Public Attitudes towards Managed Aquifer Recharge and Urban Stormwater Use in Adelaide

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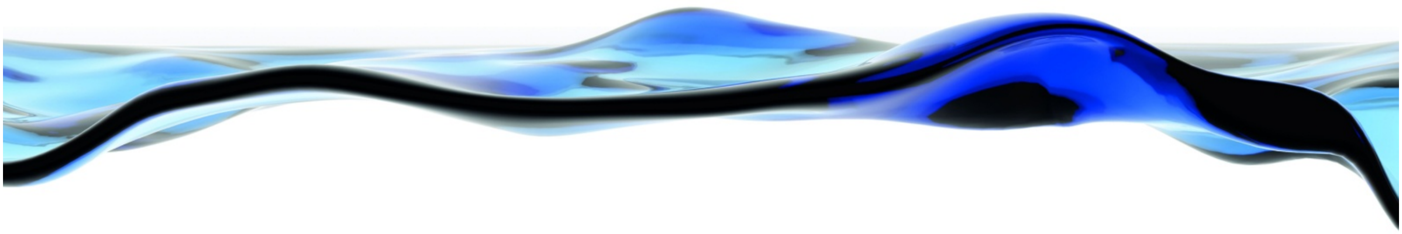

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ACKNOWLEDGMENTS

This research was undertaken as a part of the Managed Aquifer Recharge and Urban Stormwater Use Options (MARSUO) research project, which is supported under the Raising National Water Standards Program through the National Water Commission, and by the Goyder Institute for Water Research, CSIRO Water for a Healthy Country Flagship Research Program, City of Salisbury, Adelaide and Mount Lofty Ranges Natural Resources Management Board and the former United Water International.

EXECUTIVE SUMMARY

The Managed Aquifer Recharge and Urban Stormwater Use Options (MARSUO) project has been established to investigate water supply supplementation options with treated stormwater. It is funded through the Goyder Institute for Water Research.

The purpose of this study was to evaluate:

- Knowledge of, and preferences for, stormwater in Adelaide's future mix of water sources;
- Influence of proposed end use and information framing (safety vs. environmental information) on acceptance; and
- Importance of policy-related factors and psychological variables in explaining acceptance.

The online survey targeted key dimensions of acceptance found to be important in previous qualitative research on MAR of stormwater (e.g. Alexander et al., 2012; Mankad et al., 2013):

Psychological Variables	Policy-related Variables
Waste	Equality/fairness
Value of water and future water security	Effectiveness
Environmental concern	Trust
Norms associated with using treated stormwater	Water quality
	Community education
Dependent Variable: Acceptance of stormwater	Cost (willingness to pay)

Attitudes and preferences for two end use options were tested in this study:

1) *Potable use* where treated stormwater for drinking uses MAR and existing reservoirs and distribution systems, and

2) *Non-potable use* where the distribution of stormwater for non-drinking purposes is via MAR and a new 3rd-pipe system.

The investigation was coupled with an "information framing" experiment, where some respondents received targeted safety information, some received additional environmental management information, and others received generic information about MAR, to determine if the type of information received was important to the public.

Results

Almost all participants were happy to support the use of treated stormwater via MAR for non-potable applications, as they perceived stormwater to be an effective, fair and safe means of water reuse. Most people were also willing to use treated stormwater received via MAR for potable uses. However, acceptance levels were significantly higher for non-potable use than potable use. Perceived trust in authorities to safely and reliably provide treated stormwater was also higher for non-potable uses than for potable uses. Safety assurances and communication activities were considered more important when proposed uses for stormwater were potable. Interestingly, there was no significant difference in levels of acceptance between those who received more detailed information (i.e. environmental and safety informational frames) and those who received very basic information (i.e. generic informational frame) about MAR.

Type of use (potable, non-potable) explained only 7% of public acceptance for stormwater, as did knowledge of stormwater. The psychological variables and policy-related factors in the full statistical model explained 84% of the variance in acceptance for stormwater. Psychological factors explained an *additional* 8% of acceptance, over and above that explained by the policy-related factors, type of use and knowledge. The strongest unique contributors to this explanation of acceptance were *descriptive norms*, which are beliefs about the actions and attitudes of relevant others. In the present context, perceptions of whether family, friends, neighbours and people of Adelaide would support the use of treated stormwater seemed to positively influence individual acceptance. This suggests that in addition to ensuring policies are perceived as fair and effective, and fostering trust in the water authorities that manage treated stormwater, there is added benefit in addressing the psychological components. Given the high level of variance explained, we can be reasonably confident that descriptive norms, personal norms, attitudes towards stormwater and water security beliefs are important to the majority of Adelaide citizens, and not just the present sub-sample of respondents.

Participants also indicated a preference for stormwater over other alternative water options, namely desalination and purchasing more water from the River Murray. However, participants were not willing to pay more for stormwater, particularly if it was of non-potable quality. Finally, participants did not respond differently when varying levels of information was provided to them, regarding safety and environmental processes involved in the treatment and distribution of stormwater; rather, they were satisfied to make preferential decisions with minimal factual information. Moreover, knowledge of more common terms appeared to contribute to acceptance of stormwater via MAR, suggesting familiarity with certain concepts may contribute to increased acceptance.

Conclusion

The findings from this study increase our understanding of the community's perceptions and acceptance of treated stormwater as part of Adelaide's water supply. Interventions that address social and moral norms, as well as attitudes towards the benefits of stormwater, and the long term security of the region's water supply could be useful and suggest areas that may need to be addressed in future policy development.

1. Introduction

In Australia, urban stormwater is a largely untapped resource that could help cities address water scarcity issues and meet future water supply demands. Managed aquifer recharge using stormwater is one method by which cities could store and treat urban stormwater for distribution. This method can provide potable and non-potable water that citizens and agricultural producers could be used as a supplementary water source.

1.1. Research context

The Managed Aquifer Recharge and Urban Stormwater Use Options (MARSUO) project has been established to investigate water supply supplementation options with treated stormwater. It is funded by the Australian Government and is a joint initiative of the National Water Commission's Raising National Water Standards Program, CSIRO, AMLRNRMB, United Water International, the City of Salisbury, and the South Australian State Government, University of Adelaide and University of South Australia, through the Goyder Institute for Water Research. The Project aims to assess public health risks, public acceptance, economics and environmental impacts of different options for stormwater use and managed aquifer recharge (MAR) in Australia, by investigating all options for supplementing urban water supply with treated stormwater, with particular emphasis on assessing water safety and community acceptance. The Project will provide water managers and the community with the comprehensive information they need to be confident in making decisions on harvesting and storing stormwater for future use. The Project will develop a national approach to assessing stormwater and MAR options, which can be applied around Australia to advance the potential use of stormwater as an additional water supply source.

Social analysis for the MARSUO project was previously conducted by Dr Kim Alexander. The social research explored the uses of stormwater through attitudinal research methods including four focus groups with a brief pre and post survey (N=36) and an Adelaide-wide survey (N=1,043) to examine participants' attitudes to stormwater treatment options, and aquifer storage. Both methods investigated three treatment options.

Option 1 was wetland → aquifer→ treatment plant → non-drinking.
Option 2 was wetland → aquifer→ treatment plant → reservoir→ treatment plant → drinking.
Option 3 was wetland → aquifer→ treatment plant → drinking.

The focus groups allowed discussion and presented treatment options to members of the public. This provided participants with an opportunity to question scientists and helped frame the online survey. In the first Adelaide-wide survey conducted, treatment options were depicted pictorially, where questions related to the acceptability of stormwater relative to other water sources and treated in aquifers and wetlands prior to use.

Briefly, the results of those studies suggested that:

1. There was greater acceptance of stormwater and groundwater for non-potable uses than potable uses in the Adelaide community with 70% survey respondents supporting Option 1 and 50% supporting or strongly supporting Options 2 and 3. Further, approximately 20% thought that maybe they would protest against these options.
2. Knowledge was important as there was a much greater level of acceptance of ground water and stormwater after the expert information (support for options 2 and 3 increased from 34% to 93%) which is much higher than the 50% level of acceptance in the survey. However, in both the focus groups and the survey, there appeared to be no differentiation in participants' perspective between the potable Options 2 and 3. This contrasts with the view of the scientists who strongly support the benefits of multiple barriers and, therefore, very strongly prefer

Option 2 to Option 3. Thus, it appears that there were limits to the level of understanding achieved in the focus group presentation and discussion.

3. There was good support for multiple sources of water. In the Adelaide-wide survey, respondents were asked how important it was for the Adelaide community to be able to rely upon the proposed water supply options under drought and non-drought conditions. In general, respondents indicated that all water supply options were important, but more so during drought conditions. The two most preferred options, regardless of whether it was drought or non-drought condition, were water from rainwater and from Mt Lofty reservoir. Water from the desalination plant was seen as less preferred when compared with other supply options under both drought and non-drought situations. (Alexander et al 2011; Leonard & Alexander 2012)

The purpose of the present research was to examine public attitudes towards two different methods of managed aquifer recharge for stormwater, one providing potable water and the other providing water for non-potable end uses, in the greater Adelaide area. Based on past research (Alexander et al., 2012; Mankad et al, 2013), two types of information seemed to influence attitudes towards MAR of stormwater: 1) knowledge of safety and water quality measures, and 2) concern about environmental issues surrounding managed aquifer recharge. In addition, other perceptions of policy related factors seemed to affect acceptance of stormwater, and these appeared to be different based on the proposed use of the stormwater: non-potable or potable purposes. This research uses a survey with an experimental design to measure acceptance for treated stormwater and to test for these influences.

1.2. Background

On-going challenges for rapidly growing Australian cities include the provision of adequate water supplies to maintain capacity, as well as finding adequate storage for additional volumes of water. Managed aquifer recharge (MAR) addresses both of these issues, by providing cities with an alternative water source, as well as a method of storage for future extraction and use. In 2011, the Productivity Commission (Australian Government, 2011) found that the public believed urban water supplies were best secured through the use of alternative water technologies, such as recycled water and capturing urban stormwater (AWA/Deloitte, 2012).

Managed Aquifer Recharge (MAR) is the intentional depositing of partially treated water into aquifers (mostly underground) for subsequent recovery or environmental benefit. This method is increasingly being used in Australia, USA, and Europe to provide additional water storage and water treatment capability (Dillon, et al., 2010). In South Australia, the target region for this study, MAR using stormwater provides an efficient and effective means of recycling urban stormwater with appropriate treatment for non-potable use in urban and rural areas. In addition, MAR has the capacity to produce safe drinking water to augment dwindling supplies (Dillon et al, 2010). Water from the MAR process tends to be less expensive because MAR uses passive or low energy processes, it is robust and is suitable at various scales of operation. MAR is already being used to provide non-potable water for public open space irrigation in Adelaide (Molloy, et al., 2009), but is not currently being used as a supplement to existing drinking water sources.

Although treated stormwater has the potential to further augment drinking water supplies through indirect potable use, public sentiment in Adelaide still indicates concern surrounding safety precautions at a systems level, as well as factors associated with water quality and treatment processes (Mankad et al., 2013). In Australia, communities have high expectations for the security and safety of their water supplies and are extremely sensitive to any perceived health risks. Further, the degree of acceptance of alternative water appears to be associated with the source and intended use of the water (Mankad & Tapsuwan, 2011). In survey studies conducted by OgilvyEarth and Ogilvy Illumination (2010) for the Australian Water Association, over 70% of Australians surveyed were found to be concerned or very concerned with present water supplies. However, despite this concern, respondents indicated they were reluctant to consider augmenting drinking supplies with recycled water. The study asked respondents to indicate how they would act if compelled to use some form of recycled water for internal domestic uses. If compelled to do so, stormwater sources were preferred to augment drinking supplies over other sources of water for internal domestic uses.

Following heavy rain that ended the “Millennium” drought in eastern Australia, more recent research was conducted by Deloitte, on behalf of the Australian Water Association (AWA/Deloitte, 2012). The research found that innovative sources such as stormwater harvesting were preferred methods of securing urban water supplies, and only 18% of respondents favoured greater exploitation of traditional supply options (e.g. purchasing more water licences from the River Murray). In this study, 44% of people nationally would support the use of stormwater as a drinking water source. Interestingly, 67% of surveyed Australians felt that significant investments regarding desalination were not cost effective, and approximately 30% of people felt that the constructions were too large or costly.

The AWA research also found that water used to preserve the environment was an important issue to Australians, who felt that environmental water rights should be respected. Respondents believed the water sector should ensure that water catchments were well managed and that any long-term environmental impacts should be positive. The importance of environmental issues was particularly salient for surveyed respondents in South Australia, who felt that managing environmental impacts and protecting the environment’s water entitlements (57%) were almost as important as ensuring water supply security (AWA/Deloitte, 2012). However, 31% of South Australian respondents felt that the issue of long-term environmental impact was not being addressed very effectively. Interestingly, when South Australians were asked which areas the water sector should focus on to address climate change impacts, 59% of people believed that recycling more water and using a mix of water sources was important. While 38% of people agreed that stormwater should be used as a source of water, only one third of respondents from South Australia felt that stormwater was suitable for drinking, which was lower than the average for all the other Australian states and territories. This national research indicates that although environmental issues emerge as a significant driver of alternative water acceptance, safety issues associated with treating water to a drinking standard are also influential factors (e.g., Keremane & McKay, 2007; Wu, et al., 2012).

Consistent with the AWA research, analysis of the focus group data for the MARSUO project also found trust to be an important factor. Mankad et al (2013) identified trust in the safety of MAR processes, and trust in the management of environmental issues surrounding the use of aquifers as water storage and treatment facilities were central to the acceptance of MAR using stormwater. Participants described the importance of being able to trust utility companies to deliver safe drinking water, and comments indicated it was essential to their acceptance of using treated stormwater for drinking purposes. For some participants, understanding the details of the processes involved in treating and delivering treated stormwater was required to confirm that the water would be safe to drink. Harvesting stormwater was also seen as beneficial to the environment because it mitigated the damaging effects of excessive and polluted water being returned to the ocean, as well as a way to reduce local flooding in urban areas. However, people were also concerned that polluted stormwater could potentially damage the underground aquifers and, by extension, potentially diminish underground water quality and have unknown long-term effects on aquifers.

Environmental concern is well documented in water literature as a contributor to individuals’ acceptance of an alternative water source. Research indicates that perceptions of a negative environmental impact can have a negative influence on acceptance of the alternative water source (e.g., Hurlimann & Dolnicar, 2010; Po, Kaercher, & Nancarrow, 2003). Similarly, Nancarrow, Porter and Leviston (2010) demonstrated fairness, trust and risk as important to acceptance in a variety of alternative water technologies. Fairness, related to procedural and distribution issues, was shown to drive acceptance: the greater the perceived fairness, the greater the associated acceptance. Trust in utility owners and regulatory authorities to deliver outcomes of new technologies safely and reliably also associated positively with acceptance. Further, past sustainability research (e.g. Godin, et al., 2005; Spinks, et al., 2011) has shown that normative evaluations and perceptions underlie personal and moral attitudes towards pro-environmental intentions and acceptance behaviour.

In addition, Mankad et al's (2013) findings from their analysis of the focus groups also highlighted seven other key dimensions driving public acceptance of stormwater, in addition to environmental concerns and trust in safety:

- general concern about future water security
- perception that stormwater is currently being wasted
- public education of MAR at a broad level
- effectiveness of MAR in addressing Adelaide's future water security
- equitable public distribution of treated stormwater
- water quality of treated stormwater for specified end uses
- costs associated with providing fit-for-purpose treated stormwater to households

These nine dimensions, in addition to norms associated with the use of treated stormwater, were divided into two groups: perceptions relating to individual beliefs about water, and beliefs related to various policy proposals (see Table 1). This categorisation is based on an educated assessment that the variables were reflecting two types of distinct characteristics of stormwater acceptance. Perceptions of waste, water/water security, environmental concern and norms are formed using inherent personal values associated with water and the environment, and is considered to be more psychologically driven. In contrast, perceptions associated with evaluating a stormwater option, such as fairness, effectiveness, trust, and water quality, are more context-specific and driven by external evaluations of the water context which could vary with changes in government water policy, thus the distinction in our analysis.

Table 1 The dimensions of public acceptance for MAR of stormwater grouped according to areas of influence

Psychological Variables	Policy-related Variables
	Perceptions of equality/fairness
Perceptions of waste	Perceptions of effectiveness
Value of water and future water security	Perceptions of trust
Environmental concern	Perceptions of water quality
Norms associated with using treated stormwater	Importance of community education
	Cost (willingness to pay)

This present study investigates these dimensions and determines their impact on acceptance for treated stormwater. The issue of stormwater knowledge was also explored to determine if knowledge influenced acceptance of stormwater.

1.3. Present study: Second online survey of Adelaide residents

The purpose of this study is to evaluate community acceptance for non-potable and potable uses for treated stormwater, as a way to augment Adelaide's water supplies, and to understand the factors that affect this acceptance. The study extends the findings of past research, specifically targeting the dimensions of acceptance found to be important in previous qualitative studies of public acceptance of MAR of stormwater (e.g. Alexander et al., 2012; Mankad et al., 2013) by using a quantitative survey approach to investigate three broad areas:

- Knowledge and preferences for the role of stormwater in the overall mix of Adelaide's water sources;
- The influence of proposed end use (potable or non-potable) and information framing (i.e. safety vs. environmental information) on acceptance; and
- The importance of policy related factors and psychological variables in explaining acceptance.

The present study investigates two stormwater options, which have been drawn from twelve possible options analysed in the MARSUO study (Figure 1; Options 6 and 11). The twelve possible options vary with respect to treatment processes, storage alternatives, blending alternatives, distribution systems and end uses. Option 6 follows the stormwater passage through the wetland and aquifer storage and recovery, and undertakes some final treatment. The water is used for non-potable residential uses including in toilets and washing machines and for residential irrigation with distribution via a third pipeline to homes and businesses. Option 11 follows the stormwater as it passes through the wetland, is stored and recovered in the aquifer before being pumped into a drinking water reservoir and undertaking a final treatment. This water is used for potable uses with distribution via mains water supply lines. These two options were chosen through consultations with engineers, as they were deemed to be the simplest representation for plausible potable and non-potable options. There was no evaluation of options leading to public open space irrigation as this is an established standard use of stormwater in the City of Salisbury, and has widespread public support.

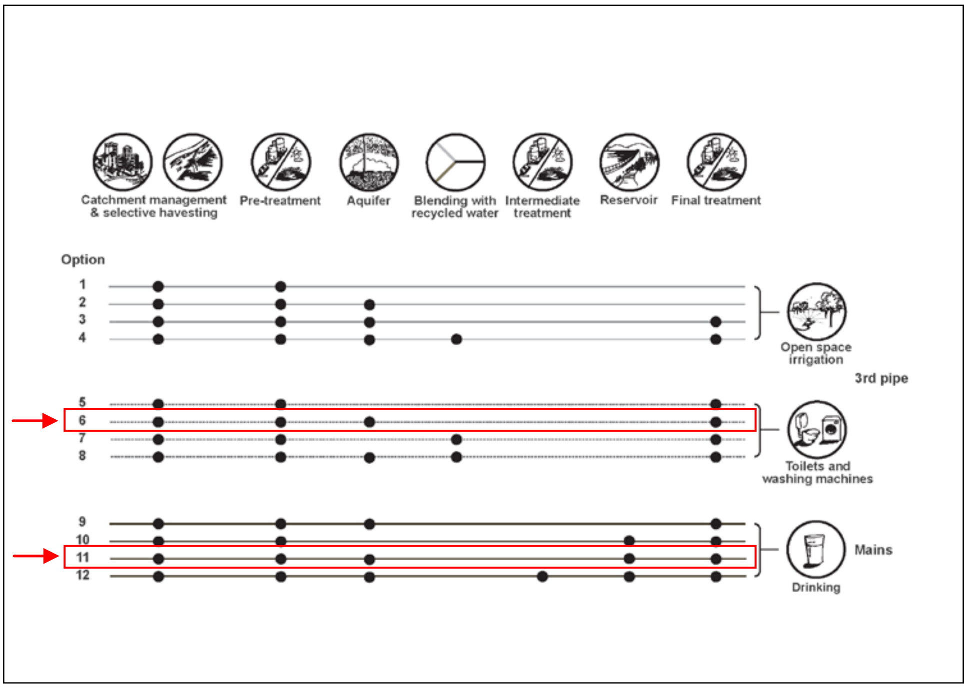

Figure 1 An illustration of 12 stormwater use options, with Options 6 and 11 serving as the test examples for non-potable and potable uses

Therefore, this study will specifically address preferences and attitudes related to two end use options:

1.) Potable use where treated stormwater for drinking uses MAR and existing reservoirs and distribution systems (i.e. highly equitable and lower costs), and

2.) Non-potable use where the distribution of stormwater for non-drinking purposes is via MAR and a new 3rd-pipe system (i.e. equitable distribution but higher costs). This investigation will be coupled with an "information" framing experiment, where some respondents receive targeted safety information, some receive additional environmental management information, and others receive just generic information about MAR. It is hoped that this experimental design will highlight which psychological and physical factors are most important to the public in terms of novel stormwater initiatives.

The nine dimensions identified as important to acceptance from the previous qualitative research (Mankad et al., 2013) together with social norms will be examined and, for the purposes of this study, will be grouped based on their overarching areas of influence: personal/psychological variables and policy-related variables.

The dependent variable was acceptance of, and willingness to use, stormwater.

The aim of the current study is to establish which psychological constructs are more important to MAR acceptance than others, and whether the type of water source and end use (reservoir-potable versus 3rd-pipe-non-potable) plays a role in public acceptance. Although, there have been numerous research studies into community attitudes towards recycled sewage effluent for non-potable reuse, there are few studies reporting on community attitudes towards water use schemes involving stormwater and/or aquifer recharge (Alexander, 2010; Wu, et al., 2012). A significant component of the current study is, therefore, dedicated to providing increased knowledge regarding community understanding and views towards stormwater use and how policy-related factors play a role in acceptance. This research is unique because it explores public attitudes towards using treated stormwater for potable uses (i.e. drinking), which other research on stormwater has not examined.

1.4. Research questions

The overarching research aim guiding this study is to understand community perceptions and acceptance of treated stormwater as part of Adelaide's water supply. This suggests eight exploratory research questions to be investigated in this study as follows:

- RQ1 How does knowledge affect acceptance of treated stormwater?
- RQ2 What are community preferences for using treated stormwater as part of Adelaide's water supply mix?
- RQ3 What are people willing to pay for stormwater via MAR?
- RQ4 What effect does the proposed use for the stormwater have on acceptance and perceptions of policy related factors?
- RQ5 What effect does the way explanatory information is framed have on acceptance of treated stormwater and perceptions of policy-related factors?
- RQ6 To what extent do policy-related factors explain acceptance, and which are the most important factors?
- RQ7 To what extent do psychological variables explain acceptance, and which are the most important variables?
- RQ8 To what extent do policy-related factors, psychological variables, knowledge levels, and type of use explain acceptance?
- RQ9 Have there been changes in attitudes to the importance of certain water sources or social norms around stormwater since the 2011 survey?

2. Methods

The research adopted a 2 x 3 between-subjects experimental design and used an online survey as the instrument for data collection (see Section 2.2.1 and Figure 2 for a description of the study design). Two different proposed uses for stormwater (non-potable and potable uses) and three different information frames (generic, environmental, and safety information) were manipulated within the surveys. As a result there were six different versions of the survey. The surveys were identical in length and format and varied only with respect to the experimental manipulations. The survey gathered data on acceptance for treated stormwater, policy related perceptions, psychosocial factors, and demographic characteristics. The survey was conducted online over a three week period in March 2013.

2.1. Participants

Participants were recruited through a third party panel listing company[1], which used a panel list of over 300,000 individuals to randomly select participants based on predetermined selection criteria. These criteria required respondents to be residents of Adelaide, at least 18 years old, and to reflect ABS distributions for age and gender (ABS, 2011). This selection was achieved through screening questions embedded in the beginning of the survey. The sample of 1218 respondents comprised slightly more females than males (56% and 44% respectively), ages ranging from 18 to older than 65 years, with 53% of respondents younger than 50 years. Most respondents were living as a couple with no children living at home (36%), or as a family with children (39%), single person households (20%), and living in shared accommodation (6%) were also represented. There was a range of socioeconomic levels represented, with 43% reporting household incomes less than 60,000, 29% with incomes of $60,00 to $120,00, 13% with incomes more than $120,000, and 15% of respondents preferring not to answer. Sixty-two percent of respondents were employed across a range of occupations, and 38% indicated they were either retired or not working. Respondents also demonstrated a range of educational background, with 31% attaining secondary school qualification, and 69% achieving higher education across a range of certificate, bachelor degree, and post-graduate qualifications. The sample was assessed to be representative of Adelaide residents, as per ABS statistics (refer to ABS, 2011 for a statistical breakdown of the Adelaide region).

2.2. Survey Design

2.2.1 Experimental conditions

The design of the survey manipulation comprised a combination of six related surveys (see Figure 2), randomly distributed among the original pool of 1218 participants. The sample sizes for each of the six experimental groups were very similar, ranging from n = 201 to n = 207, and there were no statistically significant differences for age and gender between the groups.

There were two experimental manipulations relating to the proposed purpose of the treated stormwater: non-potable (3rd pipe) uses and potable (drinking) uses, as described in Section 1.2. There were also three manipulations of the information frame where respondents were provided with one of three different types of explanatory information narratives: generic information, environmental information, and safety information. See Appendix B for the full set of six manipulation narratives.

[1] This was the same company that launched the first MARSUO online survey in 2011

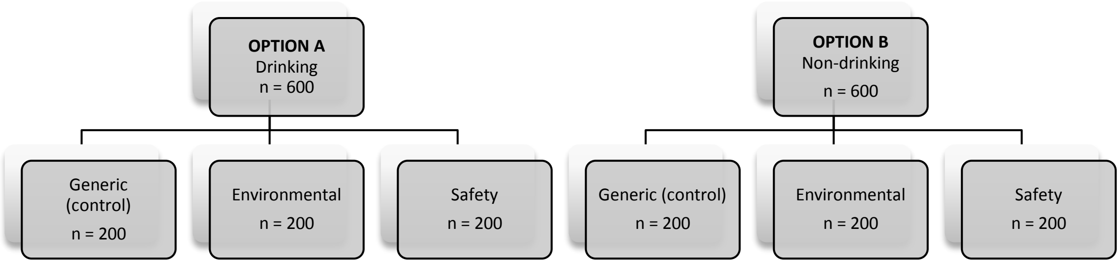

Figure 2 The 6 survey "information framing" manipulations for each Managed Aquifer Recharge of stormwater option

The three manipulations for information framing were:

Generic information: This version gave only basic information regarding MAR of stormwater for the intended purposes (i.e. drinking or non-drinking) and did not expand on environmental or safety issues surrounding the MAR and water treatment processes.

Environmental information: This version provided the same generic information as the control version; however, there was a strong emphasis on the environmental benefits surrounding MAR of stormwater (e.g. "Wetlands can provide increased biodiversity"; see Appendix C for full environment narrative). Key words with an environmental focus were highlighted for the participant. No safety related information was included in this version.

Safety information: This version provided the same generic information as the control and environmental versions; however, there was a strong emphasis on the water treatment issues surrounding MAR of stormwater, to convey a high level of safety associated with the MAR of stormwater process (e.g. "Wetlands can provide help with water purification"; see Appendix C for full safety narrative). Key safety-focused words were highlighted for the participant. There was no additional information regarding environmental benefits associated with MAR of stormwater, so that this was a pure manipulation of "safety" information.

It is important to note that the environmental and safety information provided through this information framing experiment requires a singular focus on "environmental" and "safety" points within each respective manipulation. Therefore, although the information may appear biased, it is the nature of this experiment; overall, an equal number of participants are receiving the environmental and safety messages and this satisfies ethical requirements.

2.3. Measurement Scales

The survey consisted of 89 items and took approximately 15 minutes to complete. The items were designed to elicit information from participants about various aspects related to MAR of stormwater and the water supply mix of Adelaide including: knowledge levels, acceptance levels, perceptions of policy-related factors, and perceptions of psychosocial factors related to treated stormwater and water in general. Standard demographic and household composition data was also collected to describe the sample population. Responses were typically made using a 5-point Likert scale, however, some categorical multi-choice questions were also included. Multi-item measures of the psychosocial variables were used in most instances, and were largely adapted from prior research. A summary of the measures used in the survey are displayed in Table 2; a more detailed summary of the measurement scales is included in Appendix C. The reliability values provided in Table 2 indicated reliability of the measure for the present sample population.

Table 2 Summary of measures used in the survey and their respective reliability values

Variable	**No. of items (reliability)**	**Source of measure**
General behaviour related to drinking water	4 items	Developed for the survey
Knowledge of stormwater		
Well-known terms(eg stormwater, chlorination)	5 items (α =.88)	Developed for the survey
Technical terms (eg reverse osmosis)	4 items (α =.85)	Developed for the survey
Optimal water mix preferences (drought and non-drought conditions)	14 items	Alexander, et al. (2012)
Acceptance (for drinking or non-drinking purposes)	2 items (*r* = .83)	Adapted Eriksson, et al. (2006)
Measures of policy related factors		
Perceived fairness	2 items (*r* = .65)	Adapted from Eriksson, et al. (2006); King & Murphy (2012)
Perceived effectiveness	1 item	Adapted from Eriksson, et al. (2006)
Trust (authorities to provide safe & reliable water)	2 items (*r* = .92)	Developed from SA Water mission
Importance of safety assurances	7 items (α =.82)	Developed for the survey
Importance of communication activities	5 items (α =.86)	Developed for the survey
Measures of psychological factors		
Attitude towards stormwater	5 items (α =.92)	Adapted Ajzen (2005)
Attitude towards waste	4 items (α =.81)	Adapted Fujii (2006)
Water value beliefs[a]	4 items (α = .68)	Developed from past water research (Mankad &Tucker, 2013; Mankad et al., 2011)
Water security beliefs[b]	3 items (α = .88)	Based on problem awareness measures (Eriksson et al., 2008)
Pro-environmental beliefs	4 items (α = .85)	Cools, et al. (2011), adapted from Dunlap, et al. (2000)
Descriptive norm (a type of normative pressure)	4 items (α = .94)	Adapted Gockeritz et al. (2010), Nolan et al. (2008)
Personal norm (a sense of moral obligation)	3 items (α =.90)	Adapted Abrahamse et al., 2009; Bamberg, et al., 2007;

		Harland, et al., 1999)
Willingness to pay (for non-potable and potable use)	1 item	Developed for the survey
Preferences (options for increasing the water supply)	2 items	Developed for survey
Manipulation checks	2 items	Developed for the survey
Demographics	6 items	Based on ABS

Note: Reliability statistics: Pearson's *r* for two items measures; Cronbach's alpha for multiple item measures
[a] originally a 5-item measure; α = .56 improved to α = .68 with 4 items
[b] originally a 5-item measure, α = .21 improved to α = .88 with 3 items

2.3.1 Dependent Variable: Acceptance

Two items measured participants' level of acceptance for using stormwater for drinking (*D*) or non-drinking (*ND*) purposes, based on the illustrative stormwater option model presented in their survey (6 options: *genericD, genericND, envtD, envtND, safetyD, safetyND*). The items were: "I would be willing to use treated stormwater for..." (*1 = strongly disagree, 5 = strongly agree*) and "to what extent are you in favour of using treated stormwater for..." (*1 = strongly opposed, 5 = strongly in favour*). These items were adapted from research conducted by Eriksson et al. (2006).

2.4. Procedure

The online survey was conducted in March 2013 and the survey was live for 3 weeks. The CSIRO engaged the professional services of The Online Research Unit (ORU) to distribute the survey online. Prospective participants residing in the greater Adelaide region were sent an invitational email for the survey. This email had a separate link to the survey.

Prior to the survey questions, participants were provided with an information page, followed by an informed consent page, which they had to complete before the survey could be accessed. Participants were also asked not to access any external search engines (e.g. Google) throughout the survey.

During the survey, participants progressed through each sequential page of questions, with a progress bar visible on each page. Some sections of questions were randomised, so as not to risk a sequencing effect. Participants were blocked from going back and changing answers after completing each page of the survey, to preserve the initial accuracy of responses. After completing the survey, participants were asked to click on a tab to submit the completed survey. Confidentially was maintained, as the survey responses were saved in the secure databases of The ORU and then securely transferred to CSIRO. Anonymity was also preserved, as survey respondents' email addresses were not stored with their survey responses.

2.5. Data Preparation and Analysis

All multi-item measures of policy related perceptions and psychological variables were tested for internal consistency and results are displayed in Table 2. These measures were scaled to single item measures by averaging the relevant items, except for the knowledge variable, which was scaled as two knowledge sub-scales by averaging the items comprising each type of knowledge. The two knowledge types were used in the final multiple regression analysis to explain acceptance (Section 3.10). A multivariate analysis of variance (MANOVA) was used to examine the influence of two different proposed water uses for the treated stormwater (non-potable and potable uses), and three different information frames (generic, environmental, and safety information) on levels of acceptance, and policy related perceptions. Multiple regression analyses were used to determine the extent to which the policy related variables, knowledge levels, and psychosocial variables explained acceptance of treated stormwater for non-potable and potable purposes.

3. SECTION A: Summary of Results

3.1. Summary of results organised by Research Question

RQ1 How does knowledge affect acceptance of treated stormwater?

Descriptive analyses showed that participants' self-reported knowledge of the term "stormwater" was found to correlate significantly with acceptance, however, the size of this relationship was small. Extended knowledge of technical terms related to stormwater did not correlate with acceptance. Multivariate analyses (Section 3.10) showed that knowledge of more common terms related to MAR of stormwater uniquely contributed to explaining acceptance in the full model, which comprised psychological variables and policy-related factors as well. Further evidence that knowledge positively influenced acceptance was evident in participants' preference for future water options in Adelaide. Participants were provided with a table of information relating to the cost and energy requirements to produce water for three different alternative sources and used this information determine their preferences for alternative water sources. On this basis, stormwater was identified as the most preferred water option (Section 3.4), which differed from earlier responses in the survey where participants did not have the relevant information (i.e. Section 3.3). Therefore, it was concluded that knowledge of relevant facts was used by participants to help decide whether to accept, or reject, the use of treated stormwater over other alternative water options.

RQ2 What are community preferences for using treated stormwater as part of Adelaide's water supply mix?

When comparing preferred water sources to increase Adelaide's future water supply, during drought and non-drought conditions, rainwater was the most preferred water option overall. During non-drought conditions, River Murray and Mt. Lofty catchments were cited as highly preferable; during drought conditions, preferences shifted to include treated stormwater along with rainwater and Mt. Lofty catchments. Water from the River Murray became one of the least preferred sources during drought conditions (see Section 3.3).

When asked to indicate preference for an alternative water source, given cost and energy requirements (Section 3.4), a majority of participants cited stormwater as their preferred water source over desalination and additional water purchased from the River Murray. For those selecting stormwater for non-potable uses, the main decisional factors were source of the water and cost of producing the water. For those selecting stormwater for potable uses, cost of the water and energy requirements were not as important as the source of water, indicating that stormwater is viewed favourably as an alternative water option.

RQ3 What are people willing to pay for stormwater via MAR?

Willingness to pay was fairly consistent across the potable and non-potable stormwater groups, with participants willing to pay the same as, or less than, what they were currently paying for water (Section 3.5). A higher proportion of people were willing to pay less than what they were currently paying for water if treated stormwater would be fit for non-potable applications.

RQ4 What effect does the proposed use for the treated stormwater have on acceptance and perceptions of policy-related factors?

The proposed use of stormwater, for either non-potable or potable purposes, associates with different levels of acceptance and different perceptions of policy-related factors (see Section 3.6). Non-potable uses associated with higher levels of acceptance than when the proposed purpose was for potable uses. Perceptions of fairness, effectiveness, and trust in authorities were also higher when the purpose was for non-potable uses than for potable uses. However, the importance of safety assurances and communication activities were higher when the purpose was for potable uses. These issues are discussed in more detail in Section 4.2.

RQ 5 What effect does the way explanatory information is framed have on acceptance of treated stormwater and perceptions of policy-related factors?

The way in which the two stormwater options (potable and non-potable) were presented to participants (i.e. generic, environmental or safety information framing) did not appear to influence public acceptance of stormwater or perceptions of policy-related factors (Section 3.7). This suggests that even general information about stormwater, regardless of whether it focus on environmental of safety benefits, will have the same impact on public acceptance of stormwater.

RQ 6 To what extent do policy related factors explain acceptance and which are the important variables?

Policy-related factors are robust predictors of community acceptance for treated stormwater. In the present study, policy-related variables, perceptions of fairness, effectiveness, and trust in water authorities, were all important in explaining acceptance (see Section 3.9). The fairer the policy seems, the greater the trust in water authorities, and the more effective the policy is perceived, the more accepting the person is of treated stormwater. These factors are discussed in section 4.2.

RQ7. To what extent do psychological variables explain acceptance, and which are the important variables?

Four psychological variables were identified as important to acceptance of treated stormwater: social and moral norms, attitudes towards stormwater and water security beliefs (Section 3.8). The more a person believes that others in the wider community would use treated stormwater, the greater their sense of moral obligation towards stormwater, the more favourable their attitudes towards the benefits of stormwater, and the greater their concern for the long term security of the region's water, the more accepting the person is of stormwater. These factors are discussed further in Section 4.1.

RQ 8 To what extent do policy-related factors, psychological variables, level of knowledge, and type of use explain acceptance?

The amount of variance in acceptance explained by the full model, taking into account type of use (potable/non-potable), level of knowledge (knowledge of more common terms / knowledge of less common terms), psychological variables and policy-related factors, was found to be 84%. Psychological factors contributed an extra 8% over the variance explained by type of use, knowledge, and policy-related factors (see Section 3.10). This is considered to be a very high percentage of variance explained for attitudinal data.

RQ9 Have there been changes in attitudes to the importance of certain water sources or social norms around stormwater since the 2011 survey? Although there were some changes in the ratings of the importance of the various water sources, the effects sizes were very small suggesting overall stability in perceptions (see Section 3.11). However, there was only two years between the two surveys so if the direction of change continues, then future surveys might pick up a stronger trend. There was a moderate effect size for the increase in perceived support for non-potable option by the community, therefore it seems that there has been an increase in belief that the people of Adelaide support using treated stormwater for non-potable uses.

4. SECTION B: Detailed Results

4.1. General behaviour related to drinking water

Results indicated 42% of respondents use an under-sink filter on their tap water for drinking at home; and that 32% use bottled water for drinking rather than tap water, either sometimes, often or always. Sixty-eight percent of respondents indicated they don't use bottled water for drinking over tap water. Many of the respondents had a rain water tank which they used for non-drinking purposes (45%), and 19% of the total sample indicated they use rainwater from a tank for drinking or cooking.

4.2. Knowledge about stormwater

Results indicated that knowledge about stormwater was reasonable. Two thirds of respondents self-reported that they had a moderate, high, or very high level of understanding of the term 'stormwater', and approximately 90% correctly viewed stormwater as either rainwater from roof gutters, or water from city drains. This measure of knowledge significantly correlated with level of acceptance of stormwater, however, it was a low correlation ($r = .227$, $p < .001$).

In contrast, people's self-reported understanding of technical terms related to stormwater was generally low. Respondents indicated they knew very little about the terms: managed aquifer recharge, third pipe (purple pipe) system, UV water treatment, microfiltration, and reverse osmosis, with low mean scores for levels of understanding The most well understood terms were 'reservoir' and 'wetlands'. Table 3 displays the mean scores for perceived levels of understanding for nine technical terms.

Table 3 Perceived level of understanding of technical terms

	Technical term	*Mean*	*SD*
1	Managed aquifer recharge	1.70	1.02
2	Third pipe(purple pipe) systems	1.79	1.10
3	UV water treatment	1.84	1.07
4	Microfiltration	1.91	1.06
5	Reverse osmosis	1.99	1.18
6	Aquifer	2.21	1.20
7	Chlorination	2.87	1.12
8	Wetlands	3.02	1.09
9	Reservoir	3.29	1.15

Note: Scale 1 = 'I know very little about this', 5 = 'I know a lot about this'; $N = 1218$

4.3. Optimal water mix: Non-drought and drought conditions

Participants were asked to rate the importance of the different water source options, during non-drought and drought conditions, to supply Adelaide's overall water needs. These questions were asked prior to the provision of information about stormwater use options so that all sources were rated on an equal basis. Paired sample *t*-tests showed that, on average, perceptions of the importance of all the various water sources were higher during drought conditions than non-drought conditions, except for the perception of the importance of River Murray water, which was lower during drought conditions. All differences were statistically significant, except for the Mt Lofty catchment reservoirs, which were viewed as equally important during non-drought and drought conditions. The effect sizes for the differences in perceptions ranged from extremely small to medium where a Cohen's *d* of 0.20 is considered small, a *d* of 0.50 is considered medium, and a *d* of 0.80 is considered large (Allen & Bennett, 2010). Notably the only source with a medium effect size was desalinated water suggesting that, although this source is unpopular, people are more likely to recognise its value under drought conditions. During non-drought conditions, the three water sources considered the most important to Adelaide's water supply were rainwater from tanks, Mt Lofty catchment reservoirs, and treated stormwater, and the least important was water from the desalination plant. During drought conditions, the three most important water sources were unchanged, however, desalination was perceived as the fifth most important (from seven options), and groundwater as the least important. Table 4 displays the mean scores for each alternative water source during non-drought and drought conditions, and the statistical difference in perceptions between each condition. The differences in levels of importance for each alternative water source for non-drought and drought conditions are also displayed in Figure 3.

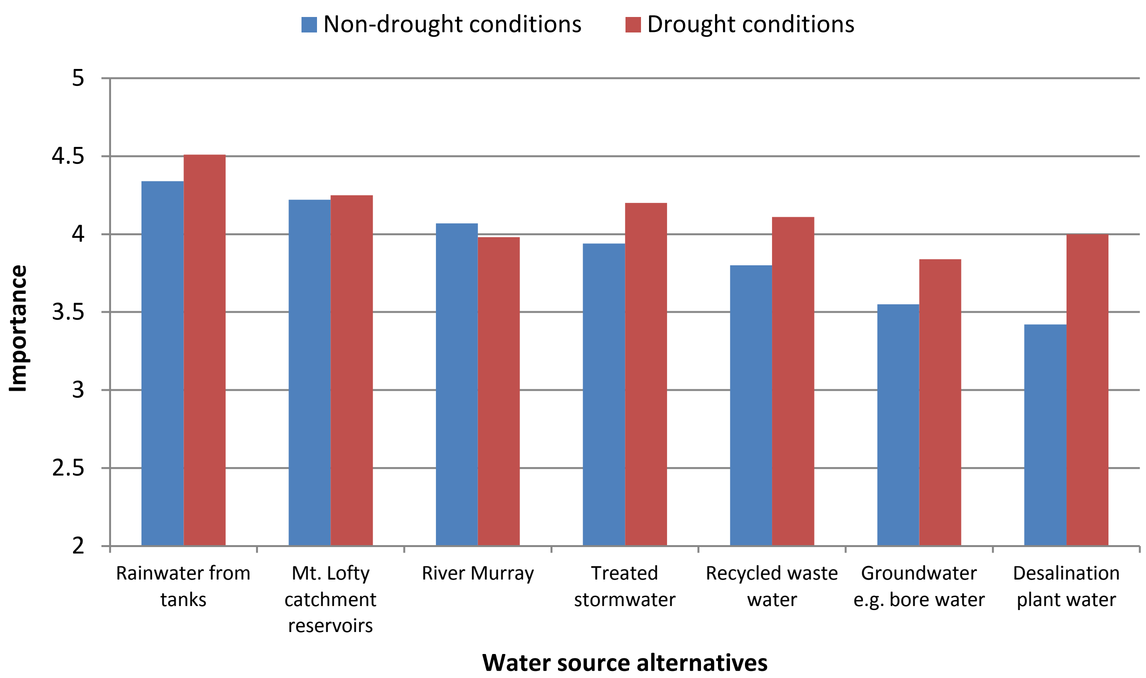

Figure 3 Perceptions of importance for alternative water sources during non-drought and drought conditions

Table 4 Perceptions of importance of alternative water sources to the overall supply of Adelaide's water

Water source	Non-drought conditions *M (SD)*	Drought conditions *M (SD)*	*t*(1217)	Effect size Cohen's *d*
Rainwater from tanks	4.34 (0.88)	4.51 (0.83)	-8.56***	0.20
Mt. Lofty catchment reservoirs	4.22 (0.88)	4.25 (0.90)	-1.03	0.03
River Murray	4.07 (1.01)	3.98 (1.08)	3.62***	0.09
Treated stormwater	3.94 (0.92)	4.20 (0.91)	-12.31***	0.28
Recycled waste water	3.80 (1.00)	4.11 (0.97)	-13.28***	0.31
Groundwater e.g. bore water	3.55 (1.01)	3.84 (1.03)	-11.48***	0.28
Desalination plant water	3.42 (1.10)	4.00 (1.06)	-21.77***	0.54

Note: *$p < .05$, **$p < .01$, ***$p < .001$. Higher mean scores indicate a higher level of perceived importance (1 = 'very unimportant', 5 = 'very important'); N = 1218

4.4. Preferences for increasing Adelaide's future water supply

After the MAR diagrams were presented in the survey, regarding either a potable or non-potable stormwater delivery system, participants were asked to give their preferences for increasing Adelaide's future water supply augmentation options. Three alternative water options were provided: desalination, stormwater, and more water from the River Murray. The most preferred option for increasing the water supply for either non-potable or potable uses was treated stormwater, followed by taking more water from the River Murray, with desalination as the least preferred option. Although the order of preferences for each option was the same for non-potable and potable uses, the level of support for each option was significantly different between the non-potable and potable use groups ($\chi^2 = 12.27$, $df = 2$, $N = 1218$, $p = .002$). Table 5 shows that more people from the non-potable group chose desalination as their most preferred option than people from the potable group. More people from the potable group chose treated stormwater as their most preferred option than people from the non-potable group.

Table 5 Most preferred option for increasing Adelaide's future water supply

Treated stormwater use	Taking more River Murray water	Desalination	Treated Stormwater
Non-potable use	22.2%	17.7%	60.1%
Potable use	23.1%	10.7%	66.1%
Total	22.7%	14.2%	63.1%

Note: Non-potable use n = 604, Potable use *n* = 614, Total *N* = 1218

Decisions for choosing the most preferred option for increasing Adelaide's future water supply appeared to be based around the source of the water for most respondents, followed by the cost of the water, and finally the energy requirements. The underlying reason for choosing their preference was statistically different between the non-potable and potable groups ($\chi^2 = 27.79$, $df = 2$, $N = 1218$, $p < .001$). Table 6 shows that for *non-potable* uses, decisions were based most on the cost of the water and the source of the water, with fewest people basing their decision on energy requirements. For *potable* uses, decisions were based most on the source of the water, and least on both the cost of the water to produce and the energy requirements. The cost required to produce the water was a more common reason for decision making in the non-potable use group than in the potable use group. This could reflect the value perception of non-potable water as 'inferior' water that should cost less (Mankad et al., 2013).

Table 6 Most important factor underpinning preference for ways to increase Adelaide's future water supply

Treated stormwater use	Source of the water	Cost of the water to produce	Energy requirements
Non-potable use	40.2%	41.7%	18.0%
Potable use	45.8%	28.0%	26.2%
Total	43.0%	34.8%	22.2%

Note: Non-potable use n = 604, Potable use *n* = 614, Total *N* = 1218

4.5. Willingness to pay for treated stormwater: non-potable and potable use

Results indicated that almost 50% of respondents preferred to pay the same as they were currently paying for the use of treated stormwater for either non-potable or potable purposes. Although 15% of respondents were prepared to pay a little more than current prices, 35% preferred to pay a little less than current prices. There was no statistically significant difference between the non-potable and potable groups ($\chi^2 = 1.749$, $df = 2$, $N = 1218$, $p = .417$). Results are displayed in Table 7.

Table 7 Willingness to pay for treated stormwater: non-potable and potable uses

Treated stormwater use	the same as*	a little more than*	a little less than*
Non-potable use	47.5%	15.7%	36.8%
Potable use	51.3%	14.5%	34.2%
Total	49.4%	15.1%	35.5%

Note: Non-potable use n = 604, Potable use *n* = 614, Total *N* = 1218
* Comparison refers to current price of water

4.6. Effect of proposed use on acceptance and policy-related perceptions: Non-potable & potable uses

On average respondents' levels of acceptance were high for non-potable and potable uses of treated stormwater ($M = 4.41$ and $M = 3.86$ respectively, on a scale of 1 to 5). Only 4% of the respondents from the non-potable group did not support the use of stormwater for non-drinking purposes, and only 15% from the potable group didn't support it for drinking purposes. The remainder of respondents supported the use of stormwater to some degree.

A multivariate analysis of variance (MANOVA) was used to examine the effect of two different proposed uses of the treated stormwater (non-potable and potable uses) on acceptance and five policy-related factors: perceptions of fairness and effectiveness; perceptions of trust in authorities to provide safe and reliable water; and the importance of safety assurances and communication activities. Findings showed that there was a significant effect of the proposed type of use (non-potable or potable) on the combined dependent variables, F (6, 1207) = 32.173, $p < .001$, partial $\eta^2 = .14$. Analysis of the individual dependent variables showed that the effect of the proposed use was statistically significant on all the variables, at a Bonferroni adjusted alpha level of 0.008.

Acceptance levels were higher for non-potable use than potable, which supports past research on acceptance of alternative water. Perceptions of fairness and effectiveness were also higher for non-potable use than potable use, suggesting that distributing non-potable water via a mains water supply and third pipe system is a way to ensure equal and effective access to non-potable water in the eyes of the community. For people in Adelaide, there is currently unequal access to non-potable water because a resident either needs a rainwater tank, access to a groundwater bore, or access to a third pipe system as a resident of a new housing development. Therefore, the proposed non-potable scheme, where all homes would receive a 3rd-pipe connection, would seem fair and effective as a way to access and utilise stormwater. Trust in authorities to safely and reliably provide non-potable water was higher than for potable water. The importance of safety assurances (e.g. regular auditing and regulation of water systems) and communication activities (e.g. information on stormwater treatment and use in the media) were higher when the proposed use was for potable than non-potable uses. Group means for each dependent variable and between group statistics are presented in Table 8.

Participants also indicated their level of agreement to the statement "I have no preference for water security assurances as long as the water is safe to drink". Average scores suggest that people showed moderate-high agreement with this statement (potable 63%, non-potable 67%). Results showed no significant difference between potable and non-potable group responses for this statement (M = 3.36 and M = 3.45, respectively; t (1216) = 1.20, p = .231).

Table 8 Mean scores and between group statistics for non-potable and potable use

Variable	***Non-potable use M (SD)***	***Potable use M (SD)***	***F*** (*df* = 1,1212)
Acceptance	4.41 (0.82)	3.86 (1.09)	98.58***
Perceived Fairness	4.34 (0.78)	4.11 (0.83)	23.48***
Perceived effectiveness	4.46 (0.81)	4.24 (0.89)	21.33***
Trust in authorities to provide	3.97 (0.97)	3.71 (1.12)	18.09***
Importance of safety assurances	4.25 (0.66)	4.46 (0.54)	36.16***
Importance of communication activities	3.59 (0.83)	3.74 (0.82)	10.07**

Note: *$p < .05$, **$p < .01$, ***$p < .001$. Higher mean scores indicate a higher level (5 pt scale);
Non-potable use n = 604, Potable use n = 614

In relation to safety assurances, most of the individual safety activities were perceived as very important (mean scores ranging from M = 4.12 to M = 4.76, on a scale of 1 = 'not important at all' to 5 = 'extremely important'), with local council management of stormwater quality viewed as the least important compared to other activities (*M* = 3.52). In relation to communication activities, the two activities perceived as the most important were information on stormwater treatment presented in newspapers, radio and television, and education programs in school. The communication activities viewed as the least important were visits to stormwater collection and treatment facilities and a visitor's centre. Tables 9 and 10 display the results of the individual items.

Table 9 Mean scores for level of importance of safety assurances (individual items) for non-potable and potable use options

Variable	*Non-potable use M (SD)*	*Potable use M (SD)*
All (*drinking* / *non-drinking*) water schemes must strictly adhere to Australian ....Water Guidelines by law	4.52 (0.72)	4.76 (0.56)
Regular auditing and regulation of water	4.48 (0.72)	4.71 (0.57)
Results of water quality tests available to the public (e.g. displayed on a water quality website)	4.43 (0.76)	4.60 (0.69)
Independent review of water quality by SA Health	4.42 (0.79)	4.66 (0.66)
Stormwater quality managed by SA Water	4.12 (0.97)	4.34 (0.87)
Stormwater quality managed by your local council	3.52 (1.18)	3.68 (1.21)
I have no preference, as long as the water is safe to drink	3.45 (1.30)	3.36 (1.33)

Note: Higher mean scores indicate a higher level of importance (5 pt scale);
Non-potable use n = 604, Potable use *n* = 614

Table 10 Mean scores for level of importance of communication activities (individual items) for non-potable and potable use options

Variable	*Non-potable use M (SD)*	*Potable use M (SD)*
Information on stormwater treatment and use in newspapers/radio/TV	3.93 (0.94)	4.07 (0.93)
Education programs in schools	3.86 (0.97)	4.01 (0.95)
Public talks by water experts with "Question & Answer" sessions	3.58 (1.04)	3.79 (0.99)
A visitor's centre at a stormwater collection or treatment facility	3.30 (1.14)	3.43 (1.13)
Open days to visit stormwater collection and treatment facilities	3.26 (1.10)	3.39 (1.11)

Note: Higher mean scores indicate a higher level of importance (5 pt scale);
Non-potable use n = 604, Potable use *n* = 614

4.7. Effect of information framing on acceptance and policy-related perceptions: Generic, environmental, and safety information

A multivariate analysis of variance (MANOVA) was used to examine the effect of three different types of explanatory information (generic, environmental, and safety) on six policy-related factors: acceptance, perceptions of fairness and effectiveness, perceptions of trust in authorities to provide safe and reliable water (potable or non-potable), and the importance of safety assurances, and communication activities. Findings showed that there was no significant difference between the three information groups for any of the dependent variables, F (12, 2416) = 1.114, p = .343, partial η^2 = .006. Group means for each dependent variable are presented in Table 9.

Acceptance levels, perceptions of fairness, perceptions of effectiveness, levels of trust in water authorities, the importance of safety assurances, and the importance of communication activities were of similar levels irrespective of the type of explanatory information provided.

Table 11 Mean scores for different types of explanatory information

Variable	***Generic information M***	***Environmental information M***	**Safety information *M***
Acceptance	4.16 (0.96)	4.13 (1.04)	4.12 (1.02)
Perceived Fairness	4.23 (0.80)	4.20 (0.85)	4.25 (0.79)
Perceived effectiveness	4.34 (0.83)	4.38 (0.89)	4.34 (0.87)
Trust in authorities to provide	3.88 (1.01)	3.83 (1.08)	3.81 (1.08)
Importance of safety assurances	4.37 (0.60)	4.32 (0.65)	4.37 (0.89)
Importance of communication activities	3.65 (0.84)	3.66 (0.83)	3.69 (0.82)

Note: Higher mean scores indicate a higher level (5 pt scale); N generic information = 408, N Environmental information = 408, N safety information = 402

To test for any interaction effects between the proposed use of stormwater (non-potable and potable) and the type of explanatory information that was provided (generic, environmental, safety) on acceptance, perceptions of fairness and effectiveness, perceptions of trust in authorities, and the importance of safety assurances and communication activities a multivariate analysis of variance (MANOVA) was conducted. Results indicated there were no interaction effects between proposed use of treated stormwater and type of information provided, F (12, 2416) = 1.58, p = .09, η^2 = .008. Thus, the information framing had no influence on acceptance, or perceptions of policy factors in either the potable or non-potable situation. This also means that the differences in acceptance levels and perceptions of policy related factors that were found between the non-potable and potable uses (Section 3.6) were not dependent on whether generic, safety, or environmental types of information were provided.

3.7.1 Manipulation check: Information framing

Two manipulation check questions were analysed using MANOVA to check for differences in the way the different types of explanatory information were perceived between the three groups. The MANOVA was statistically non-significant, F (4, 2424) = 1.132, p = .340, $\eta 2$ = .002, indicating no meaningful differences existed in how the different types of explanatory information were perceived. Respondents perceived similar potential for negative environmental impacts among the three different types of explanatory information. Also, they perceived the potential for the provision of safe, high-quality water similarly among the different information frames. The mean scores for both manipulation check questions for each type of explanatory information are presented in Table 12.

Table 12 Manipulation checks for three types of information framing

Manipulation checks	*Generic information M (SD)*	*Environmental information M (SD)*	Safety information *M (SD)*
1. Environmental check	3.68 (1.19)	3.60 (1.33)	3.51 (1.32)
2. Safety check	3.65 (1.04)	3.65 (1.05)	3.72 (1.03)

Note: Higher mean scores indicate a higher level (5 pt scale); generic information n = 408, environmental information n = 408, safety information n = 402

4.8. Predicting acceptance of stormwater from type of use and policy related factors

To assess the extent to which acceptance for stormwater could be explained by type of use and policy factors, a hierarchical multiple regression was conducted using the total sample of participants. Type of use was entered into the regression as a predictor variable in the first step, followed by the five policy related factors in the second step. The descriptive statistics for mean scores and bivariate correlation for acceptance and the five policy-related predictor variables are presented in Appendix E.

Results of the final model demonstrated that in combination type of use and the policy related factors accounted for 76% of the variance in acceptance of stormwater, R^2 = .76, adjusted R^2 = .76, F (6, 1211) = 653.76, p < .001. Type of use and four policy related factors were significant predictors of acceptance at the alpha = .05 level. The most important variables were perceptions of fairness, perceptions of trust in water authorities, perceptions of effectiveness, and type of use. Communication activities were not a statistically significant predictor of acceptance. Standardised coefficients for each of the policy-related variables are reported in Table 13.

Table 13 Hierarchical regression analysis: Final model for predicting acceptance from policy related factors and type of use

Policy related factors	R^2	ΔR^2	Final model β
Step 1	.07***	.07***	
Type of use			**.14*** **
Step 2	.76***	.69***	
Perceptions of fairness			**.42*** **
Perceptions of trust			**.29*** **
Perceptions of effectiveness			**.24*** **
Importance of safety assurances			-.051**
Importance of communication activities			-.026

Note: β = standardised regression coefficient; *p < .05, **p < .01, ***p < .001; N = 1218;

4.9. Effect of type of use on psychological variables

To examine the effect of the two different proposed uses of the treated stormwater (non-potable and potable uses) on the psychological variables a multivariate analysis of variance (MANOVA) was conducted. Findings showed that there was a significant effect of the proposed type of use on the combined dependent variables, F (4, 1209) = 30.988, $p < .001$, partial $\eta^2 = .09$. Analysis of the individual dependent variables showed that the effect of the proposed use was statistically significant on all the variables at a Bonferroni adjusted alpha level of.0125.

Attitudes towards the proposed use of the treated stormwater were more favourable when the proposed purpose was for non-potable uses than for potable uses. Participants also indicated a stronger sense of moral obligation (personal norm) to use treated stormwater when the purpose was for non-potable than potable purposes. There was also a higher belief that the wider community would use treated stormwater for non-potable purposes than for potable purposes (descriptive norms). Finally, as previously described in Section 3.6, levels of acceptance were higher when the proposed use was for non-potable than potable purposes. Group means for each variable and between group statistics are presented in Table 14.

Table 14 Means scores and between group statistics for psychological variables by non-potable and potable use

Variable	***Non-potable use M (SD)***	***Potable use M (SD)***	***F*** (df = 1,1212)
Acceptance	4.41 (0.82)	3.86 (1.09)	98.58***
Attitude towards stormwater	4.16 (0.71)	3.81 (0.86)	59.19***
Personal norms	4.18 (0.92)	3.77 (1.09)	51.15***
Descriptive norms	4.22 (0.81)	3.68 (0.95)	89.66***

Note: *$p < .05$, **$p < .01$, ***$p < .001$. Higher mean scores indicate a higher level (5 pt scale);
Non-potable use n = 604, Potable use n = 614

4.10. Effect of information framing on psychological variables

To examine the effect of the three different information frames on the psychological variables a multivariate analysis of variance (MANOVA) was conducted. Findings showed that there was no statistically significant effect of information framing on the combined dependent variables, F (8, 2420) = 1.603, p = .119, partial $\eta^2 = .005$. Group means for each dependent variable are presented in Table 15. This suggests that people interpreted the “information” and “safety” framing manipulations similarly to the “generic” (control) information framing; thus, the additional information provided in the information and safety manipulations was not any more effective in influencing attitudes and norms towards stormwater than the control version.

Acceptance levels, attitudes towards stormwater, a sense of personal obligation, and a belief regarding the use of stormwater within the wider community were of similar levels irrespective of the type of explanatory information provided.

Table 15 Means scores for psychological variables by different types of explanatory information

Variable	*Generic information M*	*Environmental information M*	Safety information *M*
Acceptance	4.16 (0.96)	4.13 (1.04)	4.12 (1.02)
Attitude towards stormwater	4.00 (0.79)	3.97 (0.80)	3.98 (0.84)
Personal norm	3.99 (0.99)	3.98 (1.07)	3.96 (1.03)
Descriptive norm	3.90 (0.93)	3.99 (0.94)	3.94 (0.91)

Note: Higher mean scores indicate a higher level (5 pt scale); N generic information = 408, N Environmental information = 408, N safety information = 402

4.11. Predicting acceptance of stormwater from type of use and psychological factors

To examine the extent to which the type of use and the psychological factors explained acceptance of stormwater a hierarchical regression was conducted on the total sample of participants. The descriptive statistics indicated that on average, acceptance levels for treated stormwater were high, and respondents reported they had favourable attitudes towards the use of stormwater. Respondents also indicated high levels of concern for the long term security of Adelaide's water, the importance of water as a resource, and the importance of not wasting water. A personal sense of moral obligation to use treated stormwater, and a belief that others in the wider community would also support the use of treated stormwater were also high. The mean scores and bivariate correlation descriptives for the seven psychological predictor variables are displayed in Table 16.

Table 16 Descriptive statistics (means and bivariate correlations) for psychological predictor variables

	Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1	Acceptance	4.13	1.00	**.83**^{r}							
2	Attitude towards stormwater	3.98	0.81	.77	**.92**^{a}						
3	Attitude towards waste	4.48	0.63	.33	.36	**.81**^{a}					
4	Value of water beliefs	4.52	0.54	.26	.30	.70	**.68**^{a}				
5	Water security beliefs	4.69	0.55	.37	.38	.74	.75	**.88**^{a}			
6	Proenvironmental beliefs	3.93	0.82	.13	.18	.44	.36	.42	**.85**^{a}		
7	Descriptive norms	3.94	0.92	.84	.72	.32	.29	.36	.11	**.94**^{a}	
8	Personal norms	3.97	1.03	.81	.71	.39	.27	.35	.22	.76	**.90**^{a}

Note: Higher mean scores indicate a higher level (5 pt scale); N = 1218; All correlations are significant at $p < .001$; Bold face = reliability statistics, ^{r} = Pearson's r for two items measures; ^{a} = Cronbach's alpha for multiple item measures

A hierarchical regression analysis was conducted to assess the extent to which acceptance for stormwater could be predicted by seven psychological variables: attitudes towards stormwater, attitudes towards waste, beliefs about the value of water, beliefs about water security, general pro-environmental beliefs, perceived normative pressure (descriptive norms), and a sense of moral obligation (personal norms). Type of use was entered in the first step of the regression to evaluate the importance of proposed use in explaining acceptance. The seven psychological variables were entered in the second step.

Results of the final model demonstrated that in combination the psychological variables and type of use accounted for 81% of the variance in acceptance of stormwater, $R^2 = .81$, adjusted $R^2 = .81$, F (8, 1209) = 639.274, $p < .001$. Type of use and six of the psychological variables were significant predictors of acceptance at the alpha=.05 level. The most important variables were descriptive norms, personal norms, attitudes towards stormwater, and water security beliefs. Standardised coefficients for each of the psychological variables are reported in Table 17.

Table 17 Hierarchical regression analysis: Final model for predicting acceptance from psychological variables and type of use

Psychological variable	R^2	ΔR^2	Final model β
Step 1	.07***	.07***	
Type of use			.03*
Step 2	.81***	.74***	
Descriptive norms			**.42*****
Personal norms			**.33*****
Attitude towards stormwater			**.23*****
Water security beliefs			**.09*****
Proenvironmental beliefs			-.04**
Water value beliefs			-.04*
Attitude towards waste			-.03

Note: β = standardised regression coefficient, *$p < .05$, **$p < .01$, ***$p < .001$; $N = 1218$

4.12. Predicting acceptance of stormwater: type of use, knowledge levels, policy related factors, and psychological variables

A hierarchical regression analysis was conducted to assess the extent to which acceptance for stormwater could be explained by type of use, knowledge levels, policy related factors and psychological variables. A hierarchical regression method was also able to determine the extent to which the psychological variables explain acceptance beyond the other factors. Type of use was entered in the first step of the regression and explained 7% of variance, and the two knowledge levels in the second step, contributing to an additional 7% in explained variance. The five policy related factors (perceptions of fairness and effectiveness, trust in water authorities, and importance of safety assurances and communication activities) were entered in the third step providing 62% additional variance, and the seven psychological factors in the final step, adding a further 8% in explained variance.

Results of the final model demonstrated that, in combination, type of use, knowledge levels, policy related factors, and psychological variables explained 84% of the variance in acceptance of stormwater, $R^2 = .84$, adjusted $R^2 = .84$, F (15, 1202) = 425.78, $p < .001$. Type of use, knowledge of more common terms, all five policy-related factors, and four of the psychological variables were significant predictors of acceptance at the alpha < .05 level. The psychological variables increased the explained variance in acceptance by 8 % beyond the other factors, $\Delta R^2 = .08$, ΔF (7, 1204) = 83.027, $p < .001$. The most important variables in the final model were descriptive norms, personal norms, perceptions of fairness, attitudes towards stormwater, trust in authorities, and perceptions of effectiveness. Standardised coefficients for each of the variables are reported in Table 18.

Table 18 Hierarchical regression analysis: Final model for predicting acceptance from type of use, knowledge levels, policy related factors, and psychological variables

Policy related factors	R^2	ΔR^2	Final model β
Step 1 Type of use	.07***	.07***	
Type of use			**.05*** **
Step 2 Knowledge	.14***	.07***	
Knowledge of more common terms			**.04***
Knowledge of less common terms			-.02
Step 3 Policy related factors	.76***	.62***	
Perceptions of fairness			**.16*** **
Perceptions of effectiveness			**.12*** **
Perceptions of trust			**.12*** **
Importance of communication activities			-.04**
Importance of safety assurances			-.03*
Step 4 Psychological variables	.84***	.08***	
Descriptive norms			**.28*** **
Personal norms			**.22*** **
Attitude towards stormwater			**.14*** **
Attitude towards waste			-.04*
Water security beliefs			.04
Pro-environmental beliefs			-.01
Water value beliefs			-.02

Note: β = standardised regression coefficient, *$p < .05$, **$p < .01$, ***$p < .001$; $N = 1218$;

4.13. Comparison between the 2011 and 2013 surveys

There were several questions which were common to the 2011 and 2013 surveys. The 14 questions about the importance of various water sources in drought and non-drought conditions (Section 3.3) and the questions related to personal and descriptive norms for potable and non-potable uses (see Table 19).

Table 19 Water sources for which the rating of its importance changed significantly between 2011 and 2013

Water sources for which the importance rating changed significantly	*t*	Effect size	Mean Difference^
Non-drought conditions			
River Murray water	4.61***	.01	.194
Desalinated water	5.10***	.01	.240
Rainwater options	3.15**	<.01	.113
Groundwater options	-3.25**	<.01	-.133
Drought conditions			
Desalinated water	2.82**	<.01	.128
Rainwater options	4.74***	.01	.170
Groundwater options	-2.79**	<.01	-.117

Note: *$p < .05$, **$p < .005$, ***$p < .0005$. N = 2259; ^ a positive result indicates higher in 2013 compared to 2011

Two sample t-tests comparing the 2011 survey and 2013 survey revealed that in non-drought conditions, respondents in 2013 thought it was *more important* to rely on Murray river, Desalinated water and Rainwater and *less important* to rely on groundwater (see Table 19). In drought conditions, respondents in 2013 thought it was more important to rely on Desalinated water and Rainwater and less important to rely on groundwater. There were no significant differences for Mt. Lofty Ranges water, Stormwater or Recycled water in either drought or non-drought conditions. However, all the effect sizes were very small indicating that there was very little change (where .01 small, .06 medium, .14 large; Cohen, 1988).

Table 20 Comparison of Personal Norms and Descriptive Norms for 2011 and 2013

Support for using stormwater	Survey Year	N	Mean	Std. Deviation	*F*	Eta Sq
	2011 1043	**2013^**				
Personal support for non-potable use	2011	1043	3.93	1.17		
	2013	604	4.34	0.91	52.28***	.03
Community support for non-potable use	2011	1043	3.67	1.08		
	2013	604	4.18	.85	99.86***	.06
Personal support for potable use	2011	1043	3.53	1.21		
	2013	614	3.83	1.15	24.40***	.01
Community support for potable use	2011	1043	3.21	1.01		
	2013	614	3.61	1.00	62.41***	.04

Note: *$p < .05$, **$p < .005$, *** $p<.0005$ ^N = 604 non-potable use, N = 614 potable use

The ANOVAs comparing items related to personal norms and descriptive norms showed a significantly more positive attitude to stormwater use in 2013 than 2011 (see Table 20). There was a moderate effect size for the increase in perceived support for non-potable option by the community/ people of Adelaide but the other effects sizes were small (where .01 small, .06 medium, .14 large; Cohen 1988). Therefore it seems that there has been an increase in belief that the people of Adelaide support using treated stormwater for non-potable uses.

[*Note:* there was a slight difference between the two surveys; in 2011 the term “community” was used but in 2013 the more precise term “people of Adelaide” was used, but it seems unlikely that this slight difference in wording would increase support for that option in 2013]

5. Discussion and Implications

The present study extends Stages 1 and 2 of the MARSUO social analysis (Alexander, et al., 2011; Mankad et al., 2013) and quantitatively explores dimensions of public acceptance of managed aquifer recharge (MAR) of stormwater. This was achieved through examining the influence of type of stormwater use (potable/non-potable) and type of informational framing (generic, environmental, safety), on psychological and policy-related variables (see Appendix C for full list).

The aim of the study was to understand community perceptions and acceptance of treated stormwater; eight research questions guided the study. Overall, the level of acceptance for stormwater was very high, and acceptance for non-potable uses was higher than for potable uses. However, acceptance varied with respect to descriptive and personal norms, perceptions of fairness, perceptions of trust, perceived effectiveness, attitudes towards stormwater, type of intended use, and knowledge.

5.1. Type of use

Acceptance for the two different types of uses for treated stormwater – potable and non-potable – was interesting. Basic preferences indicated that non-potable use of treated stormwater was significantly more preferred than potable use, but importantly, both types of use were highly accepted. Across issues such as willingness to pay, people were not willing to pay more to received treated stormwater for non-potable uses, likely because of its perceived inferiority (see analysis by Mankad et al., 2013). When asked about water source preferences for Adelaide's future water supply, given a choice of using treated stormwater, desalinated water and additional water purchased from the River Murray, it was clear that participants believed treated stormwater to be more acceptable than the other options for both potable and non-potable uses. Further, participants trusted authorities to safely deliver both options to households and indicated a strong preference that *all* proposed treated stormwater schemes adhere to Australian water safety guidelines. The public also indicated that disseminating information about treated stormwater options via media outlets (e.g. newspapers, radio, TV) would be important to acceptance.

When examining 'type of use' as a predictor of acceptance for stormwater, it was found to be relatively weak when compared to the predictive influences of psychological and policy-related factors on acceptance. An interpretation of these results suggest that while type of use for stormwater can predict acceptance, there are other more dominant factors that can explain acceptance beyond that which can be explained by the simple potable/non-potable distinction (as discussed in Sections 4.3 and 4.4).

5.2. Information and knowledge

Almost all participants were happy to support the use of treated stormwater via MAR for non-potable applications, as they perceived it to be an effective, fair and safe means of water reuse. Most people were also willing to drink treated stormwater using MAR, however, their primary concerns were related to safety assurances. This is consistent with past research that has shown a need for greater risk management as the proposed human contact with treated water increases (see Mankad & Tapsuwan, 2011 for a review of relevant literature). It is interesting to note that participants did not need a high level of detail regarding an explanation of the MAR of stormwater process when considering acceptance of stormwater. There was no significant difference in levels of acceptance between those with more detailed information (i.e. environmental and safety informational frames) and those who received very basic information (i.e. generic informational frame). Further, the manipulation check showed that participants did not interpret the varied information (safety vs. environmental) differently when considering acceptance. Each version was perceived as promoting either safety or environmental issues similarly. This suggests that participants either did not read the accompanying narrative and only focused on the diagram, *or* the information provided in the narrative did not influence participants in any particular way.

The results from the information framing experiment have useful implications for future public campaigns and communication research. These findings suggest that on average, people may not be particularly interested in detailed information provided to them regarding a stormwater initiative, rather, they may respond similarly to less detailed information. This complements earlier findings by Mankad et al (2013), where participants indicated that while they wanted to stay informed about water initiatives through the provision of factual information, they did not want too much technical information from water authorities and the government, and were only interested in a broad level of detail. Communications designed to inform the public could, therefore, aim to provide simple factual messages highlighting key benefits to citizens.

For those that require a greater level of detailed information in order to be reassured of safety and environmental concerns, a website providing this type of information could be useful. A website allows an individual to interact with the topic, and for information to more easily be tailored to meet individual needs. However, it is also important to consider a limitation of the present study, where only print media was used to convey the explanatory information. Other forms of presentation, such as film, animation, a wider use of colour and graphics could have created differences in perceptions of safety and environmental benefits and therefore potentially different acceptance levels. Therefore, we are unable to conclude that more detailed information, provided in other forms (e.g. by a professional advertiser), may not get a different result.

5.3. Psychological variables

Results indicated that four main psychological factors underpinned acceptance of treated stormwater. The issue of securing Adelaide's future water supply was a topic of concern among participants. Many responded according to social and moral obligations when considering using treated stormwater, rather than the perceived alternative of wasting it. The influence of psychological variables explained 81% of the reasoning behind people's acceptance of stormwater, which is a large percentage of explanatory power in psychological science. Consequently, we can be reasonably confident that descriptive norms, personal norms, attitudes towards stormwater and water security beliefs are important to the majority of Adelaide citizens, and not just the present sub-sample of respondents.

The strongest contributors to this explanation of acceptance were descriptive norms, which are beliefs about the actions and attitudes of relevant others. In the present context, perceptions of whether family, friends, neighbours and people of Adelaide would support the use of treated stormwater seemed to positively influence individual acceptance. Further, support for such norms had increased from the 2011 survey. Therefore, the influence of others' behaviours was found to significantly impact whether people respond favourably to using stormwater or not. Personal norms, or moral obligations, were found to be the second largest contributor of acceptance. This indicates that people in Adelaide inherently value their water supply and feel the need to contribute to future water security by being open to the idea of using stormwater as an alternative water source. This was further demonstrated by the importance of water security beliefs in predicting acceptance.

The literature suggests that previous experiences contribute to the development of such beliefs and with respect to Adelaide. This view could relate to previous experiences of drought and water shortages, and the concern for future climate variability. Interestingly, although water value beliefs and pro-environmental beliefs did not emerge as unique psychological contributors in the present study, individual item scores were high. Therefore, a potential explanation for the insignificance of water value and pro-environmental attitudes is that they are likely underpinning personal normative beliefs in some way, and are contributing to acceptance indirectly.

Participants' attitudes towards stormwater also contributed highly to acceptance, behind the influence of norms. Most people felt that using stormwater through MAR was a good thing to do and believed it to be a beneficial, valuable and wise endeavour. Type of use (potable and non-potable) was found to be a significant but small predictor of acceptance when acceptance was analysed through the lens of psychological factors, suggesting that the importance of descriptive norms, personal norms, attitudes towards stormwater, and water security beliefs are relevant to both potable and non-potable situations. Acknowledging the important role of psychological factors in stormwater acceptance can contribute to improved public campaigns for those intending to inform communities about future stormwater initiatives. Communication activities could be framed so that they appeal to people's inherent attitudes and normative values associated with water, and emphasise that stormwater initiatives are important to future water security (e.g. beneficial, valuable, and wise). It would also be advantageous to highlight the stated acceptance of stormwater by others in the wider community (i.e. promote a perception of what others might be thinking), as well as endorsing stormwater with a pro-social message that might appeal to a person's sense of value, for example, utilising alternative water sources as a way to drought proof the region, or to benefit the citizens of Adelaide.

5.4. Policy-related factors

While policy-related factors did not explain the acceptance of stormwater to the same extent as the psychological variables did, the model still explained 76% of the reasoning behind people's acceptance of stormwater. This, again, is considered a large amount of explanatory power. The contribution of three key policy factors was found to be important: fairness, trust, and effectiveness. Perceptions of trust and fairness regarding proposed treatment and distribution of stormwater using MAR were higher in the non-potable situation than the potable situation. This is consistent with past research (e.g. Mankad & Tapsuwan, 2011; Stenekes, et al., 2006; Wu, et al., 2012), which shows that public trust in authorities to provide drinking quality water is usually lower than if the water was to be used for non-potable applications such as laundry, toilet and outdoors uses. Fairness, the largest contributor to acceptance, was higher among the non-potable group, which counters findings in Mankad et al (2013) previous analysis. Mankad et al (2013) showed that a proposal for delivering treated stormwater via 3rd-pipe distribution was perceived as unfair, because only new homes would have access to a 3rd-pipe network. However, in the present study, the 3rd-pipe proposal was not presented with this differentiation and respondents may have interpreted this as though all Adelaide residents would receive a 3rd-pipe installation (new or retrofitted), instead of only residents in new housing developments. This perception of more equitable distribution of treated stormwater elicited favourable attitudes towards a 3rd-pipe initiative in the present study. This importantly suggests that policy developed for a future 3rd-pipe initiative must be perceived by the public as equitable, to promote public acceptance.

While the influence of safety assurances and communication activities was not found to be statistically significant factors in explaining acceptance of MAR of stormwater, item scores showed that participants did perceive proposed safety assurances as important. These assurances included adherence to relevant Australian water guidelines, regular auditing of water systems, water quality test results available to the public, independent reviews of water quality and overall water governance by SA Water. When asked whether they could simply trust authorities to provide 'safe' water without any preference for security assurances, most participants responded favourably to this notion. Therefore, for many people, it may not be important to them to know the specific processes involved in ensuring safety of treated stormwater and they are satisfied if told that guidelines have been met. This may reflect participants' trust in the existing water supplier and the health regulators currently managing Adelaide's water supplies.

Participants felt that key communication activities designed to engage the public on the topic of stormwater use would be best achieved through the presentation of simple facts disseminated via popular media outlets (e.g. newspapers, radio, television). Participants were also quite favourable towards the idea of teaching children about MAR of stormwater through school education programs. School education programs have the benefit of familiarising the next generation of homeowners with alternative household water options, thus normalising stormwater as a reusable water source.

There are clear policy implications that can be derived from the influence of fairness, effectiveness and trust on acceptance. Results highlight the need to develop stormwater use guidelines that take into consideration the importance of public trust in water providers, provide strategies and contingencies for the equitable household distribution of treated stormwater, and emphasise the effectiveness of stormwater in addressing water security. Given the individual importance of safety assurances found in the present study, and the importance of procedural justice which emerged in Mankad et al's (2013) qualitative analysis, this suggests communication activities which engage and consult the public could be pursued, however, with a broad level of detail. Events such as public talks by water experts and information transmitted via media outlets can work to educate the public about MAR of stormwater, and allow the public an opportunity to engage if they so choose.

5.5. Limitations

A major limitation of this study is the narrow generalisability of results to other urban water contexts. The use of MAR of stormwater to supplement an urban water supply is restricted to other urban areas with the same extensive aquifer network that is unique to the Adelaide context. Other cities that consider the use of treated stormwater to supplement the centralised water supply would need to consider alternatives for the treatment and preliminary storage of stormwater that, in the present context, is provided by the underground aquifers. This would, in turn, influence social perceptions of the water treatment process and potentially impact overall acceptability. Further, this study examined intentions to accept a proposed MAR of stormwater scheme and, as previous psychological research has consistently cautioned, intentions are no guarantee of future adoption behaviour. Therefore, results should be interpreted as a reflection of what factors are important to people when deciding to adopt a novel technology such as MAR of stormwater, rather than a prescriptive response of how the public will react to receiving a supply of treated stormwater in the future. Another important topic that was not covered in this survey was people's understanding of the range of risks that need to be managed in the reuse of stormwater. The interpretation of people's 'willingness to pay' for treated stormwater in this study is also limited in that willingness to pay was measured using a single attitudinal item. An extension of these results could be carried out by economists to develop a more definitive understanding of how much people would be willing to pay for treated stormwater in real terms.

Finally, another important limitation of this research was the inability of the information framing manipulation used in the survey to identify any effects of environmental and safety information. It is thought that perhaps stronger, more emphatic, language associated with the information framing content could elicit more distinctive results regarding what type of information is more important to the community when considering an alternative water source. However, the lack of significant differences between the information framing manipulations is, in itself, and important finding (as discussed in Section 4.2).

6. Conclusions

This study builds upon previous research by quantitatively measuring the influence of psychological and policy-related factors on the acceptance of MAR of stormwater. Two stormwater options were presented to the public (potable and non-potable) and participants indicated that both proposed schemes were highly acceptable, with the 3rd-pipe proposal slightly more acceptable and the proposed potable scheme as slightly more unacceptable. This is aligned with past research and is likely to have occurred because it entails less human contact with treated stormwater than a potable scheme would involve.

Key policy-related factors were important in explaining acceptance: perceptions of fairness, trust in water authorities to provide safe and reliable water, perceptions of effectiveness as a solution for securing a long term water supply, and the type of proposed use of the stormwater. When people perceive the policy to be fairer, the authorities to be more trustworthy, and stormwater to be an effective solution to water security, the more they accept treated stormwater. Moreover, when the proposed use of treated stormwater is for non-potable purposes, people are more accepting.

Psychological factors were found to significantly contribute to acceptance of treated stormwater. Acceptance was influenced by norms associated with social pressure and moral obligation, personal attitudes to stormwater and water security. If a person believed that others in the wider community would use treated stormwater (descriptive norm), they had a sense of moral obligation towards using stormwater, they had favourable attitudes towards the benefits of stormwater, and they had concern for the long term security of the region’s water, the more accepting they were of stormwater.

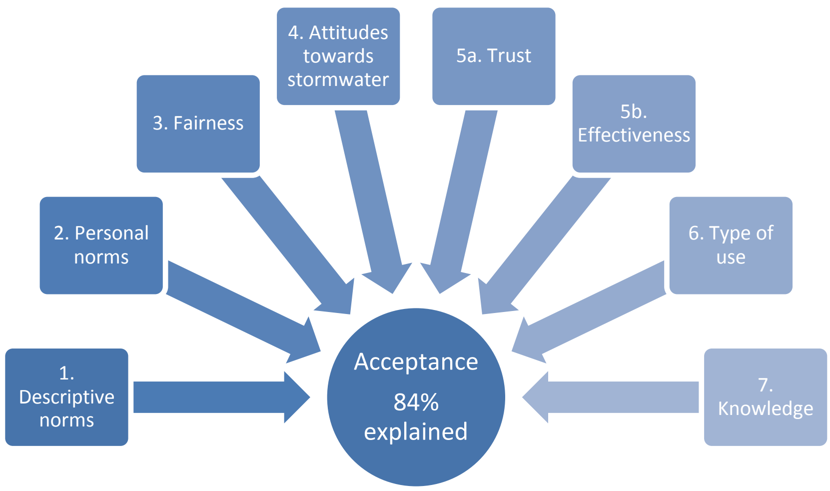

Figure 4 Illustration of factors contributing to acceptance of stormwater, ordered by relative importance

Overall, the psychological variables and policy-related factors explained 84% of acceptance for stormwater (Figure 4; see Table 2 and Appendix D for a description of scales and items). Psychological factors explained an extra 8% of acceptance, over and above that explained by policy-related factors. This suggests that in addition to ensuring policies are perceived as fair and effective, and that there are high levels of trust in the water authorities that manage treated stormwater, there is added benefit in addressing the psychological components. Interventions that address social and moral norms, as well as attitudes towards the benefits of stormwater, and the long term security of the region's water supply could be useful and suggest areas for future policy-related research.

Participants also indicated a preference for stormwater over other alternative water options, namely desalination and purchasing more water from the River Murray, for future water supply augmentation. However, participants were not willing to pay more for stormwater, particularly if it was of non-potable quality. Finally, participants did not respond differently when varying levels of information was provided to them, regarding safety and environmental processes involved in the treatment and distribution of stormwater; rather, it seems that they were satisfied to make preferential decisions with minimal factual information. Moreover, knowledge of more common terms appeared to contribute to acceptance of stormwater via MAR, suggesting familiarity with certain basic concepts may contribute to increased acceptance but a high degree of technical knowledge is not needed.

It is also important to note that while direct acceptance for non-potable stormwater was higher than for potable stormwater, an examination of participants' responses to key indicators of acceptance such as willingness to pay, costs to produce the water, and relative energy requirements, suggest that the preference for non-potable stormwater may be moderated by these factors. In the present study, when taking into account all relevant information, the use of treated stormwater for *potable* applications does emerge as an acceptable stormwater option, perhaps more so than non-potable stormwater – given all relevant information. Future research should look to confirm this empirically.

The findings from this study increase our understanding of the community's perceptions and acceptance of treated stormwater as part of Adelaide's water supply. This knowledge provides a theoretical base for policy and interventions design, and suggests areas that may need to be addressed in future policy development.

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Appendix A: Example of Online Survey (for drinking)

Welcome to the Adelaide Stormwater Survey

Thank you for agreeing to participate in this survey.

By clicking on the "Next >>" button below and continuing with the survey, you are indicating that you:

- ✓ Agree to participate in this project.
- ✓ Have understood the information provided about your participation
- ✓ Have had all questions answered to your satisfaction
- ✓ Understand that if you have any additional questions you can contact the research team
- ✓ Understand that you are free to withdraw at any time, without comment or penalty
- ✓ Understand that your participation in the study is voluntary
- ✓ Understand you will not be able to be identified from the information collected
- ✓ Understand that anonymity will be safeguarded in any publication of the results
- ✓ Understand that you can contact the research team if you have any questions about the project, or the CSIRO Human Research Ethics officer on (07) 3833 5693

Next >>

[Screener questions]

Which area of Adelaide do you live in?

- ☐ Adelaide & Greater Adelaide metropolitan area (extending to Willunga-Mt Barker-Gawler)

☐ Other SA	TERMINATE
☐ Sydney	TERMINATE
☐ Other NSW	TERMINATE
☐ Melbourne	TERMINATE
☐ Other VIC	TERMINATE
☐ Brisbane	TERMINATE
☐ Other QLD	TERMINATE
☐ Perth	TERMINATE
☐ Other WA	TERMINATE
☐ Hobart	TERMINATE
☐ Tasmania	TERMINATE
☐ Australian Capital Territory	TERMINATE
☐ Northern Territory	TERMINATE
☐ Other	TERMINATE

- ☐ What is your postcode? ________________

What is your age? [would like quotas to represent ABS if possible]

Under 18 years of age [**TERMINATE**]
18-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65+
☐ Prefer not to answer

What is your sex? [maintain approx ABS representative ratio, if possible]

- ☐ Male
- ☐ Female
- ☐ Prefer not to answer

What best describes your current living situation

- ☐ Australian citizen
- ☐ Permanent Australian Resident (non-Citizen)
- ☐ Temporary resident in Australia (non-Citizen) [**TERMINATE**]

Does the dwelling you are living in have a purple tap/third pipe system?

- ☐ Yes
- ☐ No
- ☐ Don't know

Next >>

<u>Thank you for agreeing to participate in this survey</u>

In this survey we will be asking you about <u>stormwater</u> options in Adelaide.
We are interested in your views and opinions about the potential treatment and use of stormwater.
There are no right or wrong answers. We also request that you please do not use any search engines on the internet (e.g. Google) to assist with answering the survey questions, because it is more important for us to gather *existing* community attitudes and knowledge in Adelaide on this issue.
Although some questions may seem similar, it is important you answer all questions to the best of your ability. The survey should take approximately **15** minutes to complete.
When background information on stormwater is provided, please read the information carefully.

Next >>

Background information

Drinking water sources used in metropolitan Adelaide comprise:
- River Murray
- Mt. Lofty Ranges catchment
- Desalination Plant
- Rainwater tanks

Treated Stormwater is an alternative water source that is currently being stored below ground in aquifers and being used for landscape irrigation and other non-drinking purposes.

Treated stormwater could potentially be used more widely in recycled water systems or be treated further to increase drinking water supplies.

[*Knowledge*]

1. How would you describe your level of understanding of the term "treated stormwater" at present?

Very low understanding	**Low understanding**	**Moderate understanding**	**High understanding**	**Very high understanding**
1	2	3	4	5
☐	☐	☐	☐	☐

2. When you hear the term "stormwater", what do you think it *most accurately* refers to? (please choose 1 only)

☐ Rainwater from roof gutters
☐ Water from city drains
☐ Tank water
☐ Sea water
☐ Reservoir water
☐ Greywater
☐ Sewerage water
☐ Blackwater

3. **Water experts often use technical terms that may not be understood by the general public. We are interested in knowing how much you think you may know about each of these technical terms. Please choose one response per item.**

	1 **I know very little about this**	**2**	**3** **I know a moderate amount about this**	**4**	**5** **I know a lot about this**
a. Reservoir	☐	☐	☐	☐	☐
b. Aquifer	☐	☐	☐	☐	☐
c. Managed aquifer recharge	☐	☐	☐	☐	☐
d. Wetlands	☐	☐	☐	☐	☐
e. Third pipe (purple tap) system	☐	☐	☐	☐	☐
f. Micro filtration	☐	☐	☐	☐	☐
g. Reverse osmosis	☐	☐	☐	☐	☐
h. UV water treatment	☐	☐	☐	☐	☐
i. Chlorination	☐	☐	☐	☐	☐

4. **How important is it for the Adelaide community to be able to use each of the following water options as part of their overall water supply under normal conditions:**

	1 **Very unimportant**	**2** **Unimportant**	**3** **Unsure**	**4** **Important**	**5** **Very important**
River Murray					
Mt. Lofty catchment reservoirs					
Desalination plant water					
Recycled waste water					
Treated stormwater					
Rainwater from tanks					
Groundwater (e.g. bore water)					

5. **How important is it for the Adelaide community to be able to use each of the following water options as part of their overall water supply in drought conditions:**

	1 **Very unimportant**	**2** **Unimportant**	**3** **Unsure**	**4** **Important**	**5** **Very important**
River Murray					
Mt. Lofty catchment reservoirs					
Desalination plant water					
Recycled waste water					
Treated stormwater					
Rainwater from tanks					
Groundwater (e.g. bore water)					

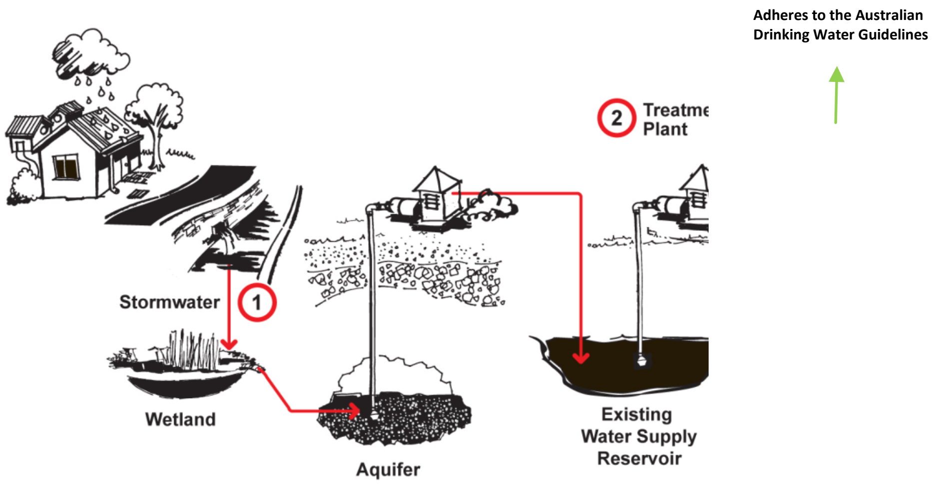
Next >>

What is stormwater?

- Any rain that falls on the roof of your house or collects on paved areas like driveways, roads and footpaths is called **stormwater**.
- Stormwater drains carry stormwater into waterways such as rivers, creeks and the sea.

Proposed example of how stormwater could be treated and used

The following illustration is one example of how stormwater could be delivered to the community and households to supplement **drinking water supplies**:



1. Water collects in the city's stormwater drains and travels to a pre-treatment facility (e.g. a wetland).

From the wetland, the water is transferred into an (underground) aquifer for storage.

2. Water is then pumped out of the aquifer and into an existing reservoir.

3. All water from the reservoir goes through full treatment and is then fit for consumption.

This water is delivered, as normal, to homes and businesses via existing mains water pipes.

The following three questions relate to the proposed example (previous page) of how stormwater could be treated and used for drinking.

6. **I would be willing to use treated stormwater as a supplement to our existing drinking water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

7. **I believe the proposed way of treating and distributing stormwater for drinking (as per diagram) would be a fair way to distribute treated stormwater to everyone in Adelaide?**

☐1	☐2	☐3	☐4	☐5
Very unfair				Very fair

8. **I believe that treated stormwater would be effective in helping to secure Adelaide's water supply?**

☐1	☐2	☐3	☐4	☐5
Very ineffective				Very effective

9. **I believe *my family* would support the use of treated stormwater to supplement drinking water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

10. **I believe *my friends* would support the use of treated stormwater to supplement drinking water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

11. **I believe *my neighbours* would support the use of treated stormwater to supplement drinking water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

12. **I believe the *people of Adelaide* would support the use of treated stormwater to supplement drinking water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

13. **I would feel morally obliged to use treated stormwater to supplement our existing drinking water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

14. **Regardless of what others would do, I would feel it is important to support the use of treated stormwater to supplement our existing drinking water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

15. **I would feel guilty if I didn't support the use of treated stormwater to supplement our existing drinking water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

16. **I trust my water provider (e.g. State Government water provider) to *safely* deliver treated stormwater for drinking**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

17. **I trust my water provider (e.g. State Government water provider) to *reliably* deliver treated stormwater for drinking**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

18. **To what extent are you in favour of using treated stormwater as a supplement to your existing drinking water supplies?**

☐1	☐2	☐3	☐4	☐5
Strongly opposed				Strongly in favour

19. **Treated stormwater would...**

	1 Strongly disagree	**2**	**3**	**4**	**5 Strongly agree**
a. Provide access to more water	☐	☐	☐	☐	☐
b. Make access to water more expensive	☐	☐	☐	☐	☐
c. Have a negative environmental impact	☐	☐	☐	☐	☐
d. Provide safe, high-quality water	☐	☐	☐	☐	☐

20. **I would be willing to pay A LITTLE MORE/A LITTLE LESS/SAME** [drop down menu] **than I am currently paying, for the use of treated stormwater for drinking.**

21. **Supplementing our drinking water supply with treated stormwater would provide more water for everyone**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

Next >>

22. **Treated stormwater, desalination and taking extra water from the River Murray are three alternative water options that can increase Adelaide's drinking water supply in the future.**

The *baseline cost* and *baseline energy* represent the cost and energy figures calculated for the current Mt. Lofty water supply, and is used as a comparison in the table below.

Please indicate your preference between these three possible sources in increasing Adelaide's drinking water supply, considering the associated factors for each method.

	Source of water	**Cost to produce****	**Energy requirements**
Option 1	Take more water from River Murray	**2 to 3 times** the baseline cost	**6 times** the baseline energy
Option 2	Desalination	**5 times** the baseline	**16 times** the baseline energy
Option 3	Storm Water for drinking	**6 times** the baseline (includes cost of extra treatment & pipes)	**4 times** the baseline energy

a) **My preference is:** **(drop down menu)**
   - Option 1: Taking more water from River Murray
   - Option 2: Desalination
   - Option 3: Stormwater

b) **For you, which is the most important aspect in deciding your preference, from the available options?** **(drop down menu)**
   - The source of the water
   - The cost of the water to produce
   - The energy requirements

Next >>

23. If you were required to drink water that was supplemented with treated stormwater, please identify how important each of these safety assurances are to you in accepting this water for drinking:

SAFETY ASSURANCE	1 Not important at all	2 A little important	3 Moderately important	4 Very important	5 Extremely important
All drinking water schemes must strictly adhere to Australian Drinking Water Guidelines by law					
Regular auditing and regulation of water systems					
Results of water quality tests available to the public (e.g. displayed on a water quality website)					
Stormwater quality managed by SA Water					
Stormwater quality managed by your local council					
Independent review of water quality by SA Health					
	1 Strongly Disagree	**2**	**3 Moderately agree**	**4**	**5 Strongly agree**
I have no preference, as long as the water is safe to drink					

24. **If treated stormwater were to be introduced for drinking, how important are each of the following community activities:**

COMMUNITY ACTIVITY	1 Not important at all	2 A little important	3 Moderately important	4 Very important	5 Extremely important
Open days to visit stormwater collection and treatment facilities					
Information on stormwater treatment and use in newspapers/radio/TV					
A visitor's centre at a stormwater collection or treatment facility					
Public talks by water experts with "Question & Answer" sessions					
Education programs in schools					
Other [free text box]					

25. **I think that using treated stormwater for drinking would be:**

☐1	☐2	☐3	☐4	☐5
Extremely bad		Neither		Extremely good
☐1	☐2	☐3	☐4	☐5
Extremely harmful		Neither		Extremely beneficial
☐1	☐2	☐3	☐4	☐5
Extremely worthless		Neither		Extremely valuable
☐1	☐2	☐3	☐4	☐5
Extremely unpleasant		Neither		Extremely pleasant
☐1	☐2	☐3	☐4	☐5
Extremely foolish		Neither		Extremely wise

Next >>

The following statements represent general thoughts and beliefs. We ask that you indicate how much you agree or disagree with each one. These questions are designed to be answered quickly, therefore, your first answer is most appropriate. Please select one value per line.

26. **When humans interfere with nature, it often produces disastrous consequences**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

27. **Humans are severely abusing the environment**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

28. **If things continue on their present course, we will soon experience a major ecological catastrophe**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

29. **The balance of nature is very delicate and easily upset**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

The following statements represent views towards water in general. Please indicate your level of agreement or disagreement. Once again, these are designed to be answered quickly, therefore, your first answer is most appropriate.

30. **I think that wasting water is bad**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

31. **I feel regretful if I waste water**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

32. **We, as a community, should cherish water**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

33. **Conserving water is part of the Australian lifestyle**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

34. Water is a precious resource

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

35. Without water we cannot survive

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

36. Water is important to my way of life

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

37. Water is an unlimited resource

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

	1 Strongly disagree	**2**	**3**	**4**	**5 Strongly agree**
38. Having a secure water supply is important in Adelaide	☐	☐	☐	☐	☐
39. Now that Adelaide has a seawater desalination plant, we don’t need to use other water sources	☐	☐	☐	☐	☐
40. Adelaide can afford to buy River Murray water from the water market, so we don’t need to use treated stormwater	☐	☐	☐	☐	☐

41. We, as a community, should think about the long-term supply of water

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

Finally, the following questions allow us to get a better sense of the different types of people who participated in the survey, based on the larger Adelaide population. This information is purely descriptive and will not be used to identify individual responses.

42. What is the highest level of education you have completed?

- ☐ Primary education
- ☐ Certificate level
- ☐ Bachelor Degree level
- ☐ Postgraduate Degree level
- ☐ Secondary education
- ☐ Advanced Diploma & Diploma level
- ☐ Graduate Diploma & Graduate Certificate level

43. What best describes your usual occupation?

- ☐ Retired
- ☐ Student
- ☐ Manager
- ☐ Professional
- ☐ Technician/trade worker
- ☐ Community/personal service worker
- ☐ Clerical/administrative worker
- ☐ Sales worker
- ☐ Machinery operator/driver
- ☐ Labourer
- ☐ Not employed

Approximately, what is your household's annual income before tax?

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

What best describes the situation of your household?

- ☐ Single person
- ☐ Couple with no children living at home
- ☐ Family with small children
- ☐ Family with teenagers or adult children living at home
- ☐ Share accommodation

How many people usually live in your house?

Drop down menu – 1,2,3,4,5,6,7,8,9,10,11,12, >12

44. Do you use an under-sink filter on your tap water for drinking, at home?

- ☐ Yes
- ☐ No

45. Do you use bottled water for drinking, rather than your tap water?

- ☐ Yes, always
- ☐ Yes, often
- ☐ Yes, sometimes
- ☐ No

46. Do you have a rainwater tank at home that you use for drinking/cooking water?

- ☐ Yes
- ☐ No

47. Do you have a rainwater tank at home for non-drinking purposes?

- ☐ Yes
- ☐ No

You have reached the end of the survey

If you wish to receive a summary of the results from this research, please tick this box ☐

Thank you for taking the time to participate in this important research

Appendix B: Example of Online Survey (for non-drinking)

Welcome to the Adelaide Stormwater Survey

Thank you for agreeing to participate in this survey.

By clicking on the "Next >>" button below and continuing with the survey, you are indicating that you:

- ✓ Agree to participate in this project.
- ✓ Have understood the information provided about my participation
- ✓ Have had all questions answered to your satisfaction
- ✓ Understand that if you have any additional questions you can contact the research team
- ✓ Understand that you are free to withdraw at any time, without comment or penalty
- ✓ Understand that your participation in the study is voluntary
- ✓ Understand you will not be able to be identified from the information collected
- ✓ Understand that anonymity will be safeguarded in any publication of the results
- ✓ Understand that you can contact the research team if you have any questions about the project, or the CSIRO Human Research Ethics officer on (07) 3833 5693

Next >>

[Screener questions]

Which area of Adelaide do you live in?

- ☐ Adelaide & Greater Adelaide metropolitan area (extending to Willunga-Mt Barker-Gawler)

- ☐ Other SA TERMINATE
- ☐ Sydney TERMINATE
- ☐ Other NSW TERMINATE
- ☐ Melbourne TERMINATE
- ☐ Other VIC TERMINATE
- ☐ Brisbane TERMINATE
- ☐ Other QLD TERMINATE
- ☐ Perth TERMINATE
- ☐ Other WA TERMINATE
- ☐ Hobart TERMINATE
- ☐ Tasmania TERMINATE
- ☐ Australian Capital Territory TERMINATE
- ☐ Northern Territory TERMINATE
- ☐ Other TERMINATE

- ☐ What is your postcode? _________________

What is your age? [would like quotas to represent ABS if possible]

Under 18 years of age [**TERMINATE**]
18-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65+
☐ Prefer not to answer

What is your sex? [maintain approx ABS representative ratio, if possible]

- ☐ Male
- ☐ Female
- ☐ Prefer not to answer

What best describes your current living situation

- ☐ Australian citizen
- ☐ Permanent Australian Resident (non-Citizen)
- ☐ Temporary resident in Australia (non-Citizen) [**TERMINATE**]

Does the dwelling you are living in have a purple tap/third pipe system?

- ☐ Yes
- ☐ No
- ☐ Don't know

Next >>

Thank you for agreeing to participate in this survey

In this survey we will be asking you about <u>stormwater</u> options in Adelaide.
We are interested in your views and opinions about the potential treatment and use of stormwater.
There are no right or wrong answers. We also request that you please do not use any search engines on the internet (e.g. Google) to assist with answering the survey questions, because it is more important for us to gather *existing* community attitudes and knowledge in Adelaide on this issue.
Although some questions may seem similar, it is important you answer all questions to the best of your ability. The survey should take approximately **15** minutes to complete.
When background information on stormwater is provided, please read the information carefully.

Next >>

Background information

Drinking water sources used in metropolitan Adelaide comprise:

- River Murray
- Mt. Lofty Ranges catchment
- Desalination Plant
- Rainwater tanks

Treated Stormwater is an alternative water source that is currently being stored below ground in aquifers and being used for landscape irrigation and other non-drinking purposes.

Treated stormwater could potentially be used more widely in recycled water systems or be treated further to increase drinking water supplies.

1. **How would you describe your level of understanding of the term "stormwater" at present?**

Very low understanding	**Low understanding**	**Moderate understanding**	**High understanding**	**Very high understanding**
1	2	3	4	5
☐	☐	☐	☐	☐

2. **When you hear the term "stormwater", what do you think it *most accurately* refers to? (please choose 1 only)**

- ☐ Rainwater from roof gutters
- ☐ Water from city drains
- ☐ Tank water
- ☐ Sea water
- ☐ Reservoir water
- ☐ Greywater
- ☐ Sewerage water
- ☐ Blackwater

3. **Water experts often use technical terms that may not be understood by the general public. We are interested in knowing how much you think you may know about each of these technical terms. Please choose one response per item.**

	1 **I know very little about this**	**2**	**3** **I know a moderate amount about this**	**4**	**5** **I know a lot about this**
j. Reservoir	☐	☐	☐	☐	☐
k. Aquifer	☐	☐	☐	☐	☐
l. Managed aquifer recharge	☐	☐	☐	☐	☐
m. Wetlands	☐	☐	☐	☐	☐
n. Third pipe (purple tap) system	☐	☐	☐	☐	☐
o. Micro filtration	☐	☐	☐	☐	☐
p. Reverse osmosis	☐	☐	☐	☐	☐
q. UV water treatment	☐	☐	☐	☐	☐
r. Chlorination	☐	☐	☐	☐	☐

4. **How important is it for the Adelaide community to be able to use each of the following water options as part of their overall water supply under normal conditions:**

	1 **Very unimportant**	**2** **Unimportant**	**3** **Unsure**	**4** **Important**	**5** **Very important**
River Murray					
Mt. Lofty catchment reservoirs					
Desalination plant water					
Recycled waste water					
Treated stormwater					
Rainwater from tanks					
Groundwater (e.g. bore water)					

5. **How important is it for the Adelaide community to be able to use each of the following water options as part of their overall water supply in drought conditions:**

	1 **Very unimportant**	**2** **Unimportant**	**3** **Unsure**	**4** **Important**	**5** **Very important**
River Murray					
Mt. Lofty catchment reservoirs					
Desalination plant water					
Recycled waste water					
Treated stormwater					
Rainwater from tanks					
Groundwater (e.g. bore water)					

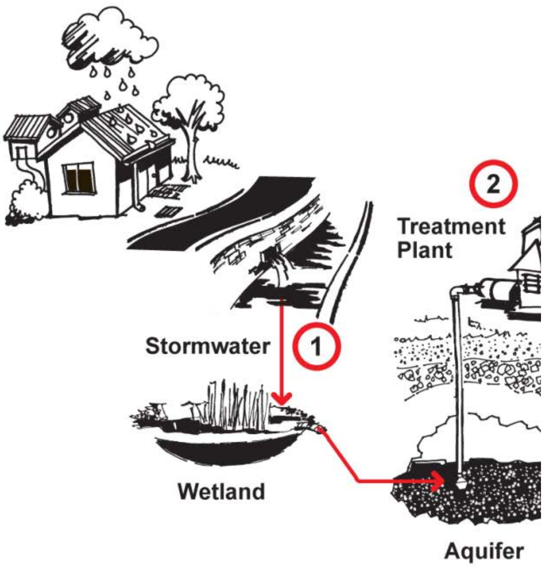
Next >>

What is stormwater?

- Any rain that falls on the roof of your house or collects on paved areas like driveways, roads and footpaths is called **stormwater**.
- Stormwater drains carry stormwater into waterways such as rivers, creeks and the sea.

Proposed example of how stormwater could be treated and used

The following illustration is one example of how stormwater could be delivered to the community and households to supplement **non-drinking water supplies**:



Adheres to the Australian Guidelines for Water Recycling, so the water is safe to use, but:

1. Water collects in the city's stormwater drains and travels to a pre-treatment facility (e.g. a wetland).

   From the wetland, the water is transferred into an (underground) aquifer for storage.

2. Water is then pumped out of the aquifer, via a treatment plant, ready for use.

3. Water fit for non-drinking purposes is then delivered to homes via a new "third pipe" system.

   This water is delivered to homes and businesses via special purple taps installed on the property.

The following three questions relate to the proposed example (previous page) of how stormwater could be treated and used for non-drinking purposes.

6. **I would be willing to use treated stormwater for non-drinking purposes, as a supplement to our existing water supplies**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

7. **I believe the proposed way of treating and distributing stormwater for non-drinking purposes (as per diagram) would be a fair way to distribute stormwater to everyone in Adelaide?**

☐1	☐2	☐3	☐4	☐5
Very unfair				Very fair

8. **I believe that treated stormwater for non-drinking purposes would be effective in helping to secure Adelaide's water supply?**

☐1	☐2	☐3	☐4	☐5
Very ineffective				Very effective

9. **I believe *my family* would support the use of treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

10. **I believe *my friends* would support the use of treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

11. **I believe *my neighbours* would support the use of treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

12. **I believe the *people of Adelaide* would support the use of treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

13. **I would feel morally obliged to use treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5

Strongly disagree				Strongly agree

14. **Regardless of what others would do, I would feel it is important to support the use of treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

15. **I would feel guilty if I didn't support the use of treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

16. **I trust my water provider (e.g. State Government water provider) to *safely* deliver treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

17. **I trust my water provider (e.g. State Government water provider) to *reliably* deliver treated stormwater for non-drinking purposes**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

18. **To what extent are you in favour of using treated stormwater for non-drinking purposes, as a separate supplement to your existing water supplies?**

☐1	☐2	☐3	☐4	☐5
Strongly opposed				Strongly in favour

19. **Treated stormwater would...**

	1 Strongly disagree	2	3	4	5 Strongly agree
e. Provide access to more water	☐	☐	☐	☐	☐
f. Make access to water more expensive	☐	☐	☐	☐	☐
g. Have a negative environmental impact	☐	☐	☐	☐	☐
h. Provide safe, fit-for-purpose water	☐	☐	☐	☐	☐

20. **I would be willing to pay A LITTLE MORE/A LITTLE LESS/SAME [drop down menu] than I am currently paying, for the use of treated stormwater for non-drinking purposes**

21. **Supplementing our water supply with treated stormwater for non-drinking purposes would provide more water for everyone**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

Next >>

22. **Treated stormwater, desalination and taking extra water from the River Murray are three alternative water options that can increase Adelaide's drinking water supply in the future.**

The *baseline cost* and *baseline energy* represent the cost and energy figures calculated for the current Mt. Lofty water supply, and is used as a comparison in the table below.

Please indicate your preference between these three possible sources in increasing Adelaide's drinking water supply, considering the associated factors for each method.

	Source of water	**Cost to produce****	**Energy requirements**
Option 1	Take more water from River Murray	**2 to 3 times** the baseline cost	**6 times** the baseline energy
Option 2	Desalination	**5 times** the baseline	**16 times** the baseline energy
Option 3	Stormwater for non-drinking purposes (toilet flushing, garden watering, laundry)	**20 times** the baseline (includes cost of third pipe networks)	**4 times** the baseline energy

c) **My preference is:** **(drop down menu)**

- Option 1: Taking more water from River Murray
- Option 2: Desalination

- Option 3: Stormwater

d) For you, which is the most important aspect in deciding your preference, from the available options? (drop down menu)
- The source of the water
- The cost of the water to produce
- The energy requirements

Next >>

23. If you were required to use treated stormwater for non-drinking purposes, please identify how important each of these <u>safety assurances</u> are to you in accepting this water:

SAFETY ASSURANCE	**1** **Not important at all**	**2** **A little important**	**3** **Moderately important**	**4** **Very important**	**5** **Extremely important**
All non-drinking water schemes must strictly adhere to Australian Water Quality Management Guidelines by law					
Regular auditing and regulation of water systems					
Results of water quality tests available to the public (e.g. displayed on a water quality website)					
Stormwater quality managed by SA Water					
Stormwater quality managed by your local council					
Independent review of water quality by SA Health					
	1 **Strongly Disagree**	**2**	**3** **Moderately agree**	**4**	**5** **Strongly agree**
I have no preference, as long as the water is safe to use for non-drinking purposes					

24. If treated stormwater were to be introduced for non-drinking purposes, how important are each of the following community activities:

COMMUNITY ACTIVITY	1 Not important at all	2 A little important	3 Moderately important	4 Very important	5 Extremely important
Open days to visit stormwater collection and treatment facilities					
Information on stormwater treatment and use in newspapers/radio/TV					
A visitor's centre at a stormwater collection or treatment facility					
Public talks by water experts with "Question & Answer" sessions					
Education programs in schools					
Other [free text box]					

25. **I think that using treated stormwater for non-drinking purposes would be:**

☐1	☐2	☐3	☐4	☐5
Extremely bad		Neither		Extremely good
☐1	☐2	☐3	☐4	☐5
Extremely harmful		Neither		Extremely beneficial
☐1	☐2	☐3	☐4	☐5
Extremely worthless		Neither		Extremely valuable
☐1	☐2	☐3	☐4	☐5
Extremely unpleasant		Neither		Extremely pleasant
☐1	☐2	☐3	☐4	☐5
Extremely foolish		Neither		Extremely wise

Next >>

The following statements represent general thoughts and beliefs. We ask that you indicate how much you agree or disagree with each one. These questions are designed to be answered quickly, therefore, your first answer is most appropriate. Please select one value per line.

26. **When humans interfere with nature, it often produces disastrous consequences**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

27. **Humans are severely abusing the environment**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

28. **If things continue on their present course, we will soon experience a major ecological catastrophe**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

29. **The balance of nature is very delicate and easily upset**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

The following statements represent views towards water in general. Please indicate your level of agreement or disagreement. Once again, these are designed to be answered quickly, therefore, your first answer is most appropriate.

30. **I think that wasting water is bad**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

31. **I feel regretful if I waste water**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

32. **We, as a community, should cherish water**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

33. **Conserving water is part of the Australian lifestyle**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

34. **Water is a precious resource**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

35. **Without water we cannot survive**

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

36. Water is important to my way of life

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

37. Water is an unlimited resource

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

	1 Strongly disagree	**2**	**3**	**4**	**5 Strongly agree**
38. Having a secure water supply is important in Adelaide	☐	☐	☐	☐	☐
39. Now that Adelaide has a seawater desalination plant, we don't need to use other water sources	☐	☐	☐	☐	☐
40. Adelaide can afford to buy River Murray water from the water market, so we don't need to use treated stormwater	☐	☐	☐	☐	☐

41. We, as a community, should think about the long-term supply of water

☐1	☐2	☐3	☐4	☐5
Strongly disagree				Strongly agree

Finally, the following questions allow us to get a better sense of the different types of people who participated in the survey, based on the larger Adelaide population. This information is purely descriptive and will not be used to identify individual responses.

42. What is the highest level of education you have completed?

☐ Primary education　　☐ Secondary education

- ☐ Certificate level
- ☐ Advanced Diploma & Diploma level
- ☐ Bachelor Degree level
- ☐ Graduate Diploma & Graduate Certificate level
- ☐ Postgraduate Degree level

43. What best describes your usual occupation?

- ☐ Retired
- ☐ Student
- ☐ Manager
- ☐ Professional
- ☐ Technician/trade worker
- ☐ Community/personal service worker
- ☐ Clerical/administrative worker
- ☐ Sales worker
- ☐ Machinery operator/driver
- ☐ Labourer
- ☐ Not employed

44. Approximately, what is your household's annual income before tax?

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

45. What best describes the situation of your household?

- ☐ Single person
- ☐ Couple with no children living at home
- ☐ Family with small children
- ☐ Family with teenagers or adult children living at home
- ☐ Share accommodation

46. How many people usually live in your house?

Drop down menu – 1,2,3,4,5,6,7,8,9,10,11,12, >12

47. Do you use an under-sink filter on your tap water for drinking, at home?

- ☐ Yes
- ☐ No

48. Do you use bottled water for drinking, rather than your tap water?

- ☐ Yes, always
- ☐ Yes, often
- ☐ Yes, sometimes
- ☐ No

49. Do you have a rainwater tank at home that you use for drinking/cooking water?

- ☐ Yes
- ☐ No

50. Do you have a rainwater tank at home for non-drinking purposes?

- ☐ Yes
- ☐ No

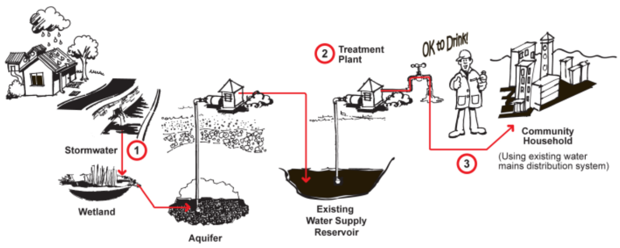
You have reached the end of the survey

If you wish to receive a summary of the results from this research, please tick this box ☐

Thank you for taking the time to participate in this important research

Appendix C: The Six Manipulation Narratives

Option A PRE-TREATMENT →AQUIFER →RESERVOIR →CENTRAL PIPES →DRINKING



GENERIC VERSION (drinking)

1. Water collects in the city's stormwater drains and travels to a pre-treatment facility
(e.g. a wetland).

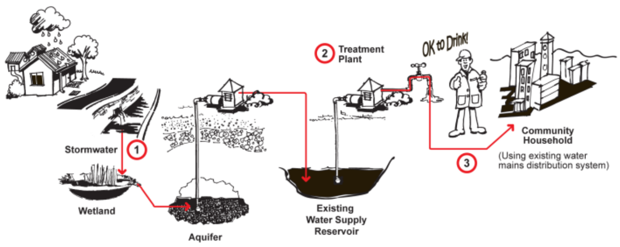
From the wetland, the water is transferred into an (underground) aquifer for storage.

2. Water is then pumped out of the aquifer, via a treatment plant, ready for use.

3. Water fit for non-drinking purposes is then delivered to homes via a new "third pipe" system.

This water is delivered to homes and businesses via special purple taps installed on the property.

Option A PRE-TREATMENT →AQUIFER →RESERVOIR →CENTRAL PIPES →DRINKING



ENVIRONMENTAL VERSION (drinking)

1. Water collects in the city's stormwater drains and travels to a **wetland** for treatment. A wetland is a shallow pool filled with plants and vegetation.

Wetlands can provide:

- Increased **biodiversity** in plant and animal life
- Improved **clarity of water** discharged to the sea
- Recreational use of public **green open space**

After filtering through the **wetland**, the water is transferred into an (underground) aquifer for storage.

Aquifers can be a more **environmentally friendly** way to store water than surface reservoirs because they **minimise water loss** through evaporation, with **no loss of land**.

2. Water is then pumped out of the aquifer when needed and transferred into an existing reservoir.

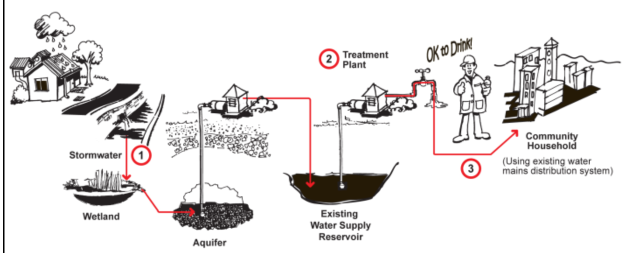
Over the long term, the rate of water taken out of the aquifer will match the rate of water being put into the aquifer, and maintain the **water balance** within the aquifer.

3. All water from the reservoir goes through

full treatment and is then fit for consumption. It is delivered, as normal, to homes and businesses via existing mains water pipes.

This system will provide additional **environmental benefits**, such as **locally sourced** water for irrigation of **green spaces** and **reduced demand** on River Murray and Mt. Lofty Ranges catchments. The treatment process is **less energy intensive** than seawater desalination.

Option A PRE-TREATMENT →AQUIFER →RESERVOIR →CENTRAL PIPES →DRINKING



SAFETY VERSION (drinking)

1. Water collects in the city's stormwater drains and travels to a **wetland for treatment** . A stormwater wetland is a purpose-built shallow pool with plants and vegetation.

Wetlands can provide:

- Help with **water purification**
- An effective natural stormwater treatment for **pollutant removal**.
- A **filter** for the stormwater, where pollutants settle, or deteriorate through uptake by organisms in the water.

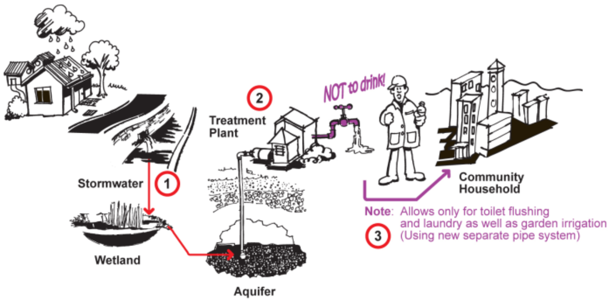
After the **cleaned** water has filtered through the wetland, it is transferred into an (underground) aquifer for **additional purification treatment** and storage. Aquifers can be a **safer** way to store water than surface reservoirs because they offer **more protection** from sources of surface pollution.

2. **Treated water** is then pumped out of the aquifer when needed and transferred into an existing reservoir. Here, it will **safely** mix with the rest of the city's drinking-water supply.

3. All water from the reservoir is treated in a **drinking water treatment plant**, as normal. It is then delivered to homes and businesses via existing mains water pipes.

These steps will adhere to the **Australian Guidelines for Water Recycling: Augmentation of Drinking Water Supplies**. Australia's water guidelines are internationally recognised for their **excellence** and are consistent with **World Health Organisation** guidelines on water quality.

Option B PRE-TREATMENT → AQUIFER →3RD PIPE → NON-DRINKING



GENERIC VERSION (non-drinking)

1. Water collects in the city's stormwater drains and travels to a pre-treatment facility (e.g. a wetland).

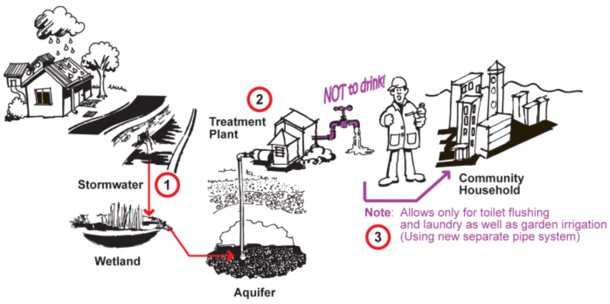
   From the wetland, the water is transferred into an (underground) aquifer for storage.

2. Water is then pumped out of the aquifer and into an existing reservoir.

3. All water from the reservoir goes through full treatment and is then fit for consumption.

   This water is delivered, as normal, to homes and businesses via existing mains water pipes.

Option B PRE-TREATMENT → AQUIFER →3RD PIPE → NON-DRINKING



ENVIRONMENTAL VERSION (non-drinking)

1. Water collects in the city's stormwater drains and travels to a **wetland** for treatment. A wetland is a shallow pool filled with plants and vegetation.

   Wetlands can provide:

   - Increased **biodiversity** in plant and animal life
   - Improved **clarity of water** discharged to the sea
   - Recreational use of public **green open space**

   After filtering through the **wetland**, the water is transferred into an (underground) aquifer for storage.

   Aquifers can be a more **environmentally friendly** way to store water than surface reservoirs because they **minimise water loss** through evaporation, with **no loss of land**.

2. Water is then pumped out of the aquifer, when needed, via a treatment plant, ready for use.

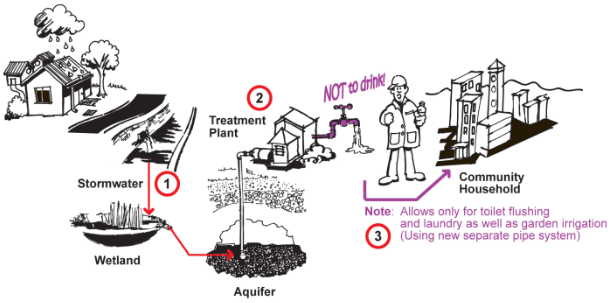
   Over the long term, the rate of water taken out of the aquifer will match the rate of water being put into the aquifer, and maintain the **water balance** within the aquifer.

3. Water fit for non-drinking purposes is then delivered to homes via a new "third pipe" system. This water can be accessed via special purple taps installed on the property.

   This system will provide additional **environmental benefits**, such as **reduced**

demand on River Murray and Mt. Lofty Ranges catchments and using **locally sourced** water for irrigation of **green spaces.** The treatment process is **less energy intensive** than seawater desalination.

Option B PRE-TREATMENT → AQUIFER →3RD PIPE → NON-DRINKING



SAFETY VERSION (non-drinking)

1. Water collects in the city's stormwater drains and travels to a **wetland for treatment**. A stormwater wetland is a purpose-built shallow pool filled with plants and vegetation.

Wetlands can provide:

- Help with **water purification**
- An effective natural stormwater treatment for **pollutant removal**.
- A **filter** for the stormwater, where pollutants settle, or deteriorate through uptake by organisms in the water.

After the **cleaned** water has filtered through the wetland, it is transferred into an (underground) aquifer for **additional purification treatment** and storage. Aquifers can be a **safer** way to store water than surface reservoirs because they offer **more protection** from sources of surface pollution.

2. **Treated water** is then pumped out of the aquifer when needed and **treated further**, ready for use.

3. Water fit for non-drinking purposes is then delivered to homes via a new, **separate**, "third pipe" system. This water can be accessed via special purple taps installed on the property, which are **separate** to the city's drinking water supplies.

This water will be subject to **Australian Guidelines for Water Recycling** for stormwater harvesting and use. Australia's water guidelines are internationally recognised for their **excellence** in water quality.

Appendix D: Extended Methods

Measures
The online surveys (see Appendix A and B) comprised a battery of psychological scales, used to measure factors associated with the acceptance of stormwater for drinking and non-potable uses. Note that where a blank has been left, this can be filled with either “drinking” or “non-drinking”, depending on the version of the survey in question.

Knowledge of stormwater and water security issues
In order to contextualise participants’ responses, it was important to get a baseline understanding of how familiar participants were with the concept of stormwater. Three questions measured: understanding of the term “treated stormwater” (*1 = very low understanding, 5 = very high understanding*); what does the term “stormwater” most accurately refer to (i.e. water from city drains); and general knowledge of common urban water terminology, such as “reservoir”, “aquifer”, “reverse osmosis”, etc. (*1 = I know very little about this, 5 = I know a lot about this*; see Appendix A, Qs.1-3, for full options).
Three items (Q. 28) assessed participants’ agreement about Adelaide’s water security (e,g, “having a secure water supply is important in Adelaide”, “we as a community should think about the long-term supply of water”). These items were developed based on preceding qualitative research conducted by Alexander (Alexander, et al., 2012; Mankad, et al., 2013) and responses were made using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Optimal water mix preferences
These items (Qs. 4 & 5) were included to gain an understanding of public preferences for seven different types of water sources available to Adelaide residents (River Murray, Mt. Lofty catchment, desalination plant, recycled waste water, treated stormwater, rainwater from tanks, and groundwater from bores), during drought and non-drought (normal) conditions. Participants rated each water source according to its importance to Adelaide’s overall water supply (*1 = very unimportant, 5 = very important*). These items replicate those used in Alexander et al.’s (2012) early work on stormwater attitudes in Adelaide, a precursor to this study.

Acceptance
Two items (Qs. 6 &18) measured participants’ level of acceptance for using stormwater for drinking [*or non-drinking*] purposes, based on the illustrative stormwater option model presented in their survey (6 options: *genericD, genericND, envtD, envtND, safetyD, safetyND*). The items were: “I would be willing to use treated stormwater for...” (*1 = strongly disagree, 5 = strongly agree*) and “to what extent are you in favour of using treated stormwater for...” (*1 = strongly opposed, 5 = strongly in favour*). These items were adapted from research conducted by Eriksson et al. (2006).

Perceived fairness and effectiveness
Two items (Qs. 7 & 21) were used to measure perceived fairness and distributive justice associated with the proposed stormwater delivery example: “I believe the proposed way of treating and distributing the stormwater for _____ would be a fair way to distribute treated stormwater to everyone in Adelaide” (*1 = very unfair, 5 = very fair*; adapted from Eriksson, et al., 2006) and “Supplementing our _____ water supply with treated stormwater would provide more water for everyone” (*1 = strongly disagree, 5 = strongly agree*; King & Murphy, 2012).
A single item measure (Q. 8), adapted from Eriksson and colleagues (2006), was used to assess participants’ perceived effectiveness of stormwater in alleviating water stress, based on the example stormwater option they were given. The item read: “I believe that treated stormwater would be effective in helping to secure Adelaide’s water supply” (*1 = very ineffective, 5 = very effective*).

Descriptive norms
Descriptive norms are used as predictors in the theory of planned behaviour and they reflect participants' opinions of whether important others would support a particular behaviour in question (Ajzen, 2002; Nolan, 2008). In the current study, that behaviour is using treated stormwater for drinking/non-drinking purposes. Four items (Qs. 9-12) were used to measure descriptive norms (e.g. "I believe my family would support the use of treated stormwater for...", "I believe my friends would support the use of treated stormwater for..."). Responses were made using a 5-point Likert scale (*1 = strongly disagree, 5 = strongly agree*).

Personal norms
Personal norms are defined as personal expectations for self-behaviour, based on internalised values (Schwartz, 1968, 1977), and are experienced as feelings of personal obligation to engage in a certain behaviour. Items (Qs. 13-15) were adapted from past norm research (e.g. Abrahamse et al., 2009; Bamberg, et al., 2007; Harland, et al., 1999;), and example items include "I would feel morally obliged to use treated stormwater for...", "I would feel guilty if I didn't support the use of treated stormwater for...". Responses were made using a 5-point Likert scale (*1 = strongly disagree, 5 = strongly agree*).

Trust
Two items (Qs. 16 & 17) were used to measure participants' trust in their State Government water provider to "safely" and "reliably" deliver treated stormwater for drinking/non-drinking purposes. The two key words, safely and reliably, were used because they were part of the water provider's customer ethos, and therefore, would reflect if the water provider was trusted to do as they stated they would. Responses were again made on a 5-point Likert scale (*1 = strongly disagree, 5 = strongly agree*).

Attitudes towards proposed stormwater option
Participants received one of two different stormwater options (i.e. drinking or non-drinking versions). This group of four attitude items (Q. 19), adapted from Amaoko-Gyampah and Salam (2004), was designed to measure beliefs associated with the stormwater harvesting and delivery method presented in their version of the survey. Example items include: "treated stormwater would provide access to more water", and "treated stormwater would make access to water more expensive" (see Appendix A, Q.19) for full set of items). Responses were made using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).
A second set of items (see Appendix A, Q.26) were included to capture participants' attitudes towards the stormwater option presented to them. The stem read "I think that using treated stormwater for ________ would be" and responses were made using a 5-point semantic differential scale (Ajzen, 1991): *bad-good, harmful-beneficial, worthless-valuable, unpleasant-pleasant, foolish-wise (*e.g. 1 = extremely bad, 5 = extremely good).

Willingness to pay
A single item (Q. 20) measure was used to descriptively assess whether participants would be willing to pay "a little more than", "a little less than", or the "same" for the stormwater scenario presented (drinking or non-drinking), compared to what they were currently paying for mains water.

Water preferences
To measure which factors were most important to respondents in selecting a supplementary water source for Adelaide, participants were presented with a table (see Appendix A, Q.22) outlining three different sources of water (River Murray, Desalination, Stormwater) and their associated production costs and energy requirements, compared to an existing baseline (i.e. figures calculated for current Mt. Lofty water supply). Given the costs and energy facts, participants were asked to decide which

water source they would prefer to see as a supplement to Adelaide's drinking water supply. Then, participants were asked to specify which of the three key factors (source of water, cost to produce, energy requirements) was the most important aspect in deciding their preference.

Community safety assurances

In order to get an idea of which safety checks were important to the community in validating the cleanliness of their water supply, participants were asked (Q. 23) to indicate the level of importance of a selection of 7 safety assurances (e.g. "regular auditing and regulation of water systems", "stormwater quality managed by SA Water", "independent review of water quality by SA Health"). A second, related, question (Q. 24) asked participants to rate the importance of a set of 6 community activities designed to educate the public on stormwater as a drinking or non-drinking source (depending on the example received). Activities included "open days to visit stormwater collection and treatment facilities", "public talks by water experts with 'Question & Answer' sessions" and "education programs in schools". The response scales for both questions reflected level of importance (*1 = not important at all, 5 = extremely important*).

Pro-environmental orientation and general water attitudes

Four items were designed to measure participants' general beliefs about the environment (pro-environmental orientation). Questions were adapted from the full New Ecological Paradigm scale developed by Dunlap and colleagues (2000), validated in Cools and colleagues' (2011) work. Example items include "when humans interfere with nature it often produces disastrous consequences" and "the balance of nature is very delicate and easily upset".

Four items measuring attitudes towards water waste were adapted from a frugality scale developed by Fujii (2006) and included items such as "I think wasting water is bad" and "I feel regretful if I waste water". Another five items were developed from past water research (e.g. Mankad and Tucker, 2013; Mankad et al., 2011) to measure participants' values towards water and water use (e.g. "conserving water is part of the Australian lifestyle", "water is a precious resource"). Responses for all items in this group were made using a 5-point scale reflecting level of agreement (1 = strongly disagree, 5 = strongly agree).

These items were randomly distributed in each iteration of the online survey, therefore exact question numbers (Qs. 26-37) varied from survey to survey.

Demographics

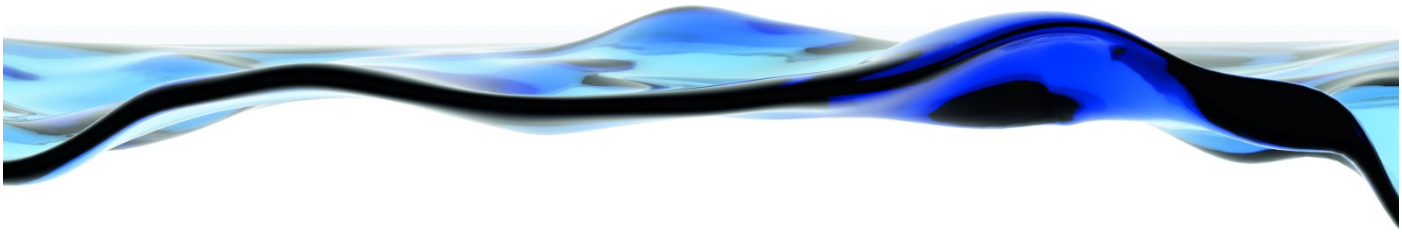
Descriptive data was gathered for all participants and included: age, sex, residency status, education, occupation, income, number of people living at home and family status, postcode, and whether participants used bottled water for drinking (see Appendix A, Q.42-50, for full list of demographic categories). Many of these categories were adapted from the Australian Bureau of Statistics categories. Several questions were also about physical aspects associated with participants' property: whether the home had an existing 3rd pipe system, whether the home had a rainwater tank for drinking and/or non-drinking purposes, and whether the home used an under-sink filter on the tap for drinking.

Appendix E: Descriptive statistics for policy related variables

Table 21 Descriptive statistics (means and bivariate correlations) for policy related predictor variables

	Variable	*M*	*SD*	1	2	3	4	5	6
1	Acceptance	4.13	1.00	**.83**^{r}					
2	Perceptions of fairness	4.23	0.82	.81	**.65**^{r}				
3	Perceptions of effectiveness	4.35	0.86	.78	.84				
4	Perceptions of trust	3.84	1.06	.72	.66	.63	**.92**^{r}		
5	Importance of safety assurances	4.35	0.61	.14	.28	.29	.15	**.82**^{a}	
6	Importance of communication activities	3.66	0.83	.11	.21	.19	.13	.41	**.86**^{a}

Note: Higher mean scores indicate a higher level (5 pt scale); *N* = 1218; All correlations are significant at $p < .001$; Bold face = reliability statistics, ^{r} = Pearson's *r* for two items measures; ^{a} = Cronbach's alpha for multiple item measures



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