but will align research where appropriate with other water research programs such as those of other SEQ water agencies, CSIRO's Water for a Healthy Country National Research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

In South East Queensland (SEQ), inconsistent rainfall and unprecedented population growth have contributed to the broader use of permanent water conservation measures (Queensland Water Commission, 2010) (QWC). There has also been an increased emphasis on household installation and utilisation of decentralised water systems such as rainwater tanks. Individual household tanks allow residents to collect and use rainwater in a localised way, reducing reliance on the central water grid. As part of the SEQ Water Strategy (itself part of broader state-wide response to drought), all homes built in SEQ from January 2007 onwards were required to install a water saving device within the home that allows the household to save approximately 70 kilolitres (kL) of mains water per year. The simplest and most efficient installation recommended for this purpose is a rainwater tank, with a minimum volume of 5,000 litres (L) (Queensland Development Code MP4.2; DIP, 2010), in this report referred to as "mandated tanks". Further regulations include the maintenance of tanks, including mosquito proofing and additions such as 'first flush' devices that keep contaminants out of the tank. Many existing homes in SEQ have also been encouraged to retrofit such systems within the home's existing infrastructure. The State and Federal governments, at various times, have offered short-term rebates designed to encourage and compensate individuals who choose to install a 3,000-5,000 L rainwater tank on their property and, later on, rebates were available for those households which chose to plumb their retrofitted tanks into some of the home's water fixtures (Beal, *et al.*, 2010).

Given the high proportion of homes in SEQ that have a rainwater tank (mandated or retrofitted) it is important for water stakeholders and engineers to understand the types of behaviours that residents are engaging in with respect to their rainwater tanks. The primary research question in the present study examines how people use their rainwater and how homeowners are maintaining their tanks (if at all) for long-term capability and performance. It is believed that factors associated with the choice to install a tank will be influential in attitudes and behaviours associated with rainwater use and tank maintenance, and will affect one's motivation to engage in certain behaviours. The objective for this study is to understand the key motivational descriptors that vary among residents who have voluntarily installed tanks on their property (i.e. *retrofitted*) and those who have installed a tank based on the Queensland Development Code MP4.2 (i.e. *mandated*).

The framework for this psychosocial analysis is self-determination theory (SDT) (Deci and Ryan, 1991; 1995). This theory is concerned with understanding the motivational drivers of choice (e.g. why do people choose to get a rainwater tank, what motivates someone to maintain their tank) and focuses on the degree to which an individual's behaviour is self-motivated (i.e. self-determined). The application of self-determination theory in the environmental context has demonstrated the utility of the theory in explaining pro-environmental behavioural choices, as well as how different types of motivation can regulate behaviour (Ryan and Deci, 2000; Deci and Ryan, 2000).

According to the theory, there are three innate psychological needs that must be fulfilled in order to self-motivate individuals to initiate behaviour (Deci and Ryan, 2002; Ryan and Deci, 2000):

- **Competence:** belief that one is effective in dealing with the situation they are experiencing;
- **Autonomy:** the universal urge to be independent; and
- **Relatedness:** the need to interact and be connected with others.

Self-determination theory also stipulates that motivation can be categorised as intrinsic, extrinsic or amotivation.

It was hypothesised that higher perceptions of competence and autonomy will predict more frequent engagement in tank-related behaviours and that the level of self-determined motivation (i.e. intrinsic, extrinsic, amotivated) will also influence these behaviours. This study found that participants who voluntarily retrofitted rainwater tanks (n = 1,443) were more likely to engage in maintenance than mandated rainwater tank owners (n = 570). Further, evidence suggests that these differences can be, in part, explained by SDT. The results are:

- Retrofitters reported higher intrinsic motivation and had a higher self-determination score than mandated participants.
- Mandated participants reported higher amotivation and thus had a lower self-determination score than retrofitted participants.
- Retrofitters demonstrated a higher sense of tank ownership compared to mandated participants.
- Self-determination variables predict greater engagement in tank maintenance, higher frequency of maintenance behaviours and greater adequacy in the frequency of tank maintenance.
- Amotivation variables predicted lack of motivation to engage in tank maintenance, lower frequency of maintenance behaviours and less adequacy in the frequency of tank maintenance.

Results should be interpreted with caution, as effect sizes were significant but low. However, overall it is believed that results from this study will help researchers in understanding differences in tank maintenance and rainwater use behaviours among residents in SEQ, based on a greater understanding of motivational influences. This information can inform policy and water researchers as to the facilitating and inhibiting variables that can impact public engagement with rainwater tanks, as well as residents' willingness to look after their tanks, once installed.

1. INTRODUCTION

In South East Queensland (SEQ), inconsistent rainfall and unprecedented population growth have contributed to the broader use of permanent water conservation measures (Queensland Water Commission, 2010). There has also been increasing emphasis on the installation and utilisation of household decentralised water systems, particularly rainwater tanks. Household tanks allow residents to collect and use rainwater locally, reducing their reliance on the central water grid. Often, this rainwater is used for non-potable applications where high quality water is not required. Some households also choose to filter and purify their rainwater for potable quality applications such as drinking and cooking. The key benefit of rainwater tank systems is reducing householders' reliance on town/mains water and providing water on a fit-for-purpose basis.

As part of the Queensland Development Code (QDC), all homes built in SEQ from 1 January 2007 must install a water saving device within the home that allows the household to save approximately 70 kL of mains water per year. The easiest and most efficient installation recommended for this purpose is a rainwater tank, in this report referred to as a mandated tank, with a minimum volume of 5,000 L (QDC MP4.2; DIP, 2010). The QDC stipulates performance criteria for rainwater tanks to be met and provides acceptable solutions to assist with meeting these criteria. The performance criteria and acceptable solutions contained in the development code include rainwater tank installation, capacity and water quality protection measures as follows:

- At least half the available roof catchment area or 100 m^2 (whichever is less) must feed into the tank via fitted downpipes.
- Any tank must be plumbed into toilets, washing machine cold water taps and external taps of detached, single residential households.
- All tanks must have suitable measures to prevent mosquitoes breeding (e.g. mosquito-proof screens) and prevent contaminants from entering the tank (e.g. first flush mechanism for the first 20 L of collected water).
- Internal fixtures supplied from the tank must have a continuous supply of water and, therefore, a back-up supply of mains water using a trickle top-up or automatic valve system.

While all new homes should be installing decentralised rainwater tanks, many existing homes in SEQ are being encouraged to retrofit a decentralised system within the home's existing infrastructure. State and Federal and local governments, at various times, have offered short-term rebates designed to encourage and compensate individuals who choose to install a 3,000-5,000 L rainwater tank on their property and, later on, rebates were available for those households which chose to plumb their retrofitted tanks into some of the home's water fixtures (Beal, *et al*., 2010).

Given the high proportion of homes in SEQ that have a rainwater tank, either by choice or due to a building regulation, it is important to understand the types of behaviours that residents are engaging in with respect to their rainwater tanks. The research questions being addressed in the present study relate to how people are using their rainwater and how homeowners are maintaining their tanks (if at all) for long-term capability and performance. It is believed that factors associated with choice will be influential in attitudes and behaviours associated with rainwater use and tank maintenance, and will affect one's motivation to engage in certain behaviours.

1.1. Conceptual Framework

The overarching framework for this psychosocial analysis was self-determination theory (SDT; Deci and Ryan, 1991; 1995). This theory is concerned with understanding the motivational drivers of choice (e.g., why do people choose to get a rainwater tank, what motivates someone to maintain their tank) and focuses on the degree to which an individual's behaviour is self-motivated (i.e. self-determined) or motivated through some external factor. This model has been shown to be significantly and reliably associated with pro-environmental behaviours, and it can clearly demonstrate how motivation can influence behaviour.

According to the theory, there are three innate psychological needs that must be fulfilled in order to self-motivate individuals to initiate behaviour (Deci and Ryan, 2002; Ryan and Deci, 2000).

- **Competence**
  A person's belief that they can effectively deal with the situation they are experiencing.
- **Autonomy**
  The universal urge to be independent (note: this does not mean to be independent of others) and be 'causal agents' of our own lives.
- **Relatedness**
  The need to interact and be connected with others.

In the context of rainwater use and tank maintenance, *competence* refers to an individual's belief in their ability to carry out the relevant behaviours, for example, checking and cleaning the first flush device, removing debris from roof and gutters, inspecting mosquito screens, etc. Therefore, while a person may know that certain maintenance activities need to be carried out on their tank, individuals may vary in their perceived ability to actually perform the required tasks. The concept of *autonomy* is also very important when comparing mandated and retrofitted tank homeowners, as autonomy refers to an individual's perception that having a rainwater tank is an independent decision and not one that was prompted or forced by an external factor (e.g. government regulations). Finally, while *relatedness* is important in the context of psychological research, the focus in this study is on how competence and autonomy influence motivation to engage in tank-specific behaviours. It is argued that while relatedness is not being explored in the present study, future research should be carried out on the effects of community, culture and interpersonal relations on water conservation behaviour. In this context, relatedness would be a valuable predictor of behavioural outcomes.

Ryan and Deci (2000) suggest that individuals cannot thrive without satisfying these basic needs relative to a target behaviour. For example, an environment that presents an individual with a feeling of competence, but fails to nurture autonomy, will result in poor well-being and thus, disengagement of the behaviour. This issue is important when considering the context of tank use and maintenance. If individuals feel that they were forced to adopt a rainwater tank (i.e. low autonomy), then it is likely that their perceived competence relative to tank-related behaviours will be low also.

Self-determination theory also suggests that human motives can be explained in terms of three key categories of motivation, defined by the amount of self-determination associated with engagement in the target behaviour(s):

- **Intrinsic motivation**
  The tendency to engage in activities for the inherent pleasure and satisfaction derived from the practice of the activity itself. An intrinsically motivated person initiates behaviour out of personal choice and interest, and the behaviour is an end in itself. This is the most self-determined type of behaviour.

- **Extrinsic motivation**
  The activity is not engaged in for its inherent pleasure, but rather because the goal of the behaviour is to bring about positive consequences or to avoid negative consequences. That is, the individual is not interested in the activity for its own sake.

- **Amotivation**
  An amotivated individual experiences a lack of control and alienation from the activity and is incapable of foreseeing the consequences of the behaviour and its outcomes. As a result, the individual is unable to perceive his/her motivation underlying the behaviour, making the actions meaningless and almost mechanical. The individual is therefore likely to give up on the behaviour eventually. This is the least self-determined type of behaviour.

Deci and Ryan (2000) further sub-divide the concept of extrinsic motivation into four types of behavioural regulation resulting from extrinsic motivation, dependent upon on the level of self-determination shown. This means, how close someone's motivation is to being inherently driven. From most to least self-determined, these categories are:

- **Integration**
  This is behavioural regulation that arises because the activity has become part of the person's self-concept (i.e. the person performs the behaviour not only because it is important to reach a goal, but also because it serves as an expression of the self and is coherent with other personal goals and values). For example, someone may already view themselves as "environmental" and therefore, is more likely to engage in tank maintenance to continue using rainwater because it fits with their identity as a water saver.

- **Identification**
  Refers to behavioural regulation that stems from the inherent value the person ascribes to the activity (i.e. the person identifies with the activity because it allows him/her to reach their goals). For example, an individual may see their rainwater tank as a valuable resource because they own a large water-intensive garden and a swimming pool and thus, value the additional water supply afforded with a tank to service their household requirements.

- **Introjection**
  This refers to behavioural regulation stemming from the internalisation of external pressure, which leads to feelings of obligation to engage in the behaviour. Feelings of guilt and shame result when a person fails to undertake the behaviour. For example, one may acknowledge that sustainable living is important, yet, the individual may own two large family cars and work in a carbon-intensive industry. The individual thus acknowledges that they have a large carbon footprint and try to compensate for this by using a rainwater tank at home to alleviate stress on the mains water grid, to "do their bit" for the environment.

- **External regulation**
  Activities performed as a result of external regulation refer to those performed because of perceived external pressure applied by the social context, such as when someone is offered an incentive (or disincentive), or feels his or her place within a social group is jeopardised. For example, if one buys a property in a new housing development that has "green" credentials, there is an expectation that homeowners within this lot will utilise and run their alternative water and energy sources. Consequently, someone may feel pressured to engage use and maintain their tank because of the high level of social comparison occurring within their small community (e.g. what are the neighbours doing?) thus, the individual is not performing the behaviour because s/he wants to, but rather to avoid being negatively judged.

These further classifications mean that an individual's level of self-determination in carrying out a behaviour, such as tank maintenance, will lie somewhere along a continuum (Figure 1).

Lowest		**Extrinsic Motivation**			**Highest**
Amotivation	External Regulation	Introjected Regulation	Identified Regulation	Integrated Regulation	Intrinsic Motivation

Figure 1: The self-determination continuum (Grolnick and Ryan, 1987).

Along this continuum, intrinsic motivation represents the highest level of self-determination because it underlies behaviour borne from pleasure and freedom, whereas amotivation represents the lowest level of self-determination since it is characterised by a loss of personal control. One's position on the continuum is represented by a self-determination index (see Section 3.4.1).

1.2. Self-Determination and Environmentalism

The application of self-determination theory in the environmental context has demonstrated the utility of the theory in explaining pro-environmental behavioural choices, as well as how different types of motivation can regulate behaviour (Ryan and Deci, 2000; Deci and Ryan, 2000).

Pelletier and colleagues (1998) argued that people's activation with respect to conservation behaviours is a concern for environmentalists. Their study looked at factors related to promoting environmentally responsible behaviours in the hopes of developing a scale to measure motivational constructs proposed by self-determination theory. Pelletier and colleagues (1998) developed a scale that measured the six self-determination points along the continuum. It was found that their measure of the self-determination variables (the "Motivation Toward the Environment" Scale, MTES) was a reliable and valid indicator of environmental behaviour. Pelletier and colleagues found that not only were people engaging in environmentally conscious behaviours for different reasons, but that these reasons were also related to various consequences. Respondents who scored high on self-determination reported that they were unhappy with the state of the environment, felt competent to do something about it and were therefore engaging in pro-environmental behaviours. Conversely, individuals on the other end of the continuum reported feeling satisfied with the environment, did not feel competent in engaging with the environment and were thus less likely to engage in environmental behaviours. Pelletier and colleagues concluded that within the environmental domain, the level of satisfaction is an antecedent of motivation.

Pelletier and colleagues (1999) then further explored reasons for individuals' lack of motivation (*amotivation*) towards environmental behaviours and developed a scale specifically measuring amotivation towards the environment. Deci and Ryan (1995) defined amotivation as a state in which individuals are not able to perceive the relationship between their behaviour and subsequent outcomes of that behaviour, thus they experience a lack of control. If they cannot develop motivation to engage in that behaviour, they are likely to give up on it eventually. This lack of control was described by Pelletier and colleagues (1999) as *global helplessness beliefs* and, in the environmental context, this can occur when an individual is daunted by the enormity and severity of an environmental situation (e.g. water shortage).

Pelletier and colleagues (1999) further proposed that individuals feel amotivated for specific reasons: (a) they do not believe that proposed strategies are effective in producing the desired outcome (e.g. rainwater tanks are ineffective in reducing mains water consumption); (b) they believe that they do not have the capacity to implement any strategies to influence the situation (e.g. don't have time to maintain my tank); and (c) although they may think the proposed strategies are effective and have the capacity to engage in desirable behaviours, they doubt their ability to maintain effort in carrying out these behaviours and/or integrating the behaviours into their lifestyles. Results from Pelletier and colleagues' analysis confirmed the four-belief structure of amotivation towards the environment. This finding and the resultant measurement scale (Amotivation Toward the Environment Scale, AMTES) is very useful for the present study; considering the sub-sample of mandated tank owners in our study may have experienced little control over the decision to install and use a rainwater tank on their property.

1.3. Objectives of the Present Study

Results highlighted within the social science literature have validated the use of self-determination theory in explaining pro-environmental behaviour and this research can be used to inform the present study. While many people consider living sustainably with their own water supply as a desirable way of life (e.g. Mankad, *et al*., 2010), engaging in everyday behaviours to achieve this end, such as cleaning and maintaining a rainwater tank, may not be interesting and enjoyable for all individuals (Pelletier, *et al*., 1998). This may be because motivations for installing rainwater tanks at the household level vary among SEQ residents, due to controllable and uncontrollable/external factors. Therefore, the key objective for this study is to understand the key motivational descriptors that vary

among residents who have voluntarily installed tanks on their property (i.e. *retrofitted*) and those who have installed a tank based on the Queensland Development Code MP4.2 (i.e. *mandated*).

It is hypothesised that higher perceptions of competence and autonomy will predict more frequent engagement in tank-related behaviours and that the level of self-determined motivation (i.e. intrinsic, extrinsic, amotivated) will also influence these behaviours. Specific hypotheses for each group of participants are outlined below:

H_1 - Retrofitters will report high intrinsic motivation, integrated regulation and identified regulation (i.e. have a high self-determination index).

H_2 - Mandated participants will report higher amotivation, external regulation and introjected regulation than retrofitters (i.e. have a lower self-determination index).

H_3 - Retrofitters will demonstrate a higher sense of tank ownership than mandated participants.

H_4 - Self-determination variables will predict engagement in tank maintenance, higher frequency of maintenance behaviours and adequate frequency of tank maintenance (i.e. along recommended guidelines).

H_5 - Amotivation variables will predict lack of motivation to engage in tank maintenance, higher frequency of maintenance behaviours or adequacy in the frequency of tank maintenance behaviour.

It is believed that results from this study will help researchers in understanding differences in tank maintenance and rainwater use behaviours among residents in SEQ with different reasons and motivations for installing rainwater tanks on their property. This information can inform policy and water researchers as to the facilitating and impeding variables that impact public engagement with rainwater tanks, as well as residents' willingness to look after their tanks, once installed.

2. METHOD

2.1. Participants

Participants were 1,984 SEQ residents who had a rainwater tank installed on their property. These participants were randomly selected from a database of households known to have rainwater tanks. For privacy reasons, the list contained only the addresses of households and no individual names were provided to researchers. The study was conducted in the first half of 2011.

As one of the aims of the study was to examine any significant differences between mandated and retrofitted tank owners, selection of participants was defined by two criteria:

(1) Households with *retrofitted* rainwater tanks - these households applied for government rebates to install rainwater tanks at home. They were not required by legislation to have rainwater tanks at home but chose to have them (in conjunction with government rebates).

(2) Households with *mandated* rainwater tanks - these households applied for new water accounts from 2007 and onwards. New legislation was introduced in 2007 mandating that all new residential homes require internally plumbed rainwater tanks. Therefore, any new water accounts opened from 2007 include the mandated rainwater tanks.

Any households who had been contacted to participate in an earlier rainwater study conducted by CSIRO were not approached for the present study. Units and apartment blocks were also not sampled, as householders residing in these complexes were unlikely to be responsible for maintaining their own rainwater tanks.

2.2. Study Area

While it was desirable to sample from as many SEQ local government areas as possible, not all areas were represented in the database, so areas sampled within the study were restricted to those that were present in both mandated and retrofitted lists supplied. In total, five local government areas were found in both lists. These included Gold Coast, Logan, Moreton Bay, Redland and Sunshine Coast.

The number of participants sampled within each local government area (LGA) was intended to be a relative representation of the population size in that area. The sample size for each LGA, therefore, was estimated from the proportion of residents living in that area. For example, Gold Coast participants were represented in greater numbers than Redland in the sample, as the Gold Coast has a larger population (see Table 1).

Table 1: Sample size values represented by SEQ local government areas.

Local Governmental Areas Available from QWC List	Estimated Resident Population in 2009	% of Sample	Sample size (n)
Gold Coast	515,157	32	1,580
Logan	277,568	17	855
Moreton Bay	371,162	23	1,140
Redland	140,691	9	430
Sunshine Coast	323,423	20	995
TOTAL	**1,628,001**	**100**	**5,000**

While all SEQ suburbs were eligible to participate in the study, conscious efforts were made to avoid suburbs that were affected by the severe flooding of January 2011. In particular, Brisbane City, Ipswich and Lockyer Valley local government areas were excluded from the study.

2.3. Participant Recruitment and Participation

A total of 10,000 households were approached to take part in the study, via a mail-out of the survey. This included 5,000 households considered to have retrofitted tanks, and 5,000 thought to have mandated tanks. A total of 570 mandated and 1,443 retrofitted households returned their surveys. This discrepancy in sample numbers between groups is likely due to the fact that many people who had applied for licenses to build homes since 2007 (i.e. those in the mandated group), had not yet finished building their homes, and so valid postal locations for these properties did not exist. Approximately 5% of the mandated database was deemed unreachable for this reason.

The low response rate observed among the mandated group could also be attributed to a potential lack of interest in rainwater tank related activities. Since these individuals were required by the building code regulations to install rainwater tanks on their properties, their motivation to own a tank could be lower than those from the retrofitted group who actively sought to install rainwater tanks. Thus, a response bias may be present in the study, causing an overestimation of the observed attitudes and behaviours towards tank maintenance in the mandated group. Therefore, it is important to make note of this when interpreting and contextualising results.

A three-staged mail-out strategy was employed in the present study. The first stage commenced in late March 2011 and involved mailing out an introductory postcard, to notify potential participants of the upcoming survey on rainwater tanks. One week later, potential participants were sent a questionnaire, along with a return paid envelope and an eco-friendly shopping bag with CSIRO logo, intended to serve as a minor incentive to encourage participants to complete their surveys (Dillman, 2007). Two weeks after mailing the survey, the final stage was implemented, comprising a reminder postcard sent to participants encouraging them to return their completed surveys. Participants were given approximately six weeks to return completed surveys.

2.4. Survey Design

The survey comprised a range of questions, designed to collect descriptive information about participants' rainwater tank set-up, as well as psycho-social questions (i.e. self-determination theory variables) to provide greater insight into attitudes and behaviours of rainwater tank owners. The full questionnaire is presented in the Appendix.

2.4.1. Demographic and Tank Configuration Questions

Participants were asked to provide descriptive information in order for researchers to gain an understanding of the types of people installing rainwater tanks in SEQ. Demographic questions comprised: age, gender, income, household composition, occupation, education and ethnicity. Participants also gave some indication of the configuration of their rainwater tanks. Information such as tank volume, plumbing connections, mains water top-up, water level indicator, and structural factors were collected to provide an overall picture of the tank systems currently in use.

2.4.2. Motivation Toward the Environment Scale (MTES)

A total of 23 statements were adapted from Pelletier and colleagues' (1998) Motivation Toward the Environment Scale (MTES), to measure respondents' self-determination scores in maintaining rainwater tanks. For each participant, self-determination scores were obtained for the following six subscales:

- Amotivation
- External regulation
- Introjected regulation
- Identified regulation
- Integrated regulation
- Intrinsic motivation

Four statements were adapted for each sub-scale using the original statement structure, with the exception of the introjected regulation subscale. Only three of the original four introjected statements were deemed appropriate for the subject of our research. All statements were preceded by the stem: "I maintain my rainwater tank(s) because…"

For all 23 self-determination items, respondents were asked to rate each statement on a 7-point Likert scale, with 1 indicating "strongly disagree", 4 indicating "neither agree nor disagree", and 7 indicating "strongly agree". Table 2 gives examples of statements from each subscale.

Table 2: Examples of Motivation Toward the Environment Scale (MTES) statements.

MTES Subscales	**"I maintain my rainwater tank(s) because…**
External regulation	Other people would notice if I didn't maintain my rainwater tank
Introjected regulation	I would regret not looking after my rainwater tank properly
Identified regulation	It is part of the way I have chosen to live my life
Integrated regulation	I take pleasure in improving the quality of my rainwater
Intrinsic motivation	I enjoy keeping my rainwater tank maintenance up to date
MTES Subscale	**"I do not maintain my rainwater tank(s) because…**
Amotivation	It is a waste of my time

A final self-determination index (SDI) score was calculated for the sub-scales within the MTES. The SDI was used to integrate scores from each of the six sub-scales under one score and thus facilitate interpretation of the MTES findings. Weights were assigned to each motivational sub-scale's total, according to its relative placement on the self-determination continuum (see Figure 1, Blais, *et al*., 1990; Grolnick and Ryan, 1987; 1989). Intrinsic motivation, integrated regulation and identified regulation were assigned the weights of +3, +2 and +1, respectively, because they are considered more self-determined forms of motivation. In contrast, amotivation, external regulation and introjected regulation were assigned weights of -3, -2 and -1, respectively, because they were conceptualised as less self-determined forms of motivation.

2.4.3. Amotivation Toward the Environment Scale (AMTES)

Pelletier and colleagues' (1999) study on amotivation and the environment was also adapted in the current study to examine the reasons why some participants' may lack motivation towards maintaining their rainwater tanks. The four sub-scales in AMTES were: capacity, strategy, effort and helplessness. Again, four statements were adapted from the Pelletier study for each sub-scale. Participants were required to rate all 16 AMTES statements on 7-point scale Likert scale (1 = strongly disagree to 7 = strongly agree). Table 3 provides examples of AMTES statements.

Table 3: Examples of Amotivation Toward the Environment Scale (AMTES) statements.

AMTES Subscales	**Statements in response to "I don't always maintain my rainwater tanks because…"**
Capacity	I don't understand how to maintain my rainwater tank
Strategy	I don't believe the use of rainwater tanks will be successful in improving sustainable water use
Effort	I can't seem to get motivated enough to maintain my rainwater tank
Helplessness	I feel overwhelmed by the seriousness of water sustainability and I feel there is nothing I can do

2.4.4. Tank Ownership and Perceived Water Rights

A total of 13 statements were developed by the authors to examine participants' attitudes towards their tank water and their use of rainwater domestically. The constructs developed included: private ownership of rainwater (e.g. "tank water is my own private resource"); tank water regulation (e.g. "the Government have a right to restrict how I use rainwater"); and uses of rainwater (e.g. "I need my rainwater so that I can water my garden and lawn"). Participants once again responded to the items using a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree).

2.5. Dependent Variables (DVs): Tank Maintenance

Three dependent variables were examined in the analysis of this data (Table 4). The first examined *engagement in tank maintenance behaviours*. Participants were asked to report on 11 maintenance behaviours, indicating whether they had already undertaken the behaviour, planned on undertaking the behaviour in the future, or had not undertaken the behaviour at all. Maintenance behaviour scores were created for each participant by first recoding these responses into categorical data, with a response of: *yes* (3 points), *not yet* (2 points), and *no* (1 point). Scores were then summed so that each participant received a score out of 33 for maintenance behaviours, with higher scores representing more engagement in maintenance behaviours.

The second dependent variable identified the *frequency* in which maintenance behaviours were undertaken (Table 4). For each of the 11 maintenance behaviours identified, participants were asked how often they undertook the behaviour. Reponses were based on a time-sensitive 5-point scale, ranging from *after it rains* (most frequent) through to *every 2 to 3 years* (least frequent). In order to examine simple frequency of maintenance behaviour, responses to these 11 items were re-coded, such that participants were given a score of 5 points for the most frequent behaviours, through to 1 point for the least frequent, and 0 points if the participant did not engage in that particular behaviour at all. These scores were then averaged to give a final score out of a possible 5 points.

Table 4: Summary of dependent variables.

Dependent Variable (DV)	Possible Score Range	Description
DV1 – Engagement in tank maintenance	11 through 33	Describes engagement in 11 possible tank maintenance behaviours, with higher scores representing greater engagement
DV2 – Frequency of tank maintenance behaviours	0 through 5	Average frequency in which each of the 11 tank maintenance behaviours is undertaken.
DV3 – Correct frequency of behaviours	0 through 11	Score which indicates how often people maintained their tank in line with recommended time frames

A third dependent variable was computed, aiming to assess the *adequacy* of maintenance frequencies (Table 4). For each of the 11 maintenance behaviours, frequency recommendations were established through Australian Government guidelines (DHA, 2004; Queensland Health, 2007). Participants' responses to the frequency of behaviours were re-coded so that answers matching recommended frequencies were scored 2, and those not congruent were scored 1. Responses to each of the 11 items were summed to create a score ranging from zero to a possible 11, for each participant.

3. RESULTS

3.1. Demographic Statistics

The study sample consisted of 1,988 participants, each of whom had a rainwater tank installed on their property. Of these, 563 participants had *mandated* tanks installed in compliance with QDC 4.2, whereas 1,425 had voluntarily *retrofitted* rainwater tanks.

3.1.1. Age and Gender

Participants were asked to nominate a category in which their current age fell. More than half of the sample were over the age of 56 (56.2%), with participants under the age of 25 forming the smallest group (1.2%). Nearly two thirds of all participants were male (64.6%).

3.1.2. Household Composition and Time in Residence

In terms of the sample, as a whole, the majority of participants resided in 2-adult homes (72%) with no children (70%). In comparing household composition between the mandated and retrofitted groups, there were some slight differences. While the number of 2-adult households was relatively stable across the two groups, 75% of retrofitted participants reported having no children under the age of 18 living with them, whereas only 60% of the mandated group reported this. Thirty three percent of the mandated group reported having up to two children living with them, compared to 20% of the retrofitted group.

Participants were also asked to specify if they rented or owned their home and how long they had been residing at their present address. Participants' length of residence ranged from one month up to 60 years. The average length of time spent in the current home was just over 10 months. Almost all participants owned their home or were in the process of paying off their home (93.3%), with only 6.3% of participants currently renting.

3.1.3. Income and Education

Income groupings were more normally distributed among participants, with the majority (60%) of participant households earning less than $90,000 per year. The distribution of income categories did not seem to vary between the groups. In terms of education, most people in the sample reported having high school (29%) or trade/TAFE (32%) qualifications. These findings did not significantly vary between the groups, although the mandated group did also have a high proportion of respondents with only a primary school education (21%).

3.1.4. Ethnicity

Participants in this study overwhelmingly identified themselves as Anglo-European (94%), with people of Asian/Sub-continental ethnicity as the second-most common group, comprising 3% of the total sample.

3.2. Dealing with Missing Data

As is common with self-report questionnaires, there was a proportion of missing data across the set. In most cases this, missing data is acceptable, particularly for simple descriptive and comparative statistics, where the missing cases can be precluded from analysis and the smaller sample size reported on. However, for the further analyses (e.g. multiple regression), missing data becomes problematic. Therefore, a missing data replacement technique was used to replace missing data within the MTES and AMTES and Tank Ownership items. In all cases, the proportion of missing data in these items was less than 5%, making the use of data replacement acceptable. The missing data replacement technique employed was Expectation Maximisation (EM), a form of Maximum Likelihood estimation, and was undertaken in SPSS v19 (see Carter 2006 for a review on methods for dealing with missing data).

3.3. Rainwater Tank Configurations

While all participants sampled had a rainwater tank on their property, nearly a quarter (24.1%) of these participants installed the tank due to government building regulations. Participants were asked to give information about the rainwater tanks they had on their properties. Over three quarters of participants (78.4%) stated that they received most of their water from mains supplies. However, a small proportion of the sample (7.3%) was not connected to mains supplies at all. Sizes of tanks on properties varied, ranging up to 200,000 litres (L) in volume, though it is likely that this case was on a rural property. The average tank volume among all participants was 8,527 L.

Of all the participants, only 39.8% had their tank plumbed into indoor fixtures. The difference between mandated and retrofitted participants, however, is considerable. A total of 87.6% of mandated tanks were plumbed indoors[1], compared with only 20.9% of retrofitted tanks. Table 5 shows the facilities to which the rainwater tanks had been plumbed and the differences between mandated and retrofitted connections.

Table 5: Plumbing connected to rainwater tanks.

Rainwater plumbed in to:	Mandated Participants (%)	Retrofitted Participants (%)	All participants (%)
Toilet	79.2	14.4	32.8
Laundry	80.8	16.2	34.6
Outside taps	84.2	28.6	44.3

Participants were also asked if they knew how to check whether their tanks were being topped up by mains water. Many participants were unsure (10.9%), however, some participants reported manually checking the levels in their tanks (11.9%) and others read from a tank gauge (2.3%) or had a sensor on the tank (4.4%).

Almost all participants stated that they had never had their rainwater tank professionally cleaned (94.8%). Participants were also asked if they had ever painted the pipes connected to their rainwater tank to prevent entry of light. Only 8.7% of participants had done so.

3.4. Tank Ownership and Perceived Rights of Water Use

Thirteen items were included in the survey to identify attitudes towards rainwater and perceived rights over the water, in relation to use, metering and possible government charges. As these items had not been used previously, a confirmatory factor analysis was conducted to identify patterns of responses. While the factor analysis suggested four sub-scales across the 13 items, examination of these sub-scales did not highlight any meaningful groupings. Independent sample *t*-tests were run to identify differences between mandated and retrofitted groups and descriptive analyses were run to understand how participants felt about rainwater and their rights to use this water. A number of statistically significant differences were found between the mandated and retrofitted groups (Table 6).

Generally, *retrofitted* participants were more likely to:

- see tank water as their own private resource;
- feel that they could use more water than if they didn't have a tank;
- feel that rainwater should not be connected inside of the house;
- believe that governments introduced tanks in response to water shortages;
- feel that rainwater was needed for their gardens and lawns;
- feel most others with tanks used the water for gardens and lawns;
- see rainwater as their own to do with as they see fit, and;
- see their tanks as a source of independence to use as much rainwater as they liked.

[1] Since by regulation, all mandated tanks should be plumbed indoors, the figure of 87.6% reported by respondents suggests a degree of inaccuracy – either some people do not know that their tanks are plumbed internally, or they have reported their retrofitted tank as a mandated tank.

Mandated users were more likely to:

- be happy to have tank water regulated, and;
- see the government as having the right to restrict the use of rainwater.

Table 6: Tank ownership and rights statements – mean scores across mandated and retrofitted groups.

Item	Type	Mean	SD	t	df	Sig. (*p*)
Tank water is my own private resource	Mandated	5.99	1.40	-6.87	1986	<.001
	Retrofitted	6.41	1.16			
I would be happy to have my tank water regulated	Mandated	1.70	1.49	4.54	1986	<.001
	Retrofitted	1.41	1.18			
My tank lets me use more water than if I didn't have it	Mandated	4.78	1.98	-4.32	1986	<.001
	Retrofitted	5.20	1.94			
I don't think rainwater should be connected to plumbing inside the house (e.g. toilet flush, laundry)	Mandated	2.09	1.68	-14.75	1986	<.001
	Retrofitted	3.55	2.10			
Governments introduced tanks in response to the drought and water shortage	Mandated	5.70	1.49	-4.03	1986	<.001
	Retrofitted	5.99	1.39			
I need my rainwater so that I can water my garden and lawn	Mandated	5.24	1.73	-4.89	1986	<.001
	Retrofitted	5.67	1.76			
I think that most people who own tanks use the water for their gardens and lawns	Mandated	4.92	1.51	-6.05	1986	<.001
	Retrofitted	5.37	1.49			
The government have a right to restrict how I use rainwater	Mandated	1.49	1.14	2.68	1986	<.001
	Retrofitted	1.35	1.07			
Rainwater that I collect is mine to use as I see fit	Mandated	6.16	1.31	-7.96	1986	<.001
	Retrofitted	6.59	0.98			
My tank gives me the independence to use as much rainwater as I like	Mandated	5.44	1.78	-5.19	1986	<.001
	Retrofitted	5.88	1.68			

Note: effect sizes ranged from .01 to .1, indicating small effects.

3.5. Motivation Toward the Environment Scale (MTES)

The MTES (Pelletier *et al*., 1998) measured six sub-scales believed to contribute to self-determination: amotivation, external regulation, introjected regulation, identified regulation, integrated regulation and intrinsic motivation. In line with previous research using the MTES to measure self-determination, a self-determination index (SDI) was calculated for each individual.

3.5.1. Mandated versus Retrofitted Groups: *t*-tests

Independent samples *t*-tests were used to compare the average scores between mandated and retrofitted groups on each of the MTES subscales, as well as the total weighted SDI score for individuals in each group. The *t*-tests comparing means for each subscale are presented in Table 7. It can be seen that all of the self-determination subscales were significantly different between mandated and retrofitted groups, except for external regulation. However, from visual inspection of the means and calculation of effect sizes (η^2), the magnitude of differences between the groups was small, as all effect sizes were around the .01 value. According to interpretation guidelines proposed by Cohen (1992), .01 is considered a small effect.

Table 7: *t*-test results comparing mandated and retrofitted groups on the six MTES subscales.

Subscales	Type	Mean	SD	*t*	df	Sig. (*p*)
Amotivation	Mandated	10.66	5.71	3.78	1986	<.001
	Retrofitted	9.57	5.83			
External regulation	Mandated	14.54	5.39	-.74	1986	.462
	Retrofitted	14.74	5.42			
Introjected regulation	Mandated	14.34	4.13	-2.55	1067.65	.011
	Retrofitted	14.87	4.29			
Identified regulation	Mandated	21.80	4.69	-6.72	943.42	<.001
	Retrofitted	23.33	4.24			
Integrated regulation	Mandated	17.02	5.83	-5.01	1074.78	<.001
	Retrofitted	18.52	6.12			
Intrinsic motivation	Mandated	18.20	5.10	-3.60	1071.34	<.001
	Retrofitted	19.12	5.32			

The summary of *t*-tests in Table 7 indicates that:

- Mandated participants reported experiencing greater amotivation than those in the retrofitted group;
- Participants with retrofitted rainwater tanks reported significantly greater introjected regulation, identified regulation, integrated regulation and intrinsic motivation than mandated participants; and
- Overall, individuals within the retrofitted group were more motivated to engage in tank maintenance behaviours than those in the mandated group.

Another independent samples *t*-test was also conducted to compare the SDI between mandated and retrofitted groups. Results showed that there was a significant difference between SDI scores for mandated ($M = 35.04$, $SD = 34.38$) and retrofitted ($M = 44.68$, $SD = 34.79$) groups, $t(1986) = -5.58$, $p = .000$. The magnitude of the differences in means was relatively small ($\eta^2 = .02$). These results demonstrated that participants who had retrofitted their domestic rainwater tanks recorded significantly higher self-determined motivation than those with mandated rainwater tanks.

3.5.2. Engagement in Maintenance Behaviours

A hierarchical multiple regression (HMR) was used to assess the ability of the six MTES subscales to predict engagement in rainwater tank maintenance behaviours (Dependent Variable 1 (DV1) from Table 4), after controlling for the influence of tank installation type (i.e. mandated vs. retrofitted). Preliminary analyses were carried out to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity.

The type of tank installation (mandated/retrofitted) was entered at Step 1, explaining 5% of the variance in maintenance behaviours. After entry of the six MTES sub-scales at Step 2, the total variance explained by the model as a whole was 27%, $F(7, 1980) = 102.43$, $p < .001$. The MTES sub-scales explained an additional 21% of the variance in maintenance behaviours, after controlling for the type of installation, $R^2_{change} = .21$, $F_{change}(6, 1980) = 95.29$, $p < .001$. In the final model, installation type and two of the MTES subscales were statistically significant contributors, with the amotivation sub-scale recording the highest beta value ($\beta = .26$, $p < .001$), indicating that amotivation was the most important predictor of maintenance behaviours within the model. Integrated regulation was a stronger predictor of tank maintenance behaviour ($\beta = .23$, $p < .001$) than installation type ($\beta = .18$, $p < .001$).

The results of the HMR indicate that while the type of tank installation is important in predicting tank maintenance, motivational factors – in particular, amotivation and integrated regulation – play a significant role in maintenance behaviours above and beyond that explained by the circumstances under which one has installed a tank.

3.5.3. Frequency of Maintenance Behaviours

A HMR was used to assess the ability of the six MTES subscales in predicting frequency of maintenance behaviours (Dependant Variable 2 (DV2) from Table 4) among those who reported maintaining their tank. As with the previous HMR for DV1, the type of tank installation (mandated/retrofitted) was entered into the HMR equation at Step 1. In this instance, tank type explained 7% of the variance in frequency of maintenance behaviours. After entry of the six MTES subscales (Step 2), the total variance explained by the complete model was 37%, F (7, 1980) = 166.95, $p < .001$. The MTES subscales explained an additional 30% of the variance in the frequency of tank maintenance behaviours, after controlling for the type of installation, $R^2_{change} = .30$, F_{change} (6, 1980) = 158.96, $p < .001$. Overall, the stronger predictor of frequency of maintenance within the model was integrated regulation ($\beta = .32$, $p < .001$), followed by amotivation ($\beta = .25$, $p < .001$), type of tank ($\beta = .20$, $p < .001$) and intrinsic motivation ($\beta = .14$, $p < .001$).

These results provide evidence that integrated regulation (i.e. a more self-determined form of motivation that arises because the activity has become part of a person's identity, such as "I am an environmentally friendly person") is a key predictor of the frequency with which individuals maintain their rainwater tanks. As with the HMR for maintenance behaviour, amotivation (i.e. a sense of apathy and lack of interest or motivation) is also an important predictor of maintenance frequency. These motivational concepts influence DV2 even when the type of tank installation is controlled for in the model.

3.5.4. Maintenance Behaviours: Frequency Recommendations

A final HMR was conducted to assess whether the six MTES subscales could predict the adequacy of the frequency in participants' tank maintenance behaviours (Dependant Variable 3 (DV3) from Table 4) among those who reported engaging in tank maintenance. When the type of tank installation (mandated/retrofitted) was entered into the hierarchical MR at Step 1, it accounted for 4% of the variance in maintenance frequency aligned with maintenance recommendations. When the six MTES subscales were entered into the model at Step 2, the total variance explained by the final model was 19%, F (7, 1980) = 67.48, $p < .001$, with the MTES subscales explaining an additional 15% of the variance in maintenance frequency as per recommendations, $R^2_{change} = .15$, F_{change} (6, 1980) = 61.05, $p < .001$. In the final model, the most important predictor of behaviour was again integrated regulation ($\beta = .28$, $p < .001$), closely followed by amotivation ($\beta = .25$, $p < .001$). Other significant predictors of maintenance frequency adequacy were type of tank installation ($\beta = .17$, $p < .001$) and identification ($\beta = -.06$, $p = .05$).

Similar to the HMR findings for maintenance behaviour and frequency, these results show that motivational variables significantly explain tank maintenance behaviour, in this case, the adequacy of the frequency in participants' tank maintenance, above and beyond that explained by the type of tank people install (i.e. mandated or retrofitted).

3.6. Amotivation Toward the Environment Scale (AMTES)

The AMTES (Pelletier *et al*., 1999) consisted of 16 items measuring four sub-scales believed to determine amotivation. These sub-scales measured the concepts of helplessness, effort, strategies and capacity.

3.6.1. Assessment of the AMTES Subscales

A confirmatory factor analysis was run using SPSS v19, assessing the validity of the four sub-scales in the AMTES. Confirmatory analysis failed to confirm a four-factor solution, instead suggesting that the 16 items were measuring only two sub-scales. Further exploratory factor analysis confirmed a two-factor solution, with items relating to capacity and effort grouping together, and helplessness and strategy similarly grouping together (one helplessness scale did not load on either factor substantially and was removed from subsequent analysis). Reliability analysis was run on the two emerging combined factors. Both the effort/capacity and the helplessness/strategy scale combinations showed excellent scale reliability ($\alpha = 0.92$ for both scales). Given the similarity of constructs being measured

by effort and capacity, as well as by the helplessness and strategy scales, the constructs were combined for subsequent analysis.

3.6.2. Creating Composite Scores for Participants

Given the extremely high scale reliabilities for the effort/capacity and helplessness/strategy scales, it was decided to create composite scores for all participants for these two latent variables. Participants' scores on all effort and capacity items were added to create an effort/capacity score. Similarly, participants' scores on all helplessness and strategy items were added to create a help/strategy score. Scores were averaged so as to remain on a scale from 1 through 7, with higher scores representing increased motivation and capacity to maintain rainwater tanks on the first scale and higher scores representing higher self-belief and more strategies to maintain rainwater tanks on the second scale.

3.6.3. Mandated versus Retrofitted Groups: *t*-tests

Independent samples *t*-tests were used to compare the average scores between mandated and retrofitted groups on each of the two AMTES subscale composites. These *t*-tests indicated that mandated participants scored significantly higher on the effort/capacity scale (see Table 8), indicating a greater level of amotivation within these subscales. However, no significant differences were identified between mandated and retrofitted groups on the help/strategy scores. Analysis of eta squared values was undertaken to assess the magnitude of the differences in the effort/capacity scores, which showed the effect to be small ($\eta^2 = 0.02$).

Table 8: Comparison of mandated and retrofitted scores on AMTES composite scales: effort/capacity and helplessness/strategy.

	Type	Mean	SD	t	df	Sig.
Effort/Capacity	Mandated	2.80	1.25	5.75	1986	<.001
	Retrofitted	2.43	1.31			
Help/Strategy	Mandated	2.21	1.25	-1.17	1986	.240
	Retrofitted	2.28	1.33			

3.6.4. Engagement in Maintenance Behaviours

A HMR was used to assess the ability of the two AMTES subscales in predicting engagement in rainwater tank maintenance behaviours (DV1), after controlling for the influence of tank installation type (i.e. mandated vs. retrofitted). Preliminary analyses were carried out to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity.

The type of tank installation (mandated/retrofitted) was entered at Step 1, explaining approximately 5% of the variance in maintenance behaviours. After entry of the two composite AMTES variables at Step 2, the total variance explained by the model as a whole was 21.4%, F (3, 1984) = 113.05, $p <$ .001. The AMTES sub-scales explained an additional 16% of the variance in maintenance behaviours, after controlling for the type of installation, $R^2_{change} = .16$, F_{change} (2, 1984) = 202.36, $p < .001$. In the final model, installation type and the two adjusted AMTES subscales were statistically significant contributors, with the effort/capacity scale recording the highest beta value ($\beta = -0.43$, $p < .001$), indicating that effort/capacity was the most important predictor of maintenance behaviours within the model.

The results indicate that people who felt they did not have the capacity to understand or know how to maintain their tanks, and those who mentally felt they couldn't make the effort to maintain their tanks, were less likely to engage in tank maintenance due to a lack of directed, or apathetic, motivation.

3.6.5. Frequency of Maintenance Behaviours

A HMR was used to assess the ability of the two AMTES subscales in predicting frequency of maintenance behaviours (DV2) among those who reported maintaining their tank. As with the previous HMR for DV1, the type of tank installation (mandated/retrofitted) was entered into the equation at Step 1. In this instance, tank type explained 6.8% of the variance in frequency of maintenance behaviours. After entry of the two AMTES subscales (Step 2), the total variance explained by the complete model was 30.5%, $F(3, 1984) = 287.58, p < .001$. The AMTES sub-scales explained an additional 23.6% of the variance in the frequency of tank maintenance behaviours, after controlling for the type of installation, $R^2_{change} = .236$, $F_{change}(2, 1984) = 337.18, p < .001$. Overall, the stronger predictor of frequency of maintenance within the model was effort/capacity ($\beta = -.515$, $p < .001$), followed by type of tank ($\beta = .194$, $p < .001$). Help/strategy was not a significant predictor of frequency of maintenance ($p > .01$).

Once again, an individual's perception of capacity (e.g., knowledge) and ability to produce effortful behaviour is influential in whether one maintains their tank frequently or not. In this analysis, it was found that participants with greater amotivation (relating to effort and capacity) were less likely to maintain their tanks as frequently than those with less amotivation.

3.6.6. Maintenance Behaviours: Frequency Recommendations

A final HMR was conducted to assess whether the two revised AMTES subscales could predict the adequacy of the frequency in participants' tank maintenance behaviours (DV3) among those who reported engaging in tank maintenance. At Step 1 of the regression, type of installation accounted for 4.3% of the variance in maintenance frequency aligned with maintenance recommendations. In the second step of the regression, the addition of the AMTES revised sub-scales increased the explained variance to 15.2%. In the final model, the most significant predictor of behaviour was effort/capacity ($\beta = -.33$, $p < .001$), followed by installation type ($\beta = .16$, $p < .001$). As with the previous models, help/strategy failed to significantly contribute to the variance in frequency recommendations ($\beta = .01$, $p > .001$).

As with the other dependent variable models (DV1 and DV2), the DV3 model shows that a lack of motivation, driven by poor perceptions of effort and capacity, can account for a significant proportion of variance in maintenance frequencies, even when accounting for frequency recommendations.

4. DISCUSSION

Self-determination theory was utilised in the present study to understand tank maintenance behaviours among users of decentralised systems technology, specifically, those who had mandated and retrofitted rainwater tanks on their properties. It was hypothesised that motivation towards rainwater tank maintenance, perceptions of autonomy from regulating authorities, and perceptions of individual choice would influence engagement in tank-related maintenance behaviour.

Results relating to the first two hypotheses (H_1 and H_2) showed that, despite small effect sizes, retrofitters reported more self-motivated behaviour towards rainwater tank maintenance. In contrast, participants with mandated rainwater tanks were found to have higher levels of amotivation than retrofitters, suggesting that individuals with mandated rainwater tanks may experience a lack of control and independence when relating to their rainwater tank and, subsequently, their drive to engage in maintenance behaviour may lack self-directed motivation. As a result, relating to one's tank could be meaningless and perhaps mechanical, leading to a reduction or cessation in the behaviour (i.e. tank engagement). This indicates potentially poor maintenance outcomes among the mandated sample, suggesting that motivation driven by perceptions of choice and autonomy are important in consistent tank maintenance behaviours.

Hypothesis 3 (H_3) predicted that retrofitters would demonstrate a higher sense of tank ownership when compared to mandated participants. Results showed that this was indeed the case, with retrofitters reporting a greater sense of ownership specific to their decentralised system installation. This result was anticipated because, among those within the retrofitted sample, individuals actively chose to install a decentralised system on their property and, presumably, did the associated research and fact-finding prior to installing the tank. This active engagement in the process of acquiring a tank has important implications for individuals' sense of autonomy and control with respect to having a rainwater tank. Thus, the filter-down effect of having this initial choice engagement is important when considering subsequent engagement in tank-related maintenance behaviours. Those with mandated tanks may feel less connected to the process of actively acquiring the tank and thus, feel less ownership of it because it may be perceived as a mandatory government installation.

Finally, the last two hypotheses (H_4 and H_5) made predictions relative to the effect of self-determined motivation on the three aspects of tank maintenance behaviour that were tested, namely: 1. engagement in tank maintenance; 2. frequency of tank maintenance; and 3. adequacy of the frequency in tank maintenance behaviour. Results showed that, while not all self-determination subscales were significantly influential in predicting the three variations in tank maintenance, overall the MTES and AMTES explained a high amount of variance in the behaviours. This indicates that self-determined motivation is significantly important in predicting engagement in tank maintenance, the frequency of maintenance behaviours, and also learning/knowing the appropriate time-frame for correctly engaging in tank maintenance.

Integrated regulation, amotivation, and *effort/capacity* were consistently highlighted as important predictors of whether someone will carry out maintenance on their tank and how often, regardless of the type of tank installation (i.e. retrofitted or mandated). *Integrated regulation* was found to be high among retrofitters and this indicates that, although retrofitters are not engaging in tank maintenance for purely intrinsic reasons, they are engaging in maintenance because it helps them to achieve a goal (e.g. supplementary water) while also serving as an expression of their personal values (e.g. sustainability). Therefore, individuals with high integrated regulation motivation have the drive to look after their tank and learn more about tank maintenance so as to ensure the longevity of their tank.

Conversely, *amotivation* can lead to least self-determined types of behaviour and amotivation was found to be significantly higher among the mandated sample. As an influential predictor of tank maintenance, the results highlighted that having a sense of apathy with respect to owning a rainwater tank can negatively impact future engagement in tank maintenance. Individuals high in amotivation also have little drive to learn more about their tank or to use the rainwater collected for appropriate applications. Relatedly, the amotivational subscale composite *effort/capacity* was also found to be an important negative predictor of maintenance, with individuals in the mandated group once again reporting higher scores on this factor.

The message from this finding is that, among the mandated sample, people felt as though they did not know enough about rainwater tank maintenance and they were not willing to put in the effort to find out more or to engage in many of the maintenance behaviours required. This suggests that greater education is needed among those who install rainwater tanks or other decentralised systems on their property as part of a government mandate rather than as an individual choice to do so. The subject of "choice" seems an important one when dealing with psychological motivation that will ultimately drive householders' behaviour.

Finally it is important to note that the study had a substantially lower response rate for mandated than retrofitted samples. This response rate does not adversely affect the outcomes of the study. However, it can potentially underestimate any differences in the attitudes and behaviours observed between mandated tank participants and those who retrofitted their tank. Participants in the mandated group may have felt disengaged with any tank related activities, as they were mandated to install tanks on their properties and thus, may not have actively been involved in the tank installation decision or process. This disengagement may have contributed to a lack of interest in completing a survey about tanks and maintenance. Future studies will need to take this discrepancy into consideration to account for this potential response bias.

In addition, mandated tanks include a pump system, which adds to the complexity of maintenance. This specific issue was not addressed, in order to retain comparability in the questions for mandated and retrofitted tank owners. However, given that the number of mandated tanks will presumably grow at a much faster rate than retrofitted tanks, issues of pump maintenance are an important consideration for future research.

4.1. Summary of Research Implications

Overall, this research demonstrates that the use of self-determination theory in understanding and explaining rainwater tank maintenance behaviour is appropriate and effective. Findings from this research have highlighted that engaging in maintenance behaviour is most likely if people are self-directed in their adoption of decentralised technology, rather than if they feel a lack of motivation towards the process. That is, allowing individuals to make their own informed choice with respect to owning and using a rainwater tank is likely to predict more frequent and correct engagement in tank maintenance. This will also promote a greater sense of tank ownership among householders, which is further likely to predict increased maintenance behaviours, as demonstrated by this research.

This psychologically-driven explanation for tank maintenance among urban communities has important implications for community encouragement and incentives for future water initiatives. Not only does this research explain the motivational differences that may exist between participants with different reasons for installing their rainwater tank, but it also highlights potential factors that prevent some people from engaging in tank maintenance frequently and correctly, which is equally as important as engaging in the behaviour at all. The research findings can be used to develop targeted education campaigns among those with mandated rainwater tanks, in particular, and emphasise perceptions of autonomy, self-determination and ownership so as to enhance engagement behaviour specific to tank maintenance. This suggestion is particularly relevant among those who may feel as though they were forced into owning a rainwater tank and experience apathy with respect to using rainwater and maintaining their tank installation.

It is important to note that, while there are statistically significant observable differences between retrofitted and mandated groups across a number of variables, these differences are actually quite small. Measures of effect size (eta squared) show that the magnitude of the differences in most cases to be what would be considered very small. Therefore, it is possible that these differences are more an effect of the large sample size, than any real differences between the groups. Therefore, recommendations should consider that, while there are indeed differences in behaviour dependent on the reasons for installation, targeting these differences might not achieve the magnitude of results/changes desired.

In conclusion, there is some indication that there are important difference in the tank maintenance behaviours of those with retrofitted tanks and those with mandated tanks. It is recommended that future research further examine this discrepancy in tank maintenance behaviours between the two tank ownership groups and trial potential educational interventions to determine the effect of hands-on tank maintenance knowledge. This type of strategy is likely to positively impact perceptions of competency, autonomy and relatedness, which is likely to lead to greater self-determined behaviour with respect to engagement in tank maintenance. If maintenance issues are not addressed at the psycho-social level, there is a real danger that in as little as 10 years, SEQ may be dealing with significantly greater tank maintenance issues, such as disrepair and abandonment. Encouraging frequent and correct maintenance among all types of decentralised system users at this early adoption stage will help to minimise problems in the future.

APPENDIX: COPY OF SURVEY QUESTIONNAIRE

SEQ Rainwater Tank Survey

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

CSIRO Ecosystem Sciences
Level G Block C
SEQ Water Survey
Reply Paid 84366
Brisbane QLD 4001

CONSENT FORM

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

***PLEASE NOTE:* If you would like to take part in this survey, it is important that you read and sign this form, so that we can use your survey information.**

Your involvement in this survey 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 voluntarily agree to participate in the research project and I am over the age of 18.
- 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.
- 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 CSIRO. 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 at CSIRO not involved in the study, by contacting CSIRO Ethics Officer Cathy Pitkin on (07) 3833 5693.
- I have been provided with the contact details of the investigating officers (see Information sheet).
- Questions regarding my participation have been answered to my satisfaction.
- I can withdraw from this study at any time without penalty and without giving an explanation for my withdrawal.
- I may ask 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 further research.
- This consent form will be removed from the completed questionnaire by researchers and stored separately from the survey.
- By signing below, I confirm that I have read and understood the information sheet and note that my involvement in this research will include completion of the attached survey.

Thank you for your participation

Name		If you would you like to be informed of the results, please tick the information that you would prefer: ☐ Summary of findings ☐ Copy of final publications
Signature		

Residential Address:

_____

_____

Phone Number: _____

Email: _____

RAINWATER TANK QUESTIONS

Please tick ☑ appropriate boxes that correspond to your answer.

1. How long have you lived at your current address? (Tick ☑ *one* option)

☐ less than 1 year ☐ between 1 and 4 years ☐ between 5 and 10 years ☐ more than 10 years

2. Do you own or rent this property? (Tick ☑ *one* option)

☐ Own (including paying mortgage) ☐ Public/private rental

3. Do you have a working rainwater tank at home? (Tick ☑ *one* option)

☐ YES
☞ **Continue to questions below**

☐ NO
☞ **Please go to Question 19**

SATISFACTION WITH RAINWATER TANKS

4. How happy are you to have a rainwater tank(s) on your property?

Not at all happy						*Very happy*
1	2	3	4	5	6	7

---

5. How happy are you with the quality of your rainwater?

Not at all happy						*Very happy*
1	2	3	4	5	6	7

While you may have more than one rainwater tank on your property, all questions in this survey refer to the tank that you use most often. This is referred as your '<u>primary rainwater tank</u>'.

6. Is your <u>primary rainwater tank</u> plumbed into your house? (Please tick ☑ *one* option)

☐ YES
Continue questions below

☐ NO
Please go to Question 9

7. What is the tank connected to? *(You may tick ☑ multiple options)*

☐ toilet ☐ laundry ☐ outside taps ☐ other: (please specify)

_____

8. How do you know when the mains water top-up is activated in your tank? *(You may tick ☑ multiple options)*

☐ by manually checking the tank level ☐ reading a tank gauge ☐ a sensor on the tank or indicator light ☐ other: (please specify) _____ ☐ I don't know how to check

***9.* Was there a building regulation requiring you to install your rainwater tank at home?** *(Please tick ☑ one option)*

☐ Yes (e.g. homes built in 2007 or later) ☐ Not sure ☐ No

10. How big is your primary rainwater tank, in litres?_____ Litres

NOTE: If you have two primary tanks that are connected together, please put the total volume of the tanks.

11. Where does the majority of your household water come from? ***(Tick ☑ one option)***

☐ Mains water ☐ Rainwater

12. Why did you install your rainwater tank?

_____

13. The following lists a number of maintenance activities that can be performed on your rainwater tank. How often do you think each one needs to be carried out? (Tick ☑ one box for each activity). **[SUBJECTIVE KNOWLEDGE]**

Please remember, there are no right or wrong answers, we just want to know your thoughts.

	After it rains	Every 3 months	Every 6 months	Every 12 months	Every 2 to 3 years	Not sure
a) check and clean first flush devices	☐	☐	☐	☐	☐	☐
b) check tank mosquito-proof screens and flap valves for rips, holes and defects	☐	☐	☐	☐	☐	☐
c) check rips, holes and defects on tank	☐	☐	☐	☐	☐	☐
d) check roof and gutters for accumulated debris, including leaf and other plant material	☐	☐	☐	☐	☐	☐
e) remove debris from roof and gutters and prune overhanging tree branches and foliage	☐	☐	☐	☐	☐	☐
f) check for evidence of animal, bird or insect access	☐	☐	☐	☐	☐	☐
g) check inside tank for accumulated sediment	☐	☐	☐	☐	☐	☐
h) siphon out the sludge covering bottom of tank, or completely empty the tank to remove sludge, as required	☐	☐	☐	☐	☐	☐
i) inspect gutters and the bottom of tanks and determine whether there is pipe work that contains stagnant water	☐	☐	☐	☐	☐	☐
j) clean, scrub or sweep the inside of your tank	☐	☐	☐	☐	☐	☐
k) check pipes for leaks or damages	☐	☐	☐	☐	☐	☐
l) check structural integrity of the tank, including the roof and access cover	☐	☐	☐	☐	☐	☐

14. Do you carry out any of the following maintenance options on your rainwater tank(s). If so, how often?
(Please tick ☑ one box on the left and right for *each* activity). **[TANK MAINTENANCE BEHAVIOUR – DV]**

Again, there are no right or wrong answers here. Please just answer as openly and honestly as possible.

Have you undertaken any of these activities?					***How often have you undertaken these activities?***					
Not Applicable	NOT YET	NO	YES		After it rains	Every 3 months	Every 6 months	Every 12 months	Every 2 to 3 years	Not sure
☐	☐	☐	☐	a) check and clean first flush devices	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	b) check tank mosquito-proof screens and flap valves for rips, holes and defects	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	c) check rips, holes and defects on tank	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	d) check roof and gutters for accumulated debris, including leaf and other plant material	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	e) remove debris from roof and gutters and prune overhanging tree branches and foliage	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	f) check for evidence of animal, bird or insect access	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	g) check inside tank for accumulated sediment	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	h) siphon out the sludge covering bottom of tank, or completely empty the tank to remove sludge, as required	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	i) inspect gutters and the bottom of tanks and determine whether there is pipe work that contains stagnant water	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	j) clean, scrub or sweep the inside of your tank	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	k) check pipes for leaks or damages	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	l) check structural integrity of the tank, including the roof and access cover	☐	☐	☐	☐	☐	☐

m) Have you ever hired a professional tank cleaner or tank maintenance professional?

☐ YES ☐ NO

n) To prevent the entry of light into tanks or pipes, have you ever painted white pipes with a dark colour?

☐ YES ☐ NO ☐ No, because the pipes were already black ☐ No, because I felt there was no need to

Thanks for your efforts so far! In the following sections, we'd like to know more about your thoughts and opinions related to rainwater tanks. While some questions may feel repetitive, we assure you than each question is important to us.

15. To what extent do you agree with the following statements about maintaining your rainwater tank(s)? *(Please circle the most appropriate number for <u>each</u> statement)*

I maintain my rainwater tank(s) because …

	Strongly Disagree						Strongly Agree
a) I get great satisfaction from learning new ways to do things	1	2	3	4	5	6	7
b) It is part of the way I have chosen to live my life	1	2	3	4	5	6	7
c) I would regret not looking after my rainwater tank properly	1	2	3	4	5	6	7
d) Taking care of my health and maintaining my rainwater tank seem inseparable to me	1	2	3	4	5	6	7
e) I take pleasure in improving the quality of my rainwater	1	2	3	4	5	6	7
f) It is the way I have chosen to contribute to water conservation	1	2	3	4	5	6	7
g) Maintaining my tank stops me from being criticised	1	2	3	4	5	6	7
h) It is an integral part of work I do at home	1	2	3	4	5	6	7
i) I would feel bad if I did not maintain my rainwater tank	1	2	3	4	5	6	7
j) It is a reasonable thing to do	1	2	3	4	5	6	7
k) It has become an important routine in my life	1	2	3	4	5	6	7
l) I enjoy keeping my rainwater tank maintenance up to date	1	2	3	4	5	6	7
m) Other people notice that I maintain my rainwater tank	1	2	3	4	5	6	7
n) I take pleasure in looking after my tank	1	2	3	4	5	6	7
o) It is a good idea	1	2	3	4	5	6	7
p) Other people notice that I maintain my rainwater tank	1	2	3	4	5	6	7
q) Looking after my rainwater tank is a sensible thing to do	1	2	3	4	5	6	7
r) Other people will be upset if I don't maintain my rainwater tank	1	2	3	4	5	6	7

16. To what extent do you agree with each of the following statements for *not maintaining* your rainwater tank(s)? *(Please indicate your agreement on the scale provided for <u>each</u> statement)*

I *do not maintain* my rainwater tank(s) because …

		Strongly Disagree						Strongly Agree
a)	I wonder why I need to maintain it	1	2	3	4	5	6	7
b)	It is a waste of my time	1	2	3	4	5	6	7
c)	I don't think tank maintenance is needed	1	2	3	4	5	6	7
d)	I cannot see the benefits of maintaining my rainwater tank	1	2	3	4	5	6	7

17. Can you please tell us how much you agree or disagree with each of the following statements. *(Please indicate your agreement on the scale provided for <u>each</u> statement)*

		Strongly Disagree						Strongly Agree
a)	I think I am pretty good at maintaining my rainwater tank	1	2	3	4	5	6	7
b)	I don't try very hard to maintain my rainwater tank.	1	2	3	4	5	6	7
c)	I feel like it is not my own choice to maintain my tank.	1	2	3	4	5	6	7
d)	I believe working on my rainwater tank could be beneficial to me.	1	2	3	4	5	6	7
e)	It is important to me to maintain my tank well.	1	2	3	4	5	6	7
f)	I feel competent maintaining my tank	1	2	3	4	5	6	7
g)	I put a lot of effort into maintaining my tank.	1	2	3	4	5	6	7
h)	I believe I have some choice about maintaining my rainwater tank.	1	2	3	4	5	6	7
i)	I believe maintaining my tank can be of some value to me.	1	2	3	4	5	6	7
j)	I am satisfied with my efforts at maintaining my tank	1	2	3	4	5	6	7
k)	I put a lot of energy into maintaining my tank.	1	2	3	4	5	6	7
l)	I think maintaining my rainwater tank is an important activity to carry out	1	2	3	4	5	6	7
m)	I feel that the seriousness of not maintaining rainwater tanks has been blown out of proportion	1	2	3	4	5	6	7
n)	Maintaining my rainwater tank is something I can't do very well	1	2	3	4	5	6	7
o)	I maintain my rainwater tank because I have to.	1	2	3	4	5	6	7
p)	I am skilled at maintaining my rainwater tank	1	2	3	4	5	6	7
q)	I think that maintaining my tank is useful	1	2	3	4	5	6	7
r)	I maintain my tank because I want to.	1	2	3	4	5	6	7

18. This question asks you some of the possible reasons as to why you do not regularly maintain your rainwater tank(s).

(Please circle the most appropriate number for each statement)

I don't always maintain my rainwater tanks because

	Strongly Disagree						Strongly Agree
a) I don't think that rainwater tanks are really going to help ease water shortages	1	2	3	4	5	6	7
b) I just can't seem to make the effort to change my habits and start maintaining my rainwater tank	1	2	3	4	5	6	7
c) I don't understand how to maintain my rainwater tank	1	2	3	4	5	6	7
d) I feel overwhelmed by the seriousness of water issues, and I feel there is nothing I can do	1	2	3	4	5	6	7
e) I don't believe that the use of rainwater tanks will be successful in improving our current water situation	1	2	3	4	5	6	7
f) I can't seem to find it in me to make the necessary sacrifices to maintain my rainwater tank	1	2	3	4	5	6	7
g) Having a rainwater tank will not have any impact on larger scale water issues	1	2	3	4	5	6	7
h) Water–related issues are considerable and I don't think I'd be able to change anything about them.	1	2	3	4	5	6	7
i) I can't seem to get motivated enough to maintain my rainwater tank	1	2	3	4	5	6	7
j) The magnitude of water issues means that my rainwater tank will have little impact on the situation	1	2	3	4	5	6	7
k) I can't make the effort to maintain my rainwater tank effectively	1	2	3	4	5	6	7
l) I feel that rainwater tanks are not effective	1	2	3	4	5	6	7
m) I know how to maintain my rainwater tank, but I'm not capable of doing it myself	1	2	3	4	5	6	7
n) I don't feel that I am capable of maintaining my rainwater tank	1	2	3	4	5	6	7
o) I don't believe that rainwater tanks are an adequate response to water shortages	1	2	3	4	5	6	7
p) I don't have what it takes to keep my rainwater tank in good condition	1	2	3	4	5	6	7

ENVIRONMENTAL STRATEGIES, THE GOVERNMENT AND YOU

19. How much do you agree or disagree with the following statements?
(Please indicate your agreement on the scale provided for <u>each</u> statment)

	Strongly Disagree						Strongly Agree
a) I feel I have a choice to use the strategies provided by the government to help conserve water.	1	2	3	4	5	6	7
b) I think the government puts a lot of pressure on people to adopt rainwater tanks.	1	2	3	4	5	6	7
c) I feel that the government forced me to adopt a rainwater tank.	1	2	3	4	5	6	7
d) I feel the government imposes its water conservation strategies on us.	1	2	3	4	5	6	7
e) I feel the government wants to make me feel guilty when I do nothing to conserve water.	1	2	3	4	5	6	7
f) The government gives me the freedom to make my own decisions in regards to my rainwater tank.	1	2	3	4	5	6	7
g) I feel I have the choice to participate in the rainwater tank programs established by the government.	1	2	3	4	5	6	7

You're on the home stretch now!
Only a few more questions to go – they won't take you long!

TANK OWNERSHIP STATEMENTS

20. Can you please tell us how much you agree, or disagree with the following statements? *(Please indicate your agreement on the scale provided for <u>each</u> statement)*

	Strongly Disagree						Strongly Agree
a) Tank water is my own private resource	1	2	3	4	5	6	7
b) I would be happy to have my tank water regulated (i.e., metered)	1	2	3	4	5	6	7
c) I value my rainwater because I feel less reliant on the government	1	2	3	4	5	6	7
d) My tank lets me use more water than I could if I didn't have it	1	2	3	4	5	6	7
e) I would not like to have my rainwater tank connected to plumbing inside the house (e.g., toilet flush, laundry)	1	2	3	4	5	6	7
f) Tanks are only necessary during periods of drought or water shortage	1	2	3	4	5	6	7
g) I need my rainwater so that I can water my garden and lawn	1	2	3	4	5	6	7
h) I think rainwater is too pure to be used to flush toilets	1	2	3	4	5	6	7
i) I think most people who own tanks use the water for their gardens and lawns	1	2	3	4	5	6	7
j) Rainwater that I collect is mine to use as I see fit	1	2	3	4	5	6	7
k) If I had a plumbed rainwater tank, the government would have a right to restrict how I use rainwater	1	2	3	4	5	6	7
l) My tank gives me independence to use as much rainwater as I like	1	2	3	4	5	6	7
m) Rainwater from plumbed tanks should be metered and paid for just like mains water	1	2	3	4	5	6	7

21. Please indicate your level of agreement for the following statements, referring to general lifestyle behaviours.

Since installing my rainwater tank, I feel more motivated to…

		Strongly Disagree						Strongly Agree
a)	Save water	1	2	3	4	5	6	7
b)	Save electricity	1	2	3	4	5	6	7
c)	Reuse the unused side of paper	1	2	3	4	5	6	7
d)	Purchase things designed/built to last	1	2	3	4	5	6	7
e)	Reuse paper lunch or grocery bags	1	2	3	4	5	6	7
f)	Hand down clothing to other people	1	2	3	4	5	6	7
g)	Throw away leftovers from meals (reverse scored)	1	2	3	4	5	6	7
h)	Save jars and containers for storing things in	1	2	3	4	5	6	7
i)	Recycle non-deposit glass jars and bottles	1	2	3	4	5	6	7
j)	Encourage friends to recycle	1	2	3	4	5	6	7
k)	Recycle newspapers	1	2	3	4	5	6	7
l)	Recycle non-deposit aluminium cans	1	2	3	4	5	6	7
m)	Buy biodegradable products	1	2	3	4	5	6	7
n)	Buy in bulk whenever possible	1	2	3	4	5	6	7
o)	Use environmentally friendly forms of transportation	1	2	3	4	5	6	7
p)	Car pool as much as possible	1	2	3	4	5	6	7
q)	Turn off appliances at the wall socket	1	2	3	4	5	6	7
r)	Pay extra to use ‘green’ energy	1	2	3	4	5	6	7
s)	Pay a company to offset carbon use	1	2	3	4	5	6	7
t)	Become active in my community (e.g., attend council meetings)	1	2	3	4	5	6	7

PART 2: DEMOGRPAHIC QUESTIONS

22. The following questions provide us with a general description of the types of people who took part in this survey. Once again, you will not be identifiable from this information. (Please tick ☑ one box for each question)

a) Do you think your household is a:

☐ High water user ☐ Medium water user ☐ Low water user ☐ Don't know

b) Which category best represents your age?

☐ 18-25 years ☐ 26-49 years ☐ 50-65 years ☐ Over 65 years ☐ Prefer not to respond

c) What is your gender?

☐ Male ☐ Female

d) What is your household's annual income before tax (gross income)?

☐ Less than $30,000
☐ $30,000-59,999
☐ $60,000-89,999
☐ $90,000-119,999
☐ $120,000-149,999
☐ More than $150,000
☐ Prefer not to respond

e) How many people usually live in your home?

No. of Adults: _____ No. of Children:_____

Ages of children: _____

f) What is your usual occupation?

☐ Manager
☐ Technician/trade worker
☐ Community/personal service worker
☐ Machine operators & drivers
☐ Professional
☐ Labourers
☐ Sales worker
☐ Clerical & administrative workers
☐ Other

g) Which category best represents your highest level of education achieved?

☐	☐	☐	☐	☐
Primary school	High school	Trade/ TAFE	Tertiary Undergraduate	Tertiary Postgraduate

h) Which category best describes your ethnic origin?

☐	Aboriginal/Torres Strait Islander	☐	Middle-Eastern
☐	Anglo-European	☐	African
☐	Asian/Sub-continental	☐	Hispanic
☐	Polynesian	☐	Mixed race
☐	Other: _____		

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