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## **Drinking water from alternative water sources: differences in beliefs, social norms and factors of perceived behavioural control across eight Australian locations**

Sara Dolnicar  
*University of Wollongong, s.dolnicar@uq.edu.au*

Anna Hurlimann  
*University of Melbourne*

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## Abstract

Australia is facing serious challenges in the management of water in various urban and regional locations. Two popular responses to these challenges are increasing supply through alternative water sources such as recycled and desalinated water. However, significant gaps exist in our knowledge of community attitudes to these alternative sources of water, particularly for potable use. This paper reports results from an Australian study of community attitudes to alternative water sources. Sixty six qualitative interviews were held at eight locations with distinctly different water situations. This paper explores all three antecedents to the behaviour of drinking recycled water and desalinated water as postulated by the Theory of Planned Behaviour: attitudes, social norms and factors of perceived behavioural control. Key results indicate that while people hold both positive and negative beliefs (mostly cost, health and environmental concerns) about water from alternative sources, nearly all of them are willing to drink it if the water crisis were to deteriorate further. People also feel they lack knowledge and state that information from scientists would influence their decision to drink recycled and desalinated water most. Friends and relatives are most influential in preventing people from drinking recycled water. The findings reported in this paper have major implications for water policy, and will be of particular interest to water engineers. The paper raises a provocative question: Is it better to avoid public consultation in introducing water from alternative sources?

## Keywords

norms, factors, behavioural, control, across, eight, australian, drinking, locations, water, alternative, sources, differences, beliefs, social, perceived

## Disciplines

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# Drinking water from alternative water sources: differences in beliefs, social norms and factors of perceived behavioural control across eight Australian locations

S. Dolnicar\* and A. Hurlimann\*\*

\*School of Management & Marketing, University of Wollongong, Northfields Ave, 2522  
Wollongong, NSW Australia  
(E-mail: [sarad@uow.edu.au](mailto:sarad@uow.edu.au))

\*\*Faculty of Architecture Building and Planning, The University of Melbourne, Melbourne 3010,  
Australia  
(E-mail: [anna.hurlimann@unimelb.edu.au](mailto:anna.hurlimann@unimelb.edu.au))

## Abstract

Australia is facing serious challenges in the management of water in various urban and regional locations. Two popular responses to these challenges are increasing supply through alternative water sources such as recycled and desalinated water. However, significant gaps exist in our knowledge of community attitudes to these alternative sources of water, particularly for potable use. This paper reports results from an Australian study of community attitudes to alternative water sources. Sixty six qualitative interviews were held at eight locations with distinctly different water situations. This paper explores all three antecedents to the behaviour of drinking recycled water and desalinated water as postulated by the Theory of Planned Behaviour: attitudes, social norms and factors of perceived behavioural control. Key results indicate that while people hold both positive and negative beliefs (mostly cost, health and environmental concerns) about water from alternative sources, nearly all of them are willing to drink it if the water crisis were to deteriorate further. People also feel they lack knowledge and state that information from scientists would influence their decision to drink recycled and desalinated water most. Friends and relatives are most influential in preventing people from drinking recycled water. The findings reported in this paper have major implications for water policy, and will be of particular interest to water engineers. The paper raises a provocative question: Is it better to avoid public consultation in introducing water from alternative sources?

**Keywords:** theory of planned behaviour, water sources, desalination, recycled water

## INTRODUCTION

Australia is in the midst of a water crisis. Water supplies of many of the country's major urban centres are dwindling after successive years of below-average rainfall, coupled with escalating pressure from increasing population and increasing uncertainty due to climate change. In Australia the dominant policy response to this crisis has been the combination of demand management initiatives (such as water use restrictions) and increasing supply through seeking other sources of water, especially wastewater recycling and desalination of sea water. Both options are technically feasible. However, implementation depends on the acceptance by politicians and the public. Several national and international recycled water projects have failed due to a lack of community support (Hurlimann and McKay, 2004).

Numerous researchers have identified the lack of literature in the area of community acceptance of, and attitudes to, recycled water use (e.g. Po *et al.*, 2003). This lack of knowledge is a major barrier

to the sustainable implementation of recycled water use policy in Australia, at both national and state levels. Even less is known about the community's attitudes towards desalination. This knowledge gap exists world wide.

The aim of this paper is to contribute to a better understanding of public perceptions with respect to water from alternative sources. The main theoretical contribution of this study lies in the use of an established behavioural theory, the Theory of Planned Behaviour (Ajzen, 1988) to underpin the understanding people's behaviour towards water from alternative sources. This approach extends the perspective from a focus on attitudes only to the inclusion of the influence of social reference groups, as well as practical factors preventing people from using water from alternative sources.

## LITERATURE REVIEW

Since the 1970s social scientists aimed at better understanding public acceptance or rejection of water from alternative sources. Prior work mainly relates to recycled water solutions and can be categorised into the following four areas:

**Acceptance studies:** Most prior research investigated the general public's willingness to adopt recycled water. Notably, the work of Bruvold (Bruvold and Ward, 1970; Bruvold, 1972) concluded that people are most opposed to using recycled water for "close-to-body" uses such as drinking and bathing. Acceptance levels for household uses which do not imply direct contact with the body, such as toilet flushing and watering the garden, are relatively high. This trend has held with recent Australian studies (McKay and Hurlimann, 2003; Dolnicar and Schäfer, 2009; Marks *et al.*, 2006; Po *et al.*, 2003).

**Concerns and perceived benefits:** The main weakness of most acceptance studies is that the actual reasons affecting acceptance and possible adoption of these alternative water sources were not explored in depth. Only a small number of studies focused on this aspect. For example, for both potable and non-potable use, Bruvold (1988) found that people were worried about possible negative environmental, economic and health problems; Dishman *et al.* (1989) identified public health concerns as the main reason for resistance to direct potable uses; and in Australia Higgins *et al.* (2002) found "public health and the environmental effect of microbiological agents" (p. 5050) to be of primary concern for non-potable uses. Hormone and pharmaceutical content would be a concern for potable use (p.5055). For non-potable use of recycled water Marks *et al.* (2002) identified quality and cost as the two main concerns among users, but also revealed some perceived benefits among users: cost savings, the positive environmental effect and the nutritional value of reclaimed water.

**Socio-demographic profiles of early adopters:** In early research into public acceptance of recycled water use for both potable and non-potable uses, the factor most frequently found to be associated with the acceptance levels of recycled water was education level. This was followed by age, then knowledge about reuse, with income and gender identified as associated in one-third of the studies (Alhumoud *et al.*, 2003). However, more recently, Hartley (2001), and Marks (2004) found socio-demographic factors are not good predictors of acceptance.

**Strategies to increase acceptance for recycled water use with close personal contact:** Baumann and Kasperson (1974) proposed associating water reuse programs with pleasant things that the public enjoys and approves of: "put the reclaimed water in an attractive setting and invite the public to look at it, sniff it, picnic around it, fish in it, and swim in it" (p. 670). Dishman *et al.* (1989)

suggested a behavioural modification approach through simple strategies, such as prize draws for volunteers to drink recycled water to decrease prejudice. Po and Nancarrow (2004) recommended community involvement, and accurate and complete information policies as central success strategies.

In sum, it can be concluded that the majority of studies aimed at quantifying the levels of acceptance of recycled water, and only little research has been undertaken to date to develop deeper understanding of the reasons for public acceptance and rejection. Also, only a very limited number of studies investigated alternative water sources other than recycled water (Dolnicar and Schäfer, 2009).

## **METHODS**

### **Theoretical underpinning**

The theoretical basis for the present study is the Theory of Planned Behaviour (Ajzen, 1988). The Theory of Planned Behaviour is a conceptual model of human behaviour which postulates that behaviour can be predicted well by people's behavioural intentions which are explained by beliefs, social norms and perceived behavioural control. Beliefs are evaluations of the behaviour under study and can be either positive or negative. Subjective norm captures the evaluation of the behaviour by people which matter to the individual under study. Perceived behavioural control represents the perceived ability of an individual to actually engage in the behaviour under study. As such it captures hindering factors.

The value for each of these three dimensions is computed by combining two underlying aspects: in the case of beliefs, one aspect is whether the individual thinks that the behaviour will have certain consequences, and the second aspect is whether the individual thinks that these consequences are positive or negative. The influence of social norms on behaviours consists of the individual's assessment of important peer's evaluation of the behaviour and the extent to which it matters what peers think. Perceived behavioural control is composed from the assessment of various factors facilitating or inhibiting the behaviour and the extent to which this is the case.

We use the Theory of Planned Behaviour as the basis of our study by specifically investigating all three dimensions assumed to influence human behaviour, as opposed to focusing only on beliefs (attitudes) as has been done in previous work. As a consequence, questions in the focus groups and interviews (to be discussed in the methods section) reflect the three constructs: beliefs, social norms and perceived behavioural control.

### **Selection of research locations**

The locations for this study were chosen based on contrasting water situations, representative of the variety of Australian circumstances. Information aiding the choice of locations included water policy, water infrastructure (current and planned) and water storage levels (both current and historic). Table one provides information about the water storage levels in each of the study locations, both at time of study, and more recently. This information was obtained from the Water Services Association of Australia (WSAA) website (WSAA, 2009), from which full information about water restrictions in each location can be found. All locations except Darwin were facing restrictions to water use, which were of varying degrees between locations.

## *Insert Table 1*

**Adelaide** is the capital city of the state of South Australia (population approx. 1.1 million). Adelaide's water is sourced from a combination of the Murray River and the Adelaide Hills catchments. In a dry year, only 35% of the metropolitan supply comes from the Hills catchments (Cullen, 2004). Consequently, indirect reuse of wastewater already occurs (many rural communities dispose their treated wastewater into the river).

**Brisbane** is the capital city of the state of Queensland (population approx. 1.8 million). The former Premier announced in 2007 that potable reuse was inevitable for South East Queensland and that a public referendum would not take place. A recycled water system has been constructed, to facilitate planned indirect potable use of recycled water in Brisbane. Recycled water will enter Brisbane's storages if their levels fall below 40% (Premier of Queensland 2007).

**Darwin**, the capital city of the Northern Territory, (population approx. 114,400) has never been subject to water restrictions. The climate is tropical, and rain is frequent in the wet season. Darwin's water is sourced from surface water (dams).

**Melbourne** is the capital of Victoria (population approx. 3.7 million). The Victorian Government has committed to building a desalination plant to supply water to Melbourne. Construction will commence in 2009 and the plant will be operational by the end of 2011 (Department of Sustainability and Environment, 2008).

**The Mallee:** Many parts of regional and rural Victoria have been facing a prolonged drought over the past 5-10 years. This is particularly true of the Mallee region which covers 3,925,584 hectares of the northwest corner of Victoria, and is home to 61,100 people. The drought has had a significant impact on the Mallee community. Residents of the Mallee who are not connected to a mains water supply (i.e. they rely on rainwater tanks or private bores) were targeted in this study.

**Perth** is the capital of Western Australia (population approx. 1.5 million). Perth's water is traditionally sourced from a combination of ground water and surface water (dams). In April 2007 a desalination plant began supplying 17% of Perth's water needs (Water Corporation, 2007).

**Sydney** is the capital of New South Wales (population approx. 4.3 million). Sydney's water supply is sourced from dams. In 2008 the New South Wales Government commissioned a 250,000m<sup>3</sup>/day capacity seawater desalination plant for Sydney, which is expected to begin production and supply of water in late 2009 (Veolia Water 2008).

**Toowoomba** is located 109km west of Brisbane (population approx. 90,000). Toowoomba's water is sourced predominantly from surface water (dams). An indirect potable wastewater reuse scheme was proposed in 2006. A referendum was held in July 2006, and the scheme was rejected by the local community (Water Futures Toowoomba, 2006). At the time of the referendum the storages were at 20% of capacity.

## **Data collection**

Because the aim of this study is to investigate the role of social norms and perceived behavioural control on water-related behavioural intentions – as opposed to making statements about population proportions who share certain attitudes or intentions – it is not necessary for the sample to be representative. Rather, it is important that input from a highly heterogeneous group of people is captured. This was achieved in the present study by outsourcing the recruitment of respondents to a professional market research company. This company organised a heterogeneous group of respondents in terms of socio-demographics to participate in a personal interview at each of the selected locations, and administered the compensation payments. The following number of interviews was conducted at each location: six in Brisbane, eight in Toowoomba, eight in Darwin, eight in Mallee, nine in Adelaide, nine in Sydney, nine in Melbourne, and nine in Perth. Interviews were conducted by one of the authors with the support of three trained research assistants. All interviewers used the same interview guide which included the key questions to be asked. Each interviewer was free to ask follow-up questions if they felt that additional relevant information could be obtained. The interviews took, on average, one hour and were recorded. Responses were transcribed, coded and categorized. The categorized data served as the basis for data analysis.

## RESULTS AND DISCUSSION

Results are reported in two sections. The first section contains insights from the study which were consistent across all eight study locations. The second section discusses findings of interest which are specific to certain locations. Note that – due to the research design – the percentages stated throughout this paper are proportions of the sample, not population proportions.

### Overall findings

*Recycled water.* Respondents were asked how they felt about drinking recycled water (see Table 2 which summarises the open-ended responses). The question aimed at eliciting general **beliefs**. The unconditional acceptance of recycled water for drinking was higher than expected given the low acceptance levels reported in previous quantitative studies. One third of the respondents said that they would have no problem with drinking recycled water and another 26% would be willing to drink it if a condition would be met (for example, scientists providing evidence that it is safe to drink). Only a small number of respondents stated that they would require more information. However, as will be shown later, the general level of knowledge about recycled water is extremely low in the population. Eight percent were undecided and expressed feelings of caution and scepticism. Eighteen percent would not drink recycled water and express a negative attitude towards it (for example some find it disgusting, some have health concerns).

*Insert table 2*

When asked who would influence their decision to drink recycled water (the **social norm** dimension of the theory of planned behaviour), responses across all locations were surprisingly consistent. One third of respondents denied that anyone would have any influence at all, one fifth stated that information provided by scientists would be influential and 6% say that the opinions of their friends and family would effect their behaviour. Other, less frequently mentioned, sources of influence included experts in general, media, previous users, the water authority, the CSIRO (Commonwealth Scientific and Industrial Research Organisation), (local) government, the local and general public, workers in recycling plants and one respondent from Toowoomba reported that their child's scout leader provided information that influenced their vote on the recycled water

referendum. It can be concluded that – while a wide range of people (in the social environment of Australia) influence their beliefs towards recycled water as well as their behavioural intention – scientists have a special role to play in the information transfer relating to alternative water sources.

Interestingly, when asked who influenced their decision not to drink recycled water people did not provide the same responses, indicating that supportive information and critical information are likely to come from different social contexts. One fifth of respondents believe that nobody would influence them. Twelve percent state that friends and family would play a major role, followed by only 8% who named scientists in the non-drinking context. Experts and doctors or GPs were named by 4% each. Other one-off statements included the public, the CSIRO, the government, the health authority, media, politicians, prior users and public health experts.

In both the drinking and the non-drinking context the main expectations respondents had from these sources of influence was to provide them with either objective factual knowledge or with subjective opinions. Factual knowledge was mentioned more frequently in the context of influencing people to drink recycled water, however opinions appear to play a bigger role in convincing them to be cautious and not to drink recycled water.

In terms of aspects of **perceived behavioural control**, 59% of the total sample stated that something was preventing them from drinking recycled water. The main factor preventing respondents from using recycled water is the lack of availability (38% of respondents). The second most frequently stated factor was that there was currently no necessity (12%). Eight percent stated health concerns, 5% taste and/or smell and another 5% a lack of knowledge. A second question related to the perceived behavioural control dimension of recycled water explored how the worsening of the drought might affect their willingness to drink recycled water. This scenario essentially takes control out of the hands of the individual entirely. This was reflected in the responses across all locations: the vast majority of respondents accept that in this case they would have no choice but to drink it, whether they are opposed to it or not. In many ways the case of drinking recycled water therefore represents a unique situation in which the elimination of behavioural control may lead to the intended behaviour with little public resistance. However, this may be a more recent phenomena specific to communities with prolonged drought coupled with high public engagement of the issues and complexities surrounding water supply.

The consideration of community attitudes to recycled water use was not considered a critical component of recycled water projects until recently, after a number of recycled water projects failed due to lack of community support (Hurlimann and McKay, 2004). Recycled water projects in the past, tended to be implemented by engineers with the mantra ‘DAD’ – ‘Decide, Announce, Defend’, which is now recognised as inadequate (Baggett *et al.*, 2004; Po and Nancarrow 2004) because of inadequate consideration of social, cultural, environmental and political implications. Others, (such as Lundqvist *et al.* 2001) advocate the inclusion of the public in policy formulation to improve public awareness of challenges and strengthen skills necessary to solve problems.

Bruvold *et al.* (1981) highlight the importance of being sensitive to public attitudes when implementing recycled water projects. They believe that adequate funds, time and expertise should be allocated to objectively assess public attitudes and opinions about proposed recycled water projects. They warn that failure to do so could result in project failure, public ill-will and distrust of the government. Bruvold *et al.* (1981) warn that while projects may be deemed by engineers and other technical personnel to be appropriate for a location, the community may not share this opinion.

In order to increase community acceptance of recycled water use Hartley (2001) believes it is necessary to develop more effective methods of public participation. Hartley (2001) identifies the following factors as being key to public participation in recycled water decision making: information and context, communication and dialogue, trust and trust building, perception of fairness, and motivation and commitment to participate in decision-making.

A central theme of the literature discussed here is the need to involve the public in decision making. However what has not been researched in practice is the parameters of community involvement. For example, would the presence of Hartley's key factors to public participation in the absence of a formal vote or referendum satisfy the public and ensure a sustainable water supply solution?

*Desalinated water.* Respondents generally held more positive **beliefs** about desalinated water than they did about recycled water (see Table 3 which summarises the open-ended responses): 45% stated that they would have no problem drinking it. Very few respondents raised health concerns or demanded evidence that it was safe to drink. Instead, 12% of respondents held negative beliefs because of the environmental damage that is caused, especially increased greenhouse gas emissions and burdening of the marine environment with salty discharge from plants.

*Insert Table 3*

Looking at the **social norm** dimension of the theory of planned behaviour, when asked who would influence respondents positively regarding desalinated water, responses were similar to those related to recycled water: 41% deny that anyone could influence them, and of the others the most identified source was scientists (14%). When asked who may influence them not to drink desalinated water, the responses were quite different with 36% stating nobody would and 17% stating scientists again. Only 6% mentioned friends and relatives in this context, possibly indicating that the matter is less controversial and less debated in the private context.

In terms of aspects of **perceived behavioural control** the main reason preventing respondents from drinking desalinated water was lack of availability (46%), followed by environmental concern (8%) and the taste (3%).

### **Location-specific findings**

*Adelaide.* One respondent stated that they are currently drinking recycled water, referring to water from the rainwater tank. This is not surprising given that Adelaide is the only study location with a long history of rainwater tanks and drinking water from rainwater tanks because of the historically low perceived quality of tap water.

All Adelaide respondents stated that they would consider drinking recycled water in future, 7 respondents stated that something is preventing them from drinking recycled water with two main arguments mentioned: the fact that is currently unavailable to them and the feeling that of a lack of information to make an informed decision. This is interesting considering a significant percentage of Adelaide's drinking water comes from the Murray River, resulting in indirect potable reuse.

When asked what they know about water recycling the majority of respondents admit they did not

know much, although one respondent was able describe accurately a number of stages of the treatment process. Another respondent was familiar with the term “reverse osmosis” and one respondent was aware of the fact that it is costly to build and run a recycling plant.

With respect to desalinated water, half of the Adelaide respondents said they would have no problem drinking it. One respondent raised the high cost and three respondents raised environmental concerns, one of whom made use conditional upon the use of clean electricity. Nobody is currently drinking desalinated water, although 8 respondents state that they would contemplate drinking it in future, with lack of availability being the only reason preventing this behaviour.

Adelaide respondents’ knowledge about water desalination was significantly higher than their knowledge about water recycling, probably because of government plans to build a desalination plant in Adelaide. Four respondents understood different aspects which caused environmental concern, three were able to explain that desalination was the purification of ocean water and one respondent explained that there were plans to build a plant in Adelaide.

*Brisbane.* None of the Brisbane respondents are currently drinking recycled water. However 4 respondents stated they would contemplate drinking it in future. Generally respondents expressed that they would probably have no choice, especially if the drought got worse. This is true given the Queensland Government’s announcement in 2007 of an indirect potable reuse scheme for Brisbane 2008 (Premier of Queensland, 2007). This is an interesting finding given that Queensland is very active in developing alternative water solutions without conducting consultation processes (probably as a consequence of the negative referendum in Toowoomba that essentially stopped their first attempt to build a recycling plant).

All respondents stated that something is preventing them from drinking recycled water. The reasons stated include non-availability and what could be referred to as the “yuck factor”, essentially subsuming a range of reasons why drinking recycled water would be disgusting. One respondent provided the following description:

*“I don’t like everything that goes into it. God only knows what people put down the toilet! Unused medication, God knows. Oh, I don’t know! Too many toxins. Too much rubbish goes in the sewerage.”*

The fact that Brisbane respondents mentioned the “yuck” factor more frequently could also be explained by the extent of the public debate regarding Toowoomba. Interestingly, despite the high media coverage of the Toowoomba referendum, the vast majority of respondents from Brisbane admit not knowing much about water recycling.

Many Brisbane respondents expressed that they would prefer desalinated over recycled water. Although one respondent was aware of the negative environmental consequences, the respondents generally did not know much about desalinated water, with one respondent stating:

*“Much happier than recycled water. I love the ocean. It seems to be a much easier way to process water. Desalination is cheaper, rather than have big treatment plants. It would be more cost effective than treating human waste. This is something which we can better control the quality of, it is more likely to be produced locally”.*

Two respondents admit that they do not know much about desalinated water, two respondents know that it is expensive and the respondent quoted above (wrongly) believes that it is simpler and more cost effective than recycling water. While none of the respondents are currently drinking desalinated water, all state that they would contemplate drinking it in future

*Darwin.* Most respondents from Darwin did not like the idea of drinking recycled water. Two said they would drink it if it was necessary. Another two respondents explicitly stated that they think drinking recycled water is disgusting. One respondent stated that they are still sceptical, and another said they would like to watch others use it for a while before they would. Despite the expressed scepticism all respondents would drink recycled water if it would be necessary given the water shortage. A few respondents admit to not knowing much about recycled water, one was able to explain that it was a filtration process and two reported on the referendum in Toowoomba as source of knowledge about recycled water.

The majority of respondents from Darwin have no problem with desalinated water. They generally see it as preferable to recycled water. One respondent raised health concerns (“All the effluent goes into it. The marine animals shit in the ocean, and sea water is salty and salt is not that good for you”), one respondent raised environmental concerns and another respondent stated that it would depend on the taste whether or not they would drink it. Darwin respondents generally did not have much knowledge about desalination. Three respondents stated that it was expensive, one respondent stated that it was of environmental concern because of the high energy use.

*Mallee.* About half of the respondents of Mallee did not like the idea of drinking recycled water, the other half had no problem. From the responses it became clear that Mallee respondents had a much closer relationship to nature and the natural water cycle. All respondents were aware of the fact that animal faeces are in rainwater tanks as well as dam water and consequently the “yuck” factor was not as high. One respondent stated they are currently drinking recycled water because the Murray River is their water source. About one third of the respondents state they believe it is currently not necessary to drink recycled water, and that is preventing them from doing so. The majority of respondents state that they do not know much about water recycling. One respondent has visited a recycling plant, and two mentioned the filtration and chemical cleaning processes.

The majority of respondents from Mallee had no concerns about drinking desalinated water. Two respondents felt very strongly about the negative environmental impacts and one respondent knew that desalination was expensive. Generally they thought it was less relevant for their region given its distance from the ocean. The two main reasons that are preventing two thirds of Mallee respondents from drinking desalinated water were (1) the distance from the sea and consequently the high cost they expect would be associated with desalinated water for them and (2) that it is currently not necessary.

*Melbourne.* Melbourne respondents had mixed feelings about drinking recycled water. About half were not concerned about drinking recycled water, about half made their acceptance conditional on the cleanliness of the water or trusting scientists. A few were opposed to the idea all together. Forty four percent stated that something is preventing them from drinking recycled water, such as; lack of knowledge, health concerns, smell and taste, possible contaminants that cannot be scientifically detected at present, and simply the fact that it is currently not necessary.

Melbourne respondents only mentioned one source of information that would influence them: scientists, scientific literature, and scientific organisations. Half of the respondents thought they could not be influenced at all. They indicated they may be influenced via general information, information about the cleaning process and by giving a safety guarantee. When asked who could influence them not to drink recycled water many of the Melbourne respondents said that family and

friends may. Only a few Melbourne respondents stated they do not know much about water recycling. Some respondents were able to provide quite a significant amount of detail into the process. Some had acquired this information through online research, some through visiting recycling plants themselves and some by listening to friends and family who have visited a recycling plant.

Half of the Melbourne respondents state they do not have any problems with drinking desalinated water, while half raise serious concerns about the negative environmental impacts. Sixty seven percent stated that something is preventing them from drinking desalinated water, mainly lack of availability, but also health concerns caused by either flawed processing or contamination that currently can not be detected by scientists. The knowledge level of Melbourne respondents regarding desalinated water was relatively high, with only three respondents stating that they knew nothing at all or not much. Some respondents were able to give a short accurate description of the process.

*Perth.* Overall, Perth respondents did not have a problem with recycled water. Three respondents did make the point, however, that they would expect it to be quality controlled. The main reasons preventing Perth respondents from drinking recycled water are health concerns, the fact that it is currently not necessary and the lack of availability.

The majority of Perth respondents either state they have already tried desalinated water or that they would not have a problem drinking it. Only one respondent raises concerns. Only one respondent states to be drinking desalinated water. This is very surprising given that there is an operational desalination plant in Perth. It appears that there may have been only limited public debate in Perth before the construction of the plant. Thirty three percent state that something is preventing them from drinking desalinated water, with two respondents stating it is not available to them, and one respondent stating that it tastes bad. One quote from a Perth respondent summarises the confusing responses when asked what prevents them to use desalinated water:

*“Not sure - do we have it here in Perth?”*

The question about the level of knowledge supported the previous responses: the level of knowledge was not higher than in other locations, including locations with plenty of water in which no plans for water augmentation of any kind was proposed (e.g. Darwin).

*Sydney.* About half of the Sydney respondents were open to the idea of drinking recycled water. One respondent stated they are reluctant, one cautious and one that they have a negative attitude towards recycled water. Three respondents stated the lack of availability as a reason preventing them from using desalinated water. Two respondents stated health concerns related to the fact that recycled water is purified sewage and one respondent named quality control monitoring as a reason. Only one respondent from Sydney had basic understanding of the recycling process, the other respondents either stated that they did not know much about water recycling or they talked about public opposition in general and Toowoomba specifically.

The majority of respondents in Sydney have no concerns about drinking desalinated water. One single respondent states that – while they have no concerns drinking desalinated water – they are opposed to it because of the negative environmental effects and the high cost. Except for two respondents who stated that the cost and the negative environmental effects prevented them for drinking desalinated water, all respondents stated lack of availability as reason. When asked what they know about seawater desalination, none of the Sydney respondents talked about the process.

Most either associated it with high cost or negative environmental effects, a few said they did not know much about it.

*Toowoomba.* The respondents from Toowoomba were surprisingly positive about recycled water given the history of the referendum in which the Toowoomba population voted against a recycling plant being built in their town. One respondent who believes the recycling project should have gone ahead said:

*“It doesn't bother me [...]. How do they know that the normal water you drink someone hasn't gone and crapped in it [...]. Fish and turtles swim in it. Some people just don't think about it. That was when the vote was and that was stupid, it just should have gone ahead. I don't think things would change now - people are still afraid of getting turds in their water, I think it is stupid.”*

Half state that something is preventing them from drinking recycled water, mostly the fact that it was not available but also the “yuck” factor, the thought of drinking treated sewage (only stated by one respondent). Surprisingly Toowoomba residents – despite the referendum and all the campaigning at the time of the referendum – generally admitted they do not know much about water recycling at all. Half of the respondents said they knew nothing or not much.

Toowoomba respondents had no concerns about drinking desalinated water. Only one respondent raised the issue of “astronomical” cost. All respondents stated the lack of availability prevented them from using desalinated water. People’s knowledge about desalinated water in Toowoomba was extremely low, with most respondents acknowledging their lack of knowledge. One respondent knew that reverse osmosis was used, and one respondent incorrectly thought that it would help with rising sea levels.

## CONCLUSIONS

The aim of this study was to reveal community beliefs, social norms and factors of perceived behavioural control with respect to the behaviour of drinking recycled and desalinated water, respectively.

Key findings emerging from this study were that Australians would drink both recycled and desalinated water if this would be necessary. This became particularly evident when respondents were confronted with the scenario of a worsening drought. Only a few respondents had such serious concerns about either of the two alternative water sources that they would refuse drinking the water if pristine water sources were producing critically little water. This finding is in contradiction with the majority of acceptance studies undertaken previously which concluded that acceptance levels for drinking were very low. We believe that this is a consequence of previous studies asking highly hypothetical questions, whereas in our study people were first asked about their general attitude and then presented with a critical scenario. While many respondents expressed negative or at least sceptical attitudes, practically all respondents were happy to drink water from alternative water sources if necessary. In many ways this supports the political decision made in Queensland where a public referendum (in Toowoomba) led to the abandonment of a planned recycling scheme and, as a consequence, referenda are no longer held (in the case of Brisbane): the public is simply informed that there is no choice given the current water crisis.

Another interesting finding is that, despite significant media coverage of the water crisis and various solutions to it, Australians have very little knowledge about the processes of both water recycling and desalination. This is particularly surprising in places where recycling schemes were

proposed and referenda held. It also reflects many respondents' belief that they lack information to make an informed decision about drinking or refusing to drink water from alternative sources.

Overall, for both recycled water and desalinated water, the main three negative beliefs mentioned by respondents were high cost, negative consequences for the environment and health concerns. The key information that respondents felt they would need to make an informed decision about their support of water recycling and desalination schemes was process information (how is the water processed before it comes into the pipes of their home), test results (scientific proof that the water was of high quality) and experience reports from current users of alternative water schemes (this was mainly of interest to those respondents who were aware that water recycling and desalination schemes are already operational in other countries).

In terms of the people who would influence their decision to drink or not to drink recycled and desalinated water, an area which has not been studied to date, responses were asymmetric. Scientists and experts were named as the main sources they would listen to in order to gain confidence in drinking water from alternative water schemes. Friends and family, on the other hand, have the most influence in raising doubts and preventing people from drinking water from alternative sources. This finding has implications for public policy and the way in which alternative water projects should be communicated to the public.

The present study is limited by the fact that it was qualitative in nature and focused on a relatively small number of locations with distinct characteristics regarding their water situation. A large scale representative quantitative study is required to be able to provide reliable percentage figures for the overall Australian population.

The present study raises a number of interesting follow-up questions which should be investigated in the future: (1) Does the level of an individual's education affect the kind of information they are seeking and the information sources they rely on most? (2) Which new products or behaviours would develop (e.g. drinking purchased bottled water, drinking rainwater tank water, etc.) if recycled or desalinated water was to be introduced into reticulated drinking water supplies? and most controversially, (3) will communities facing severe drought, who are informed about their dire water situation, be more accepting of alternative water decisions made by authorities without the need to be involved in a formal decision making process?

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**Table 1.** Water storage levels in study locations

<b>Location</b>	<b>Water supply levels July 2008 (time of study) %</b>	<b>Water supply levels March 2009 %</b>
Adelaide	50	58
Brisbane	40	47
Darwin	100	Not available
Melbourne	31	29
The Mallee (Horsham)	8	4
Perth	35	31
Sydney	66	58
Toowoomba	11	13

**Table 2.** “How do you feel about recycled water?”

<b>Evaluation</b>	<b>Statement</b>	<b>Frequency</b>
Positive	no problem	19
Positive	ok elsewhere	4
Positive	tried it - ok	1
<b>TOTAL POSITIVE</b>		<b>24</b>
conditional	if clean / controlled	7
conditional	if necessary	3
conditional	if scientist ok	3
conditional	if no chlorine	1
conditional	if through reservoir	1
conditional	watch others first	1
<b>TOTAL CONDITIONAL</b>		<b>16</b>
neutral	all water is recycled	2
neutral	need more info	2
neutral	don't ask public	1
<b>TOTAL NEUTRAL</b>		<b>5</b>
Negative	don't like idea	6
Negative	sceptical	3
Negative	negative	2
Negative	yuk	2
Negative	cautious	1
Negative	no way	1
Negative	reluctant	1
Negative	would not drink it	1
<b>TOTAL NEGATIVE</b>		<b>17</b>

**Table 3.** “How do you feel about desalinated water?”

<b>Evaluation</b>	<b>Statement</b>	<b>Frequency</b>
Positive	no problem	30
Positive	better then recycled water	5
Positive	not a bad idea	1
positive	can hardly tell the difference	1
positive	positive	1
<b>TOTAL POSITIVE</b>		
conditional	depends on taste	1
conditional	if clean	1
conditional	if I had to	1
conditional	if powered by clean electricity	1
conditional	lack info	1
<b>TOTAL CONDITIONAL</b>		
neutral	one big water cycle	1
<b>TOTAL NEUTRAL</b>		
negative	environmental concerns	8
negative	expensive	4
negative	health concerns	1
negative	sceptical	1
<b>TOTAL NEGATIVE</b>		
other	tried already	3
other	allergic to iodine	1
other	same as recycled water	1
<b>TOTAL OTHER</b>		