

Qualitative Exploration of Beliefs, Values and Knowledge Associated with Decentralised Water Supplies in South East Queensland Communities

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

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FOREWORD

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

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

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

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

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

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

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



Chris Davis
Chair, Urban Water Security Research Alliance

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EXECUTIVE SUMMARY

The purpose of this study was to explore the general beliefs, values and knowledge associated with decentralised water supply systems among residents in South East Queensland (SEQ) who were using decentralised systems in their home, as well as residents who were not. Decentralised systems allow households to collect, treat and reuse localised wastewater in areas where high quality water is not required. Examples of these are rainwater tanks and grey water systems. The key benefit of these systems is reducing households' reliance on town/mains water and providing water on a fit-for-purpose basis.

The study comprised two groups of participants, *Users*, who had some form of decentralised system on their property, and *Non-users*, who were residents of SEQ without a decentralised system installed on their property. For the Users group, participants were obtained from households in three greenfield developments within SEQ, Locations A, B and C. These three developments were of interest because they mandated individual water tanks as primary and/or supplementary water sources. Households in the Non-user group were selected from the suburbs surrounding the three greenfield developments.

Convenience sampling was used to recruit respondents from the three localities for participation in semi-structured interviews. Overall, 34 people were interviewed; 24 were Users and 10 were Non-users. Interviews took place in respondents' homes, with two CSIRO researchers present. The interviews varied between 25-60 minutes in duration and were conducted between 9:00am – 7:00pm, Monday to Saturday within a single week. Interviews were transcribed verbatim and data were then coded and content analysed using NVivo 8. Analyses of the data included identifying and extracting recurrent themes and sub-themes within the interview text to: 1) gain an understanding of participants' beliefs regarding tank water and grey water systems; 2) evaluate the existing level of knowledge among both Users and Non-users of decentralised water systems; and 3) understand personal and social values attributed to decentralised water supplies. It is important to note that while the sample used in this study is small, data saturation was achieved, suggesting an appropriate sample size. Further, a high number of older participants took part in this study, likely due to the recruitment method. While effort was made to minimise the potential effects of this, it is recommended that results be interpreted with appropriate caution, as opinions expressed during interviews may not necessarily be representative of all SEQ residents.

Results indicated Users and Non-users shared a common view in relation to key themes. First, both groups indicated that living sustainably was a desirable way of life (e.g. utilising a decentralised water system for household water). However, the decision to live sustainably was usually influenced by external factors such as property regulations and finance. Both groups also cited the benefits (or potential benefits – for the Non-users) of having increased water quantity around the home, especially with regards to an increase in the quantity of water available to water gardens and lawns.

Respondents from the Users group in all three locations stated that property location issues, such as locality, outlook and orientation, were dominant factors for choosing to live in their current homes. Environmental benefits associated with using decentralised water were of secondary importance. Users cited many advantages of having decentralised water; the primary advantage being the superior quality of drinking water produced from the rainwater tanks, which was perceived to be free of chemicals such as chlorine and fluoride, unlike council water. Cost savings were also mentioned as another benefit. However, most Users admitted that the true financial benefits of using an alternative water source would probably only become apparent after at least 10 years of continuous use.

Amongst a number of concerns raised, Users cited maintenance issues as a disadvantage of owning and using some decentralised systems. Many individuals were also concerned with the high amount of electricity required to pump water from a decentralised source into the household taps. Residents in Location C specifically raised concerns regarding poor installation of rainwater tanks, which led to problems such as leakage and back flow that then led to tensions between water system providers and the residents. Such problems were cited as a severe disadvantage and caused these residents to be less confident in the quality of their tank water.

Based on discussions with residents in each of these three locations, a key improvement that could be made immediately is the appointment of qualified individuals on-site to monitor the quality of the water systems and report back to residents on the characteristics of their water and deal with minor quality issues that may arise. This was shown to encourage greater acceptance among Users in Location B, possibly because they were well informed as to the working status of their systems. Another issue that could be targeted, potentially by manufacturers, is the high cost associated with not only purchasing and installing additional tanks and grey water systems, but also the frequent and costly maintenance involved in using these devices on a daily basis. This could be addressed by introducing permanent rebates in conjunction with subsidised costs for system maintenance.

By all accounts, the experiences Non-users observed vicariously of decentralised systems were positive, possibly explaining why the present data highlighted such high acceptance for decentralised systems among Non-users. However, there was consistent doubt among Non-users in the ability of decentralised systems to adequately treat the water to drinking standards. Additionally, the most consistent finding among the sample was that acquaintances who already had rainwater tanks primarily used the rainwater for outdoor applications. Consequently, Non-users stated their intentions for installing a rainwater tank would be for non-potable uses, such as for gardening, as they were reluctant to use rainwater for drinking and cooking. This perception alludes to the limited knowledge of the general public related to the technology behind decentralised water systems. This could be addressed by broadening the accessibility of decentralised water system knowledge, so that current Non-user can have access to reliable, accurate information with regards to appropriate uses for rainwater and grey water.

Non-users mentioned that the three main barriers to adoption of decentralised systems around their homes were related to financial limitations, perceived complexity of applying for government rebates and space constraints. Most Non-users, if building a new house, would opt for installing an underground rainwater tank at the building stage, despite the greater capital costs, rather than installing a tank outside the new home. With regards to having water efficient appliances in the home, the majority of Non-users indicated that they had low flow shower heads and dual-flush toilets installed in their homes; some also reported having water efficient dishwashers and washing machines.

Most Non-users retrospectively described their water-saving behaviour during the severe water restrictions period and reported being mindful of the length of time they spent in the shower, reusing water from the bathroom and/or laundry where possible, and limiting the amount of water used for their gardens. However, there were some individuals who believed that because of the increased rainfall, there was little threat of water shortages “these days” and reported consequently having longer showers and watering their gardens more than they used to when the drought was “on”. These findings describe a potentially alarming perception among the general public that drought conditions are seemingly solved by greater rainfall, rather than viewing drought as a terminal consequence associated with the larger issue of projected water shortages and unsustainable living.

The results highlight a number of important considerations for moving forward with this research. First, one advantage of the current study over similar studies is the incorporation of people actively engaging in the behaviour of interest. From the comparison of actual (Users) and intended behaviours (Non-users), it becomes evident that there is at least some disparity between the groups. It is proposed that future research could focus on theoretically pertinent predictor variables of actual and intended behaviours and how one can infer information from models of intended behaviour to guide in the prediction of actual behaviour.

Second, since the most prominent reason given for choosing to live in decentralised communities was the location of the development, more research is needed to quantify this effect and assess the degree to which this might be an important consideration for land and water planning in the future. One possibility is to incorporate geospatial data into potential future modelling endeavours, to essentially “map out” current and projected acceptance and adoption behaviours. This will, in turn, help inform the level of projected urban water demand in new sustainable housing development areas.

1. INTRODUCTION

Worldwide, the effects of climate change and population growth have resulted in a need to carefully consider the management of depleting natural resources. In Australia, the issue of water scarcity has come to the fore. Competing uses, a rapidly increasing population and declining water resources necessitate the urgent evaluation of water supply and the need to identify new, fit for purpose supplies. The region of South East Queensland (SEQ) represents an example of this phenomenon in Australia. A heavily urbanised area, SEQ is Australia's fastest growing region, projected to almost double in population by 2031 (DIP, 2008). A number of initiatives have been implemented by the Queensland Water Commission (QWC) in response to issues of water scarcity, making SEQ an ideal location to study communities' acceptance of alternative water supply options.

Traditionally, Australian urban households are supplied water for both potable and non-potable uses through a central supply system, commonly referred to as mains or scheme water. For example, water is taken from reservoirs, treated and supplied to all households from a central location. An alternative to this central supply option, currently being investigated in SEQ, is the use of decentralised systems. While these systems can take many forms (for example, using treated wastewater, rainwater and/or groundwater), they are characterised as water sources that are located close to the house or households being supplied. Decentralised water supply schemes have been identified as an important option for addressing water supply demands from individual homes as well as small and large housing developments (Cook, et al., 2009).

While the concept of decentralised systems seems intuitively beneficial, research into the adoption of new water supply options shows that community acceptance is key to successful implementation (Hurlimann and Dolnicar, 2010; Marks, Cromar, Fallowfield, and Oemcke, 2003; Radcliffe, 2006). Po et al (2005) indicate that even where research has shown widespread willingness to accept and understand the need for alternative water supply schemes in the community, these schemes still often fail to garner widespread public support. So, while there has been, and continues to be, much research focused on the acceptance of alternative water supplies, there is still a missing link between people's acceptance and actual adoption.

There are a number of possible reasons for the limited research available connecting acceptance and adoption of alternative water supplies. One is the predominance of quantitative investigation in the field, often favoured over deeper, qualitative inquiry, which might be better placed to understand the rationale behind acceptance or rejection. Dolnicar and Hurlimann (2009) concur, finding that literature on the acceptance of alternative water supplies suffers from a focus on the quantification of influencing factors, to the detriment of a deeper understanding of influences on acceptance.

Another issue limiting researchers' understanding of adoption is the focus on intended behaviour, rather than actual, observable behaviour, such as actual adoption of an alternative water system. In previous decades, this was likely an unfortunate necessity in Australia, with few communities set up for the use of alternative water supplies. However, case study communities are increasingly being established where the motivations and behaviours of people faced with alternative water supplies can be observed and examined (e.g. McKay and Hurlimann, 2003; Hurlimann and McKay, 2004). Recent research by Hurlimann, Dolnicar and Meyer (2009) highlights the fundamental lack of research into actual adoption behaviours, with almost all previous research focusing on intended behaviours and stated acceptance. Moreover, Marks and Zadoroznyj (2005) found that the structural and governance arrangements of water supplies can have substantial impacts on issues such as knowledge and trust in reclaimed water sources. This would suggest a need for comparative case studies to assess the degree to which behaviours and influences on behaviour differ, based on the different decentralised water supply systems available to households, ranging from one device for the garden, to using decentralised water for all household applications.

Much of the previous research examining acceptance of alternative water supplies has been focused on the use of recycled water, in particular for drinking purposes. As research by Brown and Davies (2007) indicates, greatest acceptance of recycled water uses is for non-potable purposes, with degree of contact having an inverse relationship with acceptance. This is not necessarily the case with

alternative water supplies not associated with recycled water. More research is needed to provide comparisons of the differences between recycled and other alternative sources of water for a range of uses to identify firstly, if the same social issues are relevant and, if so, are the motivations and influencing factors the same or different?

The aim of the current research is to better understand public acceptance of a range of decentralised water supply options. In order to overcome potential knowledge gaps, the research uses a qualitative method to investigate stated and actual behaviour of users and non users of decentralised water supplies. In addition, decentralised system users were sourced from three separate communities in SEQ, each with slightly different water supply arrangements, allowing for the examination of differences which may be attributable to the design of the communities. Further, this research allows for the comparison of actual users, and individuals unfamiliar with decentralised systems, to begin to understand how intentions and actual behaviour might be similar, or driven by differing factors.

2. METHODOLOGY AND SAMPLING

2.1. Study Area and Participants

A number of locations in southeast Queensland (SEQ) were identified by Cook, Tjandraatmadja, Ho and Sharma (2009) as greenfield developments that were utilising decentralised water systems. Three of these locations were chosen for this study (see Figure 1) because they are relatively well populated compared to other sites and homeowners in these sites have been using decentralised water for a sufficient amount of time to become aware of the benefits and shortcomings *ex post*. The three developments within these areas mandated individual water tanks as primary and/or supplementary water sources. Individual lots within the greenfield development at Location B were required to install a grey water system as an additional water source, as were homes in the development at Location A, which were connected to an on-site communal blackwater system designed to supplement the rainwater and grey water supply. Individual lots at Location C were not required to have additional decentralised water systems to supplement their tank water supply. Individuals from these three greenfield developments comprised the first group of participants (*Users*), operationally defined as those who were using decentralised water supplies in their homes.

For the purposes of comparison, this study also included a smaller control group, consisting of individuals who were recruited from the same localities as participants in the Users group. Non-users were not using any plumbed decentralised water systems and were connected to the main town water supply (*Non-Users*). The two groups of participants were primarily matched on approximate dwelling location and were comparable on demographic criteria, such as age and gender. Although participants were not specifically matched on socio-economic status, User and Non-user groups comprised individuals from the same localities and it was believed that there were no major differences in socio-economic standing between individuals from the same general area. For both groups, a convenience sampling technique was used to recruit the respondents for the interview until data saturation was achieved. Overall, 34 people were recruited to the study from the three localities (Users $n=24$, Non-users $n=10$).

2.1.1. Location A

This development is located on the Gold Coast, approximately 100 kilometres south of Brisbane, and 7 km inland from the coast. The total population of the locality in which the development is situated, based on the 2006 Census data, was approximately 31,539 people (ABS, 2007). Location A was chosen as it is the site of a relatively recent development with a strong focus on environmentally sustainable living. In addition to stringent environmental building regulations, including the use of recycled materials in the building construction and the use of materials with low embodied energy, the development also relied solely on several decentralised water supply systems working in tandem. Individual home sites in the development were responsible for the supply of their own potable water through rainwater collection. It was a requirement for houses to have a specific storage capacity, dependent on the size of the house. Non-potable water was supplied to home sites in the form of recycled wastewater. Each household was connected to a community based recycling plant and all wastewater from each home was treated, and then supplied back to homes for outdoor and non-potable use. Water use was not restricted within the development, and water was charged for only in the form of strata, or body corporate, fees related to the maintenance and running of the treatment plant.

2.1.2. Location B

The locality in which Location B was situated is approximately 15 km west of Brisbane city and is close to one of the city's oldest dams/reservoirs, which was originally built in 1866 and decommissioned in 2003. Although it is no longer the major source of water for households in Brisbane, the dam recommenced operation in 2008 due to prolonged drought conditions in SEQ (DERM, 2009). At the time of interviews, the dam was recorded as approximately 90% full (Seqwater, 2010). The total population of this locality, based on the 2006 Census data, was approximately 16,100 people (ABS, 2007), with approximately 96% of homes being separate, private dwellings. Location B was chosen because it was the site for a new sustainable greenfield development, which will

eventually comprise 22 lots when completed. At the time of data collection, only six lots had been developed and residents had been living in their homes for a minimum of 12 months.

Based on body corporate rules, individual lots were required to have a minimum 20,000 L capacity rainwater tank (additional 5,000 L minimum tank if property has a swimming pool). Lots were also required to have an internal grey water system built into the house, which collected kitchen, laundry and bathroom wastewater and distributed it to the garden after treatment. In addition to private tanks, the development had two 80,000 L communal rainwater tanks on-site, which were designed to serve several functions: a) as a collection point from which water could be mobilised in the event of a fire; b) as a collection point for overflow from individual rainwater tanks; and c) to feed into individual rainwater tanks if the water level of the individual tanks falls below a minimum. In the event that the communal water tanks also fell below a minimum water level, mains water would automatically trickle-feed into these tanks to supply the residents. Tanks and grey water systems on individual lots were maintained by individual home owners, however, the two communal tanks were maintained by the body corporate, which was primarily made up of resident members.

2.1.3. Location C

Location C is located in a region 45 kilometres north of the city of Brisbane. Just over 100 lots in the development were designed for environmental sustainability. Residents were required to have underground rainwater tanks, six solar panels and fibre optic technology in their home. Respondents' homes incorporated either one or two underground rainwater tanks of sizes ranging from 12,000 L to 14,000 L. The tank water was used for toilet flushing, laundry applications and for garden irrigation. In addition to being stored within individual rainwater tanks, some rainwater collected on household roofs was intended to be used to water the nearby golf course and to fill artificial lakes.

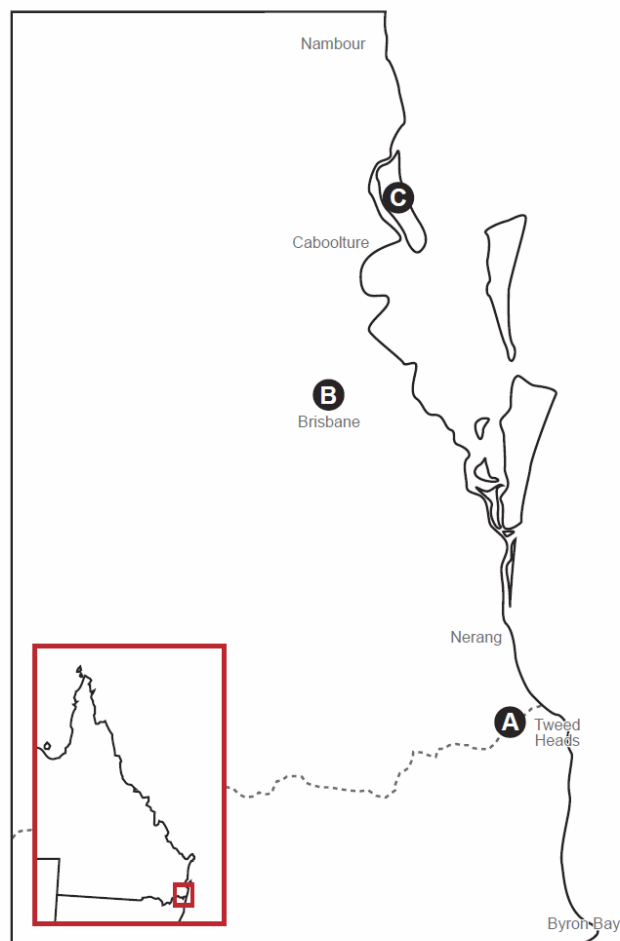


Figure 1. Map of South East Queensland, Highlighting Key Study Areas.

2.2. Sample Recruitment

Participants in the Non-User group were recruited via telephone using a recruitment company. They were selected based on a number of criteria. First, it was necessary that participants were living in the surrounding suburbs of the identified greenfield developments from which the User groups were recruited. This was to ensure similarities in the surrounding environmental condition of the area between the Users and Non-users and to minimise demographic differences related to such variables as income and education. Second, it was necessary that the Non-users were not using any type of decentralised water system. Third, respondents were homeowners, however they did not have to own the home outright; therefore, mortgage payers were eligible to take part. This was a delimitation applied to participant recruitment because typically, renters did not have the authority to make decisions regarding modifications to the property, such as the installation of a decentralised water system.

Users from Locations B and C were recruited to the study via door-knock recruitment. Research assistants approached individual home owners and explained the study's purpose, as well as participation requirements. Individuals were left with an information sheet and a consent form which they were asked to complete and bring to the interview. If home owners were not present during the door-knock occasions, a postcard and information sheet was left in the mailbox, with researchers' contact details.

Participants from Location A were not recruited this way, due to developers' restrictions on researchers accessing the community's residents. Instead, an email outlining the study and participation requirements was forwarded to residents via the community's intranet and residents were asked to contact researchers directly if they were interested in taking part.

Involvement in the study was voluntary and all respondents gave written consent for their participation. Participants were assured of confidentiality and were given a \$100 gift voucher in recognition of their participation.

This study received ethical approval from both the CSIRO Human Research Ethics Committee and The University of Queensland Ethics Committee before commencing participant recruitment and data collection.

2.3. Procedure and Interview Guidelines

Interviews took place in individual respondents' homes, with two CSIRO researchers present. The interviews varied between 25-60 minutes in duration and were conducted between 9:00am – 7:00pm, Monday to Saturday within a single week. Participants were asked to respond openly and honestly to the questions and were informed that they were free to withdraw at any time without penalty. Individuals were also asked their permission for researchers to audiotape the interview to maintain accuracy of the data being obtained. All participants agreed to these requirements and no participants chose to withdraw from their interview. Interviews were recorded using a digital recorder.

Given the semi-structured format, interviewers began the session by asking both groups of respondents what their general background knowledge was of the water supply being plumbed into their homes. This was to encourage participants to think more broadly about their household water and its use, before moving on to discuss more detailed aspects of their beliefs, values and knowledge regarding decentralised systems. At this preliminary stage, interviewers also reiterated a brief description of the study, as provided in the information sheet, so that participants were aware that the study was exploratory and there were no incorrect responses. After the initial question, the interview guidelines for the two groups varied, due to differences in exposure to, and experience with, decentralised water systems.

2.3.1. Users of Decentralised Water Supplies

Participants within this group were asked to describe their current residential decentralised system(s) and to identify the main reasons why their household had chosen to adopt this water supply. Respondents were encouraged to demonstrate their knowledge of the systems adopted and any related issues, such as maintenance and functioning. Advantages and disadvantages associated with the decentralised water systems were discussed and respondents were asked to think about ideal changes or improvement they would make, if given the opportunity. Householders were asked to consider how others (i.e. non-users) may feel about their decentralised water systems and highlight any concerns they had as users of decentralised water systems.

2.3.2. Non-Users of Decentralised Water Supplies

Respondents within this group were asked a number of preliminary questions, relating to their understanding of what a decentralised water system was, whether they were aware of any forms of decentralised systems available for residential use, and their general thoughts concerning these alternative water supplies. Interviewers then guided the topic of conversation towards gaining insight into the reasons why current non-users would or would not consider adopting the decentralised systems in the future, as well as their thoughts about why others may choose to install decentralised water systems. Participants' perceptions of the associated advantages and disadvantages were explored, and respondents were encouraged to discuss concerns they had regarding alternative water supplies.

2.4. Data Analysis

Interviews were transcribed verbatim using an external data transcription agency to prevent biases during transcription. Transcribers adhered to a confidentiality agreement and all data files stored in their company's system were destroyed after transcription was completed. Participants were not identified within the transcript at any stage. In four instances, two home owners were present during the interview (i.e. a married couple) and their responses were analysed jointly, however once again, individual respondents were not identified.

Data was then coded and content analysed using NVivo 8 (QSR International, 2008) by two researchers directly involved in the study, plus one team member who was not involved in data collection. Analysis of the data included identifying and extracting recurrent themes and sub-themes within the interview text, to gain an understanding of participants' beliefs regarding tank water and grey water systems, the existing level of knowledge among both Users and Non-users of decentralised water systems, as well as personal and social values attributed to decentralised water supplies. Inter-rater reliability was high among the three raters when comparing coding within NVivo 8.

3. RESULTS

Overall, results indicated comparable major themes among respondents in the three locations, however there were noteworthy differences between groups in the extraction of sub-themes. Therefore, to facilitate greater understanding and ease of interpretation, the following results are presented based on Users and Non-users of decentralised systems and subsequently sub-divided by locality within SEQ.

3.1. Users: SEQ Location A

Interview data was categorised based on dominant themes that emerged from the analysis. Some of the major themes were further categorised into sub-themes, which will be presented and illustrated within the text, using direct references from the transcripts where appropriate.

3.1.1. Knowledge

Participants in Location A demonstrated an understanding of the development's water supply systems. Some residents were more knowledgeable than others, demonstrating a thorough understanding of the water supply system logistics with respect to total water catchment capacity and requirements.

"We've got three tanks consisting of two 22,500 and an 18,500 coming to a total of just over 63,000 litres."

"All up we have 33,000 litres... it is a requirement of a certain amount of litres per block size in a way of speaking."

"All our water comes from rainwater tanks... except for the recycled wastewater treatment plant water."

Participants attributed their instances of poor knowledge to a lack of motivation to understand, rather than related to the capacity to understand. For example, when asked if they understood how the system operated, some participants answered:

"I should do, I don't. It's no problem to find out."

"[I know] as little as possible."

Participants were also asked about the technical operation of their systems and again understanding varied. Some participants had a good level of understanding:

"...filtered out before it gets to the tank and also a filter on the tank as well. So we're losing all the dust and sediment that sits on the roof that actually first hits [sic], that's why they're called a first flush."

"...sink, toilet, waste, and washing, all goes onto the onsite sewerage system... One big system for the lot of us."

Others appeared to have little interest in understanding how the system operated or offered seemingly inaccurate descriptions of their systems.

"Our grey water here at the present time is being supplemented by bore water because we can't produce enough grey water for it ourselves."

"It's very, very involved and complicated."

"It's just there and we know that it is there and we know you can use it and it's very good."

Knowledge about system maintenance and its importance were discussed at length. Participants recognised the need for maintenance, but thoughts about the complexity and burden of responsibility were mixed. Generally, residents were happy with self maintaining potable water supplies from personal rain water tanks, stating that this maintenance was reasonable and relatively simple.

"It's really just a question of how clean you are with your tanks. If you put a screen on top of it and another screen there and another screen here, then there won't be any wriggles in it."

"There are some people worry about it, that you should have vacuumed the bottom out, you know, I really wouldn't worry too much."

“There’s a hundred different things to do every day. Someone says don’t you find it an awful load? I said that’s what I’m used to. This is what I lead. This is the life I live.”

Maintenance of the recycled water component, however, was seen as somewhat problematic. Participants raised issues of system errors due to lack of maintenance and misuse of the system.

“We had pumps failed us [sic], we had to buy - just here there’s a pit here that pumps across to the plant, there was one pump destroyed it just couldn’t be repaired. So we bought a new pump and reconditioned a pump. The developer doesn’t want to know about it and it was just total lack of maintenance.”

“That’s one of the reasons why we have the problems with the recycling system because people are putting stuff down the drains and the toilets that aren’t meant to go down there.”

Costs associated with installing, running and maintaining the water supply systems were discussed, and participants were vaguely aware of these costs.

“The water actually is the only one that doesn’t have a huge saving because you don’t get charged for it, do you? As you say, it’s status quo.”

“In general it is much, much cheaper not to be connected to the water because we don’t need it, we don’t have to have it anymore.”

“Yes, there is because we’re paying for body corporate I think \$20 a week for the use of the recycled water coming back to us so we’re paying for that but we’re not paying rates to council for our water so it possibly evens out a little bit. It might be a little bit dearer here actually.”

3.1.2. Reasons for Choosing Decentralised Water Systems

Given that a choice to live in the development in Location A meant adopting decentralised water systems, participants were asked their reason for moving into the development rather than their reasons for adopting decentralised water systems. This allowed researchers to assess the importance of water supplies on choice of development.

Participants in Location A described a number of factors influencing their decision to live in the development. The first and most consistent factor was the location. This included appreciation of the natural settings as well as spatial position.

“Being close to the beach, but having – have land around that we can use, you know. You can go bushwalking in amongst the hills.”

“Connection to nature. I love the backdrop here, the woods there.”

“The position of it ...we have the beach, the rain forest there and here we have this beautiful paradise.”

Another prominent factor in choosing to live in the development was a strong sense of community, including a sense of safety.

“The community spirit here, it’s huge, it’s huge.”

“The community aspect of the village is probably the biggest drawcard for us and was, I guess, always.”

“So it’s very safe here. It’s just people are really – they help each other.”

Environmental sustainability, including, but not necessarily related to, water use also featured as a prominent theme, though in general it appeared to be more of an associated benefit, rather than a reason for moving.

“I just wanted to be able to live more sustainably.”

“The philosophy behind it all appealed to us, appealed to me.”

“Believe in sustainability and as far as our children growing up here, it’s great for them to be in this type of environment and also learning from observation from us.”

3.1.3. Advantages of the System

Participants were asked about the advantages of the decentralised water supply systems. The most prominent theme to arise was the quality of the water and this was more often related to the potable water supplies. A number of sub-categories of water quality emerged; the first was related to the

cleanliness of the water. Specifically that the water was untreated, remaining in its natural state and was therefore cleaner than processed or treated water.

“It’s fresh, clean water straight from the heavens above.”

“People get used to this beautiful, unpolluted water that we have here which you can drink without sending it through various filter systems that take out the goodness that’s in the water.”

“Nobody’s tampered with it and nobody’s decided how much chemicals that they wanted to make sure it’s safe for me to drink. That just overrides everything. Just every time you turn on the tap, I know nobody’s messed with this.”

The taste and sensation of the water also emerged as an important factor to people.

“Once you’ve washed and showered in rain water you don’t want to change, it’s beautiful on your skin and your hair, you don’t have to scratch the muck off when you’re finished with it.”

“When you shower you notice the difference. You use about a quarter of amount of shampoo and things.”

“I would say that the water quality that we get would be far or beyond what you’d get out of the suburban supply. And you can taste it too, or you don’t taste it should I say.”

To a lesser extent, control over personal water use emerged as an advantage of the system. This related to both rainwater and recycled water usage.

“I would hate to have to go, oh gosh, it’s Wednesday, I can’t water. But I can do it tomorrow and then, oh, tomorrow, you forget. You know, that kind of – vegetables don’t really hang on.”

“Certainly in a drought situation compared to living across the road with water restrictions I potentially couldn’t water my plants whereas here I can just water all year around and not care about anyone else.”

“Yes, so we’re in control of our own water supply so no one can come along and turn it off.”

3.1.4. Disadvantages of Using Decentralised Water

Participants were asked to discuss possible disadvantages of the decentralised water supplies. Rainwater supplies did not feature strongly in these discussions, with conversations centring on the on-site recycling system. The principle concern with the recycled water component, was not a conceptual issue, rather the focus was on issues of maintenance and specific system failures.

“They’ve had to put much – or more chlorine in it. Might be hazardous for plants. That’s been the main interruption, hasn’t it? Every now and then, there’s been a blockage and a smell.”

“I don’t like the fact that chlorine is going into the water, waste and our water stream, especially without my consultation.”

The impact of water treatment and disruption to gardening was a prominent theme when discussing possible disadvantages of the system.

“Well, they’ve been putting a lot of chlorine into that to keep it okay and it’s been killing some of my plants when the levels are really high.”

“You could tell the effect [of chlorine] on the plants, they didn’t like it at all. So as it is, you can see we have bits of desert, bits of green, and bits of half-done garden.”

Further disadvantages included difficulties in dealing with body corporate management.

“There’s always going to be concerns when you’ve got an asset like that in a body corporate situation that if something happens to it, it can get out of control and cost you a fortune even though those costs would be split amongst all the residents.”

Some participants also raised the potential disadvantages of storage capacity and low water pressure with respect to rainwater supplies.

“Or if you’re under storage, if you put too small [a tank] in, it could be a disadvantage through economical viability and also through the hassle of always having to worry if we’ve got enough.”

“I suppose if I ever run out of rainwater I would have to get water imported through a tanker so that is a risk but a small one I think.”

“Pressure, I have to have a pump under the house to provide enough pressure to all the taps and fittings that then requires power.”

3.1.5. Sources and Availability of Information

Sources of information emerged as an important theme. Specifically, many participants felt that they had sufficient information about not only decentralised systems, but water scarcity issues more generally.

“My builder gave me a run around when he finished. I talked to the plumber briefly before he finished and he was explaining what goes where.”

“I think they can always find that information. We’ve got 130 people on the [entire] network and we can just email people questions like, ‘what do I do now’ and ‘a mouse in one of my pipes, what do I do, has someone else experienced this’.”

“I’m more conscious. I turn the taps off a lot quicker. Now I don’t rinse the dishes before I put them in the dishwasher, I just put them straight in the dishwasher with heaps of crap on them. Now in having a shower I have a shorter shower.”

There was a dominance of an “us versus them” mentality, with participants expressing that while they were well versed in decentralised systems and water scarcity issues, others outside of the community were not so. In one instance, it was acknowledged prior to moving into the development, they themselves were guilty of this lack of understanding.

“...but I think a lot of people don’t really understand the real issue.”

“Because in the suburbs we’re just oh yes we have water, let’s just [have] half an hour showers and stuff. We weren’t conscious at all. We were using it.”

Education was seen as an important tool in increasing acceptance and adoption of alternative water supply options. Again, participants saw themselves as well educated, if only through the process of building and living in a development targeted at environmental sustainability. Those in more traditional suburbs and developments however were seen as needing education or policy intervention. Exposing children to ideas of sustainability was seen as a useful tool.

“Also for the kids, like being on water tank we’ve become so much more conscious. There was this whole period where we did not have any rain so we were like, okay, let’s have short showers, we don’t have any rain.”

“So there’s a whole lot of education. That’s back to the same thing again. We don’t know everything. There’s a whole lot of education. To get people interested enough to be educated is another task.”

“Yeah. I think that’s where that little thing and that shower thing, that you’re introducing children to it at an early age. It just becomes habit that you have a short shower.”

3.1.6. Confidence

Confidence in the water supplying the development emerged as a minor theme for participants in Location A. There were a number of varied comments which indicated that residents were confident that the on-site water systems had been properly overseen and was safe.

“They’ve done random tests of the water around here and they haven’t found any pathogens in any of the water of significant levels, so he’s just not concerned at all about us ever getting sick from the rain water.”

“A friend of ours, sort of, who works in the Department of Land and Water, across the border, he felt that [Location A] had really catered for everything that was needed. So that maybe gave us a little bit of peace of mind.”

Participants also cited distrust of the regulators of town water supplies to ensure health and safety. This demonstrated that participants were further confident that their decentralised water supply was superior to that provided by mains water.

“I mean they [local water authority] say they put chlorine in, but they could put all sorts of things in and we wouldn’t know about it until there’s an inquiry.”

3.1.7. Social Awareness

The issue of social awareness was raised with participants, particularly with reference to how others, outside of the development, felt about the use of decentralised systems. Generally, participants felt others to be very accepting of their decentralised water systems. The use of alternative water supplies was seen as increasing in popularity.

“It’s getting more popular I think as well. It’s more fashionable to be green these days, which is good and bad in a way.”

“It’s just Australian. That’s just, you know, the way people see the tanks.”

“People have become much more conscious.”

Some participants believed that the acceptance of the systems related to water quality and quantity.

“Out of the [location] I think they all envy us here, they are very envious about us especially ... water and splashing about.”

“Then they see the other advantages in drinking the water, you control that; there’s no fluoride or chlorine there.”

“As a whole, most people are positive but I think the place where it would worry people is the supply. Making sure they’ve got enough and that would be the problem most people are concerned with, will we run out.”

3.1.8. Equity

All non-potable water being used within the development was supplied by a communal recycling plant, where all homes shared in the water supply. Interestingly, equity issues were rarely raised by participants and interviewees perceived water use across the development to be equitable. Further, participants believed that having individual control over the potable water supplies, such as rainwater, meant that there would be no equity concerns among residents.

“...individual water, it’s the better way of going. At least you don’t have to look at your neighbours and think, his shower was 10 minutes longer than my shower there and he’s using more water on the garden but I still have to pay the same amount for it.”

3.1.9. In-group/Community Norms

A theme that emerged frequently in the data was that of community values. Participants felt that the development had a strong sense of community and they commonly cited this as a reason for moving into the development. Despite a strong sense of environmental conscience, there was a feeling that community was a stronger influencing factor in deciding where to live.

“So it’s very safe here. It’s just people are really – they help each other.”

“The community aspect of the village is probably the biggest drawcard for us and was, I guess, always.”

“...everyone is really friendly and glad to be here. It’s a great community because you can just run down and pinch someone’s hose and use it and not really ask them, they’re just not going to care.”

3.1.10. Barriers to Adoption of Decentralised System(s)

While the participants in the decentralised group of Location A were all users of alternative water supplies, some barriers to the wider adoption of alternative water options were raised. These most commonly focused on costs associated with the initial installation.

“But when you’re a pensioner you can’t afford too many gadgets ...”

“Also, the full sustainability options that we’ve chosen, it’s not cheap, not cheap at all.”

“Yes, but for the average Joe unfortunately it’s not easy because it costs.”

3.2. Users: SEQ Location B

Interview data was categorised based on dominant themes that emerged from the analysis. Some of these major themes were further categorised into sub-themes, which will be presented and illustrated within the text, using direct references from the transcripts where appropriate.

3.2.1. Knowledge

Among the User group within Location B, all interviewees demonstrated knowledge of the decentralised water systems plumbed into their homes, as well as the communal water that was available for the development as a whole. However, some residents were more knowledgeable than others. In particular, residents who were active members of the development's body corporate tended to demonstrate greater knowledge of system requirements than those who did not regularly attend the committee meetings.

"The minimum requirements of the body corporate is 20,000 litres but they've also put a statement in there, if you want to put a pool in, then you have to have another tank of 5000 as a minimum to top up the water."

"I understand that in our body corporate laws everybody must have the same. Everybody must have a tank and I believe it's just written in a certain size tank and we all must have a grey water system as well."

"I thought you might've asked me this. It's fairly large. It could be something like a 20,000 litre... fairly big."

Technical knowledge among the residents emerged as a dominant sub-theme, encompassing issues related to the water source, capacity of the water tanks, as well as functioning of the grey water systems and tanks.

"The community tanks are connected to Brisbane water. They're 160,000 litres down there, there's two big tanks of 80,000 litres. The reason they're there more than any other reason is for fire. There's a fire pumping station down there which is part of the complex that gets maintained once a week so in the case of fire, fire hoses get connected to the hydrants and as soon as it detects a drop in water pressure it turns on the diesel generator down there."

"The way the system is designed, stuff that comes from the sink – a lot of oil and bits and pieces of food and all that – once it goes in the [grey water] tank, something has to eat it to dissolve it. So they're actually putting worms on top to chew through it. Then it goes through different layers of filtration and comes out through the pump when it's ... It's because of those worms mainly...if you think of the little creatures... You try to use the [eco friendly] products."

Knowledge related to maintenance of the decentralised systems was also frequently cited and formed an associated sub-theme.

"The community [body corp] run contracts for our communal tanks to make sure they're serviced and that sort of thing, so meeting any by-laws and that sort of thing"

"I'm not 100 per cent sure but I believe that is the case that the council regulations are that you must have somebody [to carry out maintenance of grey water system] – it's a bit like if you're living in suburbia, you don't service your own sewage. It's my understanding that we have an obligation or a requirement. I can't be 100 per cent sure."

The knowledge of costs associated with installing, operating and maintaining the individual water tanks and household grey water system emerged as a sub-theme, however the level of knowledge was again varied among respondents. Much of the knowledge presented in this sub-theme was related to operation and maintenance costs.

"The pump that they put into our tank is what's called a submersible pump so it's inside the tank. I understand they don't last. They don't have a long shelf life. We're just about to replace it for the second time in three and a half years. It costs about \$2000. They're not cheap ... [what] people have to factor in is the extra cost of the servicing and maintenance and those sorts of things too."

"The council rates are about \$200 less than normal. Then we still pay for water usage if we use the water."

"I actually did a bit of – I did a few calcs [sic] on that and I don't think there is any long term cost saving. I think it's about neutral."

3.2.2. Reasons for Choosing Decentralised Water Systems

Respondents were asked to discuss the reasons why they chose to live in Location B, in order to gain some understanding of the potential attractions associated with living in a sustainable greenfield environment. Interestingly, interviewees provided reasons specific to the location's attributes, rather than of the experience related to using decentralised systems, for choosing this greenfield development.

"We just saw the house advertised and thought oh – the location and outlook just suited us. We thought we were buying an environmentally friendly house, but not to the extent of this setup. It wasn't exactly that reason ... it was a lot of reasons."

"It's funny because our real estate agent didn't tell us all the details, how it was set up. I think they were not sure exactly how it was set up. We knew we had a big rainwater tank and a grey water system but we didn't know we were actually [connected] through the communal tanks [to] the council water. I mean, we just learnt to live with it. We were not 100 per cent happy about that."

"No. I would like to say yes, but no it wasn't [because of sustainability]. I'd have to say it was more over the location. We loved the setting and what has happened with the ecologically sustainable estate was just a bonus basically. It's great to think that we're doing our bit as well but I can't take the credit."

Some residents discussed additional factors that attracted them to Location B, which were related to the sustainable design of the water systems available at this location, as well as potential financial reasons.

"It doesn't feel like you're living in suburbia and it's overlooking the bush and it's probably got more of a natural feel about it. So having water and things like that, you do feel like it's more sustainable for us as well. We've added solar power on the roof just recently, things like that as well ..."

"We liked the outlook... [decentralised water] was attractive too, I mean it was in the middle of a drought. Well, it was just as the drought was breaking when we bought and the grass here was beautiful and green when everything else is brown... we were able to keep the garden alive. Because we were doing at our old place, doing the bucket and shower thing in the garden."

"Just helping the environment and keeping your garden alive without using expensive council water."

Several respondents also cited increased quantity as a reason for choosing to adopt decentralised water sources around the home; however, these reasons were not as dominant as those related to the location.

"I think it's just the ability to use – I think you're ...if you're doing something like recycling grey water, I think you feel like you're not wasting it around the watering of the garden. You're using the grey water to water the garden."

"In general - this is just my impression - people want to have as much water as they can because water is a scarce resource and they don't want to waste it. I mean, everyone I know is really up on wastewater. No one I know would be standing there hosing their concrete like they did 20 years ago or whatever. In that way I think it's the whole not wasting water."

3.2.3. Advantages of Using Decentralised Water

Respondents were asked to discuss the pros and cons of using decentralised water supplies in their homes. Sub-themes associated with the provision of supply primarily included advantages related to the quantity and quality (e.g. taste) of water provided by the decentralised systems.

"It reminds me that there's a drought on and we are all in the same predicament, so if they're running short, we're running short. So probably our tanks would be running low as well, but the difference for us is if we can get a really short, sharp storm like we had last Tuesday night it doesn't take much for it to go from quarter to half full again, both tanks, because we've got a big roof for the water to come down on. That makes a difference."

"I suppose for me the benefit... is not having chlorine in the water, which is really good. I'd prefer not to have that. I'm happy not to have any of the chemicals in the water ... so I think we're drinking cleaner water."

“Love it, absolutely love it [tank water]. I love the taste of it. I love it. It’s nice and soft on your hair. It’s good for the clothes, that sort of thing. It’s great.”

Some financial advantages were identified, related to using the decentralised water supplies compared to council/town water, as were environmental advantages associated with using the alternative water.

“We don’t get much on our water rates. We might get \$5, you know.”

“It does make you feel better ... give you a better feeling about doing the nice thing...”

“I like to be thinking as though I’m contributing to making things greener so it’s good to be making an attempt. That to me is huge.”

Finally, several respondents highlighted the positive influence that using a decentralised water supply had on thought processes associated with living sustainably.

“I think it’s made our kids much more aware of what’s going on in terms of water because they know that – whenever we have rain we get excited. They’re much more aware of what’s going on with the water and we try to educate them with not using too much water because we say if the tank runs out we might not have any water.”

“I guess it forces you to look at the detergents and soaps and things that you’re using so they’re more eco friendly. ... [you don’t] just grab at any dishwashing powder ... or washing powder off the shelf.”

“To me ... it gives you a strong sense of ownership over your water and therefore you’re very careful with how you use it. I have a three minute shower, if that. We are very careful with it, that’s because we know it’s our water. It’s not council water.”

3.2.4. Disadvantages of Using Decentralised Water

Throughout the interview, participants also cited disadvantages associated with using tank water and grey water systems around the home. The main issue that emerged as a disadvantage related to the provision of water using an electric pump and the possible interruptions in service that could occur.

“I guess one of the issues is if the electricity is cut off you don’t have [water] ... That’s probably the main thing that is an issue with the system. If the electricity gets cut off, you have no drinking water, no toilet water, nothing [being pumped into the house] ... normal households still have the council water coming in [but] we will have no water.”

“Interruptions is [sic] an issue if the power goes out when you don’t have drinking water as well. But that’s only happened once with us since we’ve been in and that was the biggest storm for a hundred years.”

“Only when you lose power, yes you lose water as well. That’s the only thing. Yes, I mean, you lose power in any house you’re losing most things.”

Financial disadvantages also emerged as a dominant sub-theme, with participants citing that there were significant expenses associated with installing decentralised water systems on private property. Respondents acknowledged that the high cost factor could potentially limit and/or deter wider adoption of decentralised water supplies among home owners.

“It’s quite significant ‘cause every time we turn on a tap the pump is engaged. So every tap, while the washing machine’s going, that pump’s being engaged. We’ve noticed a difference in our electricity and I understand quite a reasonable amount is attributed to that pump.”

“Put it this way, our power consumption is definitely more here. It ends up being probably about - I’d say the pump costs about a \$100 extra a quarter so that’s interesting.”

“If you were going to say in general living in this environment has been cheaper, it so hasn’t been cheaper by any stretch of the imagination. We spend \$500 on the annual services, about \$500 on Bio. Just to be functioning.”

Further, related to the high cost of running the decentralised systems, respondents frequently cited maintenance issues that contributed poorly to their decentralised water experience.

“A couple of times we had issues with the [seeping] pipes. Every so often, due to the pressure, there would be leakage and you’d have to ... keep fixing it and so often. You have to go to the special people that install it. So it’s a bit of a hassle when you’re trying to fix something leaking and it takes you a month because you can’t get the part or something.”

“One of the disadvantages is the cleaning of the filters, the rain heads and all that sort of stuff... There’s constant checking.”

“The grey water system’s functionality is dubious. Sometimes it doesn’t even appear to be working and then other times it actually causes a lot of moisture. We’ve spent at least \$3000 on different occasions having those bits and pieces fixed.”

Other disadvantages cited referred to poor quality of tank water, due to external contaminants, and poor aesthetic value of the water tanks.

“With our house it’s actually slightly different to all the other ones, because if you notice we’ve got gum trees just outside our house. Because they’re gum trees, they actually pollute the quality of the water ... as our drinking water and all that is supposed to be coming from the main water tank. You’ll notice I’m using the filtered water for drinking... because if I want to use that water for drinking from the tap, it’s not good quality. So in theory it’s supposed to be for the whole household and everything else, but we found that in our case we have to limit it to certain things. Obviously we can’t use it for drinking.”

“I don’t mind having my own tank. I just think they can be quite unsightly given the size of them. It takes up a portion of our garden. I think that concept is quite a good idea, the community one, so long as it doesn’t ever break down ’cause if it breaks down you’re all out of water, whereas if we break down, it’s just us and it’s not the rest of the community.”

3.2.5. Confidence

The theme of confidence related to decentralised water systems emerged with several sub-themes, the most dominant of which related to confidence in the quality of water being provided by the water tanks and confidence in the backup system for household water. Once again, responses varied, with some residents describing high confidence and others questioning the filtration ability of the systems.

“Recently, we had to discontinue that water from the rain from the roof coming into our house, because the quality just wasn’t good enough. So right now we just use the communal water tanks and use the other tanks for the garden. I know we’ve got a UV light and all these other things but... Well a health issue is ... water quality. I mean, the government comes in and tests the water. They do take measures and test the water quality. Everybody else is fine except for ours.”

“It goes through two charcoal filters – two-stage charcoal filters. Then it goes through a UV steriliser as well so it’s got a purifying system as well under the house. All the rainwater gets treated that way so it’s drinking and washing and kitchen and everything. I don’t know long term. I mean I’ve done research on the system and it’s all been approved.”

“They do test the water there [the grey water system] and last time they tested it they thought it was almost drinking water quality.”

The second sub-themes classified under the umbrella of confidence referred to confidence gained from learning more about the decentralised system installed in the home from the researchers studying the development and knowing where to find the relevant information when required.

“Just went on the website and talked to a guy from Department of Natural Resources as well.”

“At the moment all of our water taps have the measurement thing and they [DNR] come and analyse that and see the consumption. The civic study they did do was the usage of power, the turning over of the pump, versus the use of water.”

“As I say we have all these different people. Really, the people who taught me how to understand it are the guys who have been doing the studies. They really imparted a lot of knowledge and they’ve really helped us out because we’ve had different things happen here and they’ve said, hey, your grey water system isn’t working because sometimes we haven’t even known. They say, it’s not working properly or, this has happened, and then they’ve explained why.”

Issues related to perceived ability to carry out self-maintenance also fell within the theme of confidence, however, it was determined that those responses were co-related to technical knowledge of decentralised systems, so relevant response examples have been presented in that section (3.2.1) and have not been repeated here.

3.2.6. Trust

Issues related to the broader theme of trust emerged among the User group, though not as dominantly as within the Non-user group. In the User group, there was some data related to a sub-theme of lack of trust in some Government and local Council decisions, as well as personnel delivering information to the greater public.

“I think from an everyday ‘how to save water’ type, they’ve [Government] been very good. I don’t agree with them taking the water restrictions up to 230 litres now from 100 and whatever it was going to be. I disagree with that. We’ve all shown that we can do it - why don’t we stick to it? Just because we’ve got 70 per cent water there now, there could be a drought for the next five years again.”

“I think about all this Traveston [dam] and things like that, I don’t think there was a clear water strategy for South East Queensland there, and I don’t think there’s been much debate on it. I think the decisions have been made, like Traveston, and we all agree that something is going to happen now. Where are we going to get the water?”

“Already there’s no debate on our recycling. It was a political decision with regards to recycling. Obviously some people don’t like it, it’s a kneejerk reaction. They’ve spent millions and millions on recycling but they’re only going to use it when the dams go down like they were before, to 16 per cent or whatever. Well, that’s pretty concentrated recycled water.”

3.2.7. Social Awareness

This theme comprised respondents’ perceptions of how others felt about their decentralised system, and system adoption relative to the general public.

“They [friends and family] think it’s wonderful because they ... they think it’s great ...they’re trying to put their own systems in place. I think [the public] is becoming aware of how it might be used... I think people are... trying to do the right thing. ... I don’t think cost comes into it.”

“I suppose people did comment [on our green lawn] but I don’t know if it inspired people to go and put water systems in or a tank in or anything.”

“Anyone I talk to thinks it’s great.”

Respondents also commented on why they believed their neighbours bought into the development, attributing others’ choice of residence to the local outlook, as well as to the sustainable design of the development.

“For most of them, it’s the outlook. Most of them I think like the outlook and I guess I think the eco part of it’s an added benefit, because its east facing blocks, it’s all that sort of thing... in Brisbane. A bit of elevation, all those sort of things.”

“I think it’s mixed. We know each other all very well, the first houses, because we’ve all been here a while. I think it’s probably mixed. All of us moved here definitely because of the external environment. I’ve never actually had a specific conversation with any but I’d say because of certain behaviours that at least half of us probably do live here because of the whole infrastructure.”

3.2.8. Equity Issues

By far the strongest independent theme that emerged from the interview data was the issue of equity related to shared resources, specifically, the communal water tanks on-site. The communal tanks are designed to feed into individual water tanks if their water levels become low and based on responses, there is currently no monitoring of how much water from the communal supply was feeding into the individual water tanks.

“The water that’s coming from the communal tanks whilst there’s [sic] only a few houses here at the moment, there’s plenty of water. But when there’s 22, I think that surplus tank may draw down much quicker. When it comes from the communal tank to our house, it’s not measured as to how much is coming to my house, how much is coming to Lot [X], how much is going to Lot [Y]. It just fills it in. That excess water that we’ve paid for may not have even been our own water. That’s probably a bit of a fault in this estate that they haven’t done that; that they haven’t made it an equitable distribution, how to measure the water that’s coming back from the communal tanks.”

“What’s happening at the moment which has to change as well is there’s 22 lots here and on our rates when people use that water it’s actually just divided into 22. So these people who have all put in their pools have technically used a lot more but the rest of us are paying for it. Not that it’s a lot of money and that’s not so much the issue. What we’ve ended up doing, the body corporate I’m saying, they [homes with a pool] have to have an extra tank.”

3.2.9. In-group/Community Norms

An interesting theme that emerged frequently in the data was the notion of in-group behaviour and community values. Respondents were happy with their small community and wary of future newcomers to the development.

“We all get together. We’ve got community parkland down the bottom of the estate here. That sort of fairly nice, community type feeling at the moment but I think that’s because everybody seems to be fairly reasonable. We all seem to be on the same page. If you’ve got more people coming into that, you run the risk of things changing just through people being people I think. You just never know. You never know how people are going to act or behave, think or whatever.”

“The people who live here are [like-minded] but some of the ones that are moving, it’s all a bit... It’s all a bit daunting for them.”

“We know each other all very well, the first houses, because we’ve all been here a while... There hasn’t been any conflict so far but there’s only been six houses and we’ve all been a really close group, it’s all been fine. I think with new people, the people down the road, haven’t complied at all with the requirements in terms of their water tank. It’s in the wrong position, their grey water system is in the wrong position, that kind of stuff.”

Interestingly, within this theme, there was also some indication that sub-group norms existed within the community, though references to this were occasional.

“We know next door’s water quality is a bit different from [ours] - they’re the only ones with overhanging trees and their water comes out brown. For me, that wouldn’t worry me, but it would worry them. I mean, a lot of Australians drink tannined [sic] water - Tasmania is a good example - [but] they’re a bit iffy about it so they access from down at the big tank for their drinking water.”

3.2.10. Improvements

Finally, comments related to improvements were collated into an independent theme, reflecting respondents’ views on what they would do differently with their current decentralised systems set-up and in the future if buying into a sustainable development like this. Participants also provided suggestions for future practices that would encourage wider adoption of decentralised water supplies.

“We are looking at wanting to put in more of a larger container so the pump doesn’t come on as much - a pressurised vessel which a lot of installations use, and there is one on the main pumping shed. There’s water in reserve and it doesn’t require the pump to come on if you just wash your hands. The pump doesn’t have to come on.”

“I reckon if I built this house over again I’d have three 10,000 litre tanks, not two.”

“Well we have gas hot water here in this house. But I know that some of the other houses that are being built at the moment are going to solar which I think would’ve been a better alternative, given the nature of this estate, to have gone solar for hot water.”

Overall, the most common improvements related to wanting a larger water tank and wanting a tank that required less energy to pump the water into the household taps. Implementing an equitable way of measuring water use from the communal tanks was also cited as an important improvement that needed to be made prior to all homes in the development being occupied.

3.3. Users: SEQ Location C

Residents of the greenfield development at Location C discussed many themes that also emerged in the other two locations. However, given the differing level of use of decentralised systems at Location C, some of the sub-themes varied. These will be demonstrated within text with appropriate supporting excerpts from the interview transcripts.

3.3.1. Knowledge

When asked about the decentralised water supply systems in the development, the majority of interviewees believed that they had good level of understanding regarding how the system worked. Some interviewees had noticeably more knowledge than others, however.

“The house is built with two water supplies. The rain [water] tank is separate from the normal kitchen supply but it is used for the laundry and used for the toilet, But the kitchen and shower, the water that comes into contact with humans, is town water. So we've got two water systems in the house. There's an electronics device out front that regulates, should it — as it did — run out of water in the tank. It will switch over to sort of town water.”

“So if that [water] runs out, then it automatically tops up from the mains too, which is something we haven't quite come to grips with yet, how exactly that works.”

One interviewee said they did not know the system well as they weren't present when the handover of the property took place. The interviewee also commented that he or she was unsure where the bathroom water actually came from. All interviewees knew about the provision of underground water tanks by the developer when they bought into the area. Some had decided to increase their rainwater capacity and purchased additional underground tanks themselves.

3.3.2. Reasons for Choosing Decentralised Systems

Despite living in a development targeted at environmental sustainability, decentralised water supplies did not feature prominently as a factor in moving into the area. Rather, many interviewees stated that they were attracted to the development for its location, or a specific house, with the rainwater collection seen as an additional bonus.

“It was a nice fact but it was not a deciding factor, no. Because I would have put a rain tank in anyhow because we already had the rain [water] restrictions.”

3.3.3. Advantages of Using Decentralised Water Systems

All interviewees commented that their underground rainwater tank worked well for them as it provided them with an additional source of water and required literally no maintenance. The system was also very easy and convenient to use. The underground tanks were provided to them as part of the land package in the precinct. Interviewees commented that this was positive as they felt it did not cost them any money. At the same time, they acknowledged that the developer would have factored in the cost of the tanks into the land prices.

“So if it [the tank] is not going to be a cost to us and if it was built into the package anyway, we didn't see it as anything other than a positive.”

While environmental sustainability was not emergent as a direct benefit of the scheme, participants did note that the system allowed the use of water that might have otherwise been wasted, and one participant also identified that the tanks themselves were made from recycled materials, enhancing the environmental benefit.

“Basically just to not waste the rainwater, I think that's the main reasons. You're not wasting that, it's being put to good use.”

“...if you've got a big enough storage you're just saving more water being reticulated I guess. That's the only advantage I can think of.”

“The system has been developed here in Australia but by a Dutchman. It is made out of recycled milk bottles...So it is using some of the waste that we have and I think for this 10,000 litre one that I have it took about 28,000 milk bottles to build.”

Participants also noted that the underground positioning of the tanks was an advantage of the system, negating any possible aesthetic issues.

“We don't want the thing being a visual blight, so that's another reason, so we were happy having them underground because in our old place we wanted to do them underground.”

Interestingly, some interviewees also commented that harvesting rainwater would allow them to overcome restrictions and save their garden.

"In so far as the collecting rainwater, the gardens won't need to die during the dry period because they'll have that water in reserve."

When asked about possible economic advantages of the system, participants somewhat hesitantly agreed that there may be some economic benefit, however, again this was not a strongly emergent theme.

"Well hopefully it's cheaper. I know it's not but there's a hope there that it's cheaper, that we're not going to have excess water charges, we're minimising those excess water charges so there's a cost. I think mainly we just didn't want to see the waste of the rainwater."

"I don't think the cost saving is very significant. I guess every little bit helps but it's not so much a cost saving thing."

"I think it would, yeah [add value to the property]. I think generally people are conscious of issues with water and so the fact is that you've got your own little water supply there is valuable."

3.3.4. Disadvantages of Using Decentralised Water

When interviewees were asked to identify the disadvantages of their decentralised water system, most were unable to identify any disadvantages related to water use.

"Just the benefit is we're harvesting water from the house which is obviously a good thing. I can't think of any disadvantages."

However, all interviewees had found that the installation of the system had been riddled with problems.

"The only thoughts are that the system, I think, is certainly of a good quality and an excellent system to have in any household. We come down to that same issue again. It is only as good as the installer so as long as it is installed correctly to manufacturer's recommendations then there shouldn't be any issues and we don't have any issues with it now since I put the hammer on the builder's head and said get it fixed."

A lack of knowledge by the plumbers about the systems appeared to have caused initial installation problems in the development.

"No it was plumbed wrongly. They hadn't - they got the outlet and [main inlet] pipe mixed up and they've actually been changed over. It's not back in its original position, it's been modified. Hopefully, well, it's working. The filter that filters from the roof because the rain comes from the roof as well, we [unclear] the water wasn't running into the tank, it was all going down into the gutter. So the tank wasn't filling up. They left a hole this side of the tank where they took a pipe out and didn't block it, so a lot of sand went in. The sand and the stain has caused problems in the toilets and that's why it's not going to come in the house until it's clean again."

Staff changes and problems with communication were seen to have exacerbated the installation problems.

"The people in the estate, the groundsman, told me that every one of the builders on the estate was sent to, I don't know, an introduction on how to put the tanks in and what they were supposed to do. But from what I've gathered, this wasn't passed on to the plumbers. I think there's been a communication breakdown somewhere."

"No, they were our builder's plumbers who supposedly had done a course on the way they worked. Sadly, when it came to actually fitting them, the guy that actually did the course had left the company and this is the problem with a lot of these builders. They have only got one or two people doing the course to understand how to do it and if they're not around, they leave ... they don't appear to replace that person and put them through the system as well. This is what we're all finding."

Issues with maintenance and technology were also seen as problematic. With particular reference to water gauges.

"...with the tank, [there] is a gauge to tell us what the water level was. That didn't work and, well, the plumber didn't have any idea how to make it work. The guy over the road who 's a New Zealander, he actually showed my husband how to fix the gauge. A lot of the people on [the] estate, the gauge doesn't work, so we don't know how much water we've got in."

"There was nothing wrong with the tanks so the system itself was working but we could never monitor how much was in there because the system is set up with a level gauge out there which is attached to the

outside of the wall and it was always showing empty. That is why we had to find out what was in the tanks. We found they were full and we found that they actually hadn't connected the gauge. They just left it dangling underneath the tank lid so we had to get them back and they had to go and re-educate themselves how to fit it because they didn't understand how to fit it. Now it is working properly."

3.3.5. Confidence

Interviewees were confident about the quality of their tank water since it was not used for drinking and showering. Some residents said they would drink from their tank.

"Oh yes, I would imagine the rainwater treats the garden far better than what tap water would because you're not putting all the chemicals and that on the garden and it's natural isn't it."

"Practically, it's [tank water] better than all the other water."

Residents in the precinct also preferred a system that they could self-maintain, rather than those that had to be maintained by a body corporate.

"I would like to be in the know. I would like to have access to it. I would like to know the technicalities of the operation of it, but that's my nature. I would not want to leave it to somebody else to do ... there are shonky business people around too."

3.3.6. Trust

Trust was mentioned by participants in relation to governance of water resources. Some interviewees relayed negative experiences with their council in attempts to install decentralised water supply systems.

"We got tanks on our old place, had them put in, although again the council stuffed us around like you wouldn't believe because we wanted to put in an underground one over there and we got it designed and had it all built and every time we put it to the council for approval they sent it back and said, no, we weren't happy with that, we want something different. So the tank went from \$25,000 to \$75,000 so we didn't do the underground one in the end. That's the council who didn't know what they were doing."

Despite some participants identifying a lack of trust and confidence in the government management of water systems, it was suggested that legislating the uptake of alternative water supply systems would be beneficial.

"In the end, they'll have to legislate that everybody has got to have the secondary systems. They'll force them to. The government has to do more. It has to. It's going to come out of taxes I know but there's so much wastage in what they do just on the water side at the moment. If they really were channelling that money properly into what should be going on, that's what I think."

3.3.7. Social Awareness

Most participants said that they did not talk to family or friends about the decentralised system. Reasons for this varied.

"No, I have never discussed it. I think it doesn't need to be discussed. I don't think it is a rarity anymore these days. I would think all of my friends – I would think – would have some sort of a rain tank."

"I think it's all fairly newish. This is the first time I've heard of these underground tanks out the front. There may be other estates that have them but I haven't heard of them until we came here."

"Quite a few people ask us, have we got tanks? We say that it's underground - oh, that's a good idea. That's as far as it goes. We don't go around going, we've got underground water tanks."

3.3.8. Equity Issues

Discussion of equity arose only around the concepts of individual versus community-based systems. When asked about their preferences for communal or individual water systems, most interviewees preferred the individual water systems due to possible equity issues amongst different users of the water.

"Basically so we'd have control over our own usage and our own demands. If you're sharing with 10 other people and you've got a house over there that has got eight people in it, and we've got a house with 2 people in it, well we'd be disadvantaged by the amount that they're using."

3.3.9. In-group/Community Norms

There was very little discussion during the interviews about in-group or community norms. This may have been a function of the participants seldom choosing to discuss the system with others. The only real apparent group or community norms that emerged were a sense of kinship around issues with the system. For example, it seemed that the installation problems also helped to unify residents for collective action in presenting water tank problems to their builders.

“Everybody here has all got the same thing. I mean the only discussions we’ve had about the system is the fact that nothing worked properly at the beginning. We have all banded together to have a combined force to make sure the builders get it right first time.”

3.3.10. Improvements

Most interviewees felt they would put in bigger rainwater tanks if they could do it again. A suggestion was made by a resident about conducting a proper assessment for each home to determine the appropriate size of the rainwater tank that should be installed. Once the house was built, it was difficult and costly to retrofit additional tanks. One resident also commented on the possible social effects of installing an inferior system in the home just for the sake of carrying out a “sustainable” act, when in fact this was not necessarily the case.

“We got these voltaic photocells up top there producing some electricity, which the government paid the majority. The only thing... don’t put a cheap little version in just to say we have done it....it’s fooling oneself that we did something when really we didn’t do.”

Many interviewees thought about installing other decentralised water systems on their property in addition to their underground rainwater tank. One interviewee thought to put in a bore to supplement rain water and another interviewee suggested their acceptance of a separate pipe with recycled wastewater (i.e. the purple pipe system).

3.3.11. Barriers to Adoption of Decentralised Systems

Cost was frequently identified by interviewees as the main barrier to the uptake of decentralised water systems.

“...so there’s a balance point where people will say, we want to help the environment, we want to be able to preserve water, we’ll pay for it. But a lot of people won’t.”

“Yes, I would think so because the system is not cheap. But that is a question of how much the government does assist. Like the electricity, we got these voltaic photocells up top there producing some electricity, which the government paid the majority – probably about two thirds of it the government paid.”

Additionally, retrofitting existing houses to accommodate a decentralised system was seen as too difficult and costly. Therefore, most interviewees themselves were reluctant to install the system once they had built their home.

“These big rainwater tanks though, it may be difficult to install them after you’ve already built the house. Depending on where you put it. This new house, I’ve put it right at the back of the house so I wouldn’t be able to put it there if the house was already built because I wouldn’t be able to get the equipment in to dig the hole.”

“... it’s getting difficult now... to get somebody in to dig a big hole. The only place that we would have [a bigger tank] would be the side of the house up there. It has access to it. But anywhere else, I couldn’t.”

Aesthetics of rainwater tanks were seen as a barrier to broader adoption, with many interviewees stating that they would not consider a system that was visible on their properties.

“We wouldn’t do anything visible.”

Past unpleasant experiences with alternative water systems were also seen as a possible deterrent to the adoption of alternative water supply systems. The effects of past experience on the acceptance of a decentralised system, however, might be moderated by the intended use of the water. For example, one interviewee had heard of a bad experience with drinking rainwater. He or she would not drink water from the tank but felt the water could be used for garden irrigation.

"I wouldn't drink rainwater, not until such time as it had been purified and that's only because my friend's son and his elder boss did some work on a house over in Perth and there was a rainwater tank and they drank from that. They were both hospitalised and then the older man died, so I would never – there was bacteria in the water, where it came from I really don't know but I would never drink rainwater water."

3.4. Non-users: Close to Location A

Non-users of decentralised systems were sourced from the localities adjacent to decentralised Users in Location A. Centralised (mains) water supplies to Location A primarily come from Hinze Dam, and the smaller Little Nerang Dam, which were at 89% and 96.5% respectively at the beginning of the interview week. Non-users lived in individual, separate dwellings and had no decentralised systems installed on their properties.

3.4.1. Knowledge of SEQ Water Issues and Information Sources

Participants in Location A generally had some understanding of where water supplies in the area were sourced from. However, responses also indicated that, although participants were interested in water issues generally and were aware that they were on a scheme water supply, the specifics of how that water was captured and supplied were not overly important.

"From what I understand, it all comes from the hills."

"Yeah, you don't really think about the process, you just run the tap, you just know that if it doesn't come on, there's panic."

"...it comes out of the tap."

Some participants showed understanding of recent water related issues in SEQ, particularly with respect to recycled water.

"I know about the sort of recycling plants and stuff like that but that's purely through work that I found out about that."

"Yeah, there's [sic] dams. I don't know whether a percentage of it is – I don't think they've allowed recycled water into the water yet, I'm not too sure."

Specific sources of information were not spoken about at length, however one participant noted the television as providing information about dam levels and water scarcity nationally.

"Like, I watch the weather channel a lot and I watch like the dam levels and whatnot and like my in-laws live in Melbourne and... it's dry, it's been so hot, it's just hell which is just crazy and you look at the dams in Perth which are actually not too bad at the moment."

3.4.2. Acceptance of Decentralised Water

Overall, there was acceptance for the idea of decentralised water supply options. Support for both individual rainwater tanks and grey water recycling was high, as was more community based ideas of alternative water supplies.

"I'm fairly comfortable if you're supplying yourself with a rainwater tank, that's your own sort of responsibility."

"We had tank water all the time so we were used to it. If you ran out then you just had to get a tanker truck."

"Yeah, I'm all for that [greywater recycling]. I think it's awesome. I have no idea how expensive it would be or how you'd go about doing it but I reckon that would be awesome, especially with the washing machine, like recycle that because I do a load pretty much every day."

Acceptance was based around two major themes; water being more of an individual responsibility, and avoiding water restrictions.

"If something does happen, excuse the French, the shit hits the fan or something, you've still got something to back up on."

"If we could find a way that we could perhaps avoid water restrictions by changing the system ...yeah, I'm all for it...absolutely."

Centralised alternative water supply systems were also raised as an acceptable option by one participant.

“Yeah we’re open to all sorts of ideas, even when they were talking about putting some recyclable water in our [dam] water.”

3.4.3. Barriers to Adoption of Decentralised System(s)

Although Non-users in Location A were accepting of the concept of decentralised systems, with the exception of one participant (who had a spear pump), none of the Non-users had adopted alternative water supply systems. The main reasons espoused for this included associated costs and time constraints, though space issues also featured, albeit less prominently.

“I have thought about rainwater tanks, that sort of thing, but the thing that stopped me from doing that is purely cost.”

“Yeah, and if there’s any like costs involved, once again [inaudible] costs involved in keeping it, maintaining the upkeep of it, yeah. Lifespan of it and will it deteriorate and yeah.”

“Time, no, not so much cost, just time – the time of doing it and making it a priority.”

While costs were seen as a barrier to some participants, others believed that any initial outlay would be returned over time.

“No. Those things, they pay for themselves. Some things do take longer to pay for themselves, like the LPG tank in the car.”

3.4.4. Curtailment and Efficiency

This theme was defined as everyday practices designed to save water around the house and garden (curtailment), as well as the installation of water efficient appliances (efficiency). Non-users close to Location A spoke of curtailment behaviours with respect to their home water usage. Some participants noted that severe water restrictions had been in place for some time, however, despite these restrictions being lifted, their curtailment behaviours generally remained.

“We don’t have water restrictions in place that I’m aware of, I’m still very vigilant with my four minute showers. It’s a mindset for me, it’s a whole – like we try to go energy [saving] and I’m very onto the kids about their showers, like the four minutes, that’s it and they always try to wrangle more out.”

“I just can’t justify putting a pool in because I think that’s just a waste of water.”

“Also, with things like cleaning your teeth, we always used a cup. You put the toothpaste in the cup, you don’t have the tap running all the time and stuff like that.”

Despite an obvious desire to cut down on water usage, participants did not report efficiency measures and generally had not adopted water saving devices around the home. Their water conservation efforts were limited to behavioural (curtailment) changes.

3.4.5. Trust

Issues of trust did not emerge strongly from Non-users. What minimal discussion occurred on the matter indicated trust in those managing water supplies.

“Putting some recyclable water in our [main] water, I wasn’t too concerned about that. I mean if they’re saying to me it’s a certain grade, then I’m happy with that, I’m not too concerned.”

3.4.6. Social Awareness

Respondents spoke about the willingness of others in the community to adopt alternative water supply options. There was the belief that people, more broadly, were accepting of the systems and that motivation was sustainability based, rather than financially.

“From my experience, like my sisters use grey water and stuff like that ... my parents are doing it at the moment, so combined experiences. I know that my wife’s parents as well, they’ve got it hooked up at their place. So I think everyone is willing to use the grey water.”

“Yeah, I don’t think it’s so much the cost or anything like that. I think it’s more sort of they just want to do [their] bit, so you want to utilise the water as well, it’s sort of a free resource, oh well they’re paying for it, but it’s a double use.”

One participant did indicate a belief that, more broadly, the importance of water conservation was simply not getting through.

“We need water to sustain existence not only for our gardens and whatever, but for us, and I don’t really think the seriousness of it is getting through. Once again, I think it’s just like a whole public, you know, ignorance - too hard, don’t want to know about it someone else will figure it out and it’s not good enough.”

3.5. Non-users: Close to Location B

Individuals comprising the Non-Users group lived in the locality surrounding the matched Users group in Location B. These Non-users lived in private, separate dwellings and did not have a decentralised water system on their property. Centralised water for Location B is sourced from a combination of Wivenhoe, Somerset, and North Pine Dams, which had a combined level of 73% at the beginning of the interview period.

3.5.1. Knowledge of SEQ Water Issues and Information Sources

Participants in the Non-users group demonstrated good general knowledge of SEQ water issues and described the various media sources from which they gained their knowledge. Some participants also offered opinions related to recent issues.

“Usually the papers, I read the newspaper every day, and when I listen to the radio I listen to the ABC most of the time. So they were talking about the Traveston Dam issue forever last week.”

“I didn’t [have water concerns] for a long, long time but yeah, when we had the drought the dam level went down to about 17 per cent, yeah. It was really worrying, yeah, because you started thinking about what if it doesn’t rain. But the climate is so erratic. We have virtually like a wet dry season and in summer we have so much water that just gushes down the drains and is totally wasted.”

“When we get the rates, quite often in there there’s a brochure about what’s happening in Brisbane City Council and in the area of Brisbane. It’s always adding little things about how wonderful they are and what they’re doing and all the rest of it. There were things about tanks at one stage and rainwater, and when you go to the shopping centre there’s [sic] a couple of different people giving out information about it. People see it so often they get a bit desensitised.”

3.5.2. Acceptance of Decentralised Water

Positive acceptance of decentralised water sources was dominant among this group, despite interviewees being non-users of tank water or grey water systems. Responses indicated high acceptance for non-potable uses for decentralised water, however, there was little confidence in the quality of potable water provided by a water tank supply.

“On the garden, yes, something like that. That would be fine for tank water. I just mean not for everyday drinking, but as far as watering or flushing the toilets, all those types of things, that would be fine.”

“[A] water tank I think would be great and we probably will go down that track some time, but I don’t know enough about the grey water to make an informed decision about it at this stage. Overall, I think our centralised water system is not too bad here.”

“I would like to have a water tank and I think it would be good and I think the same with solar heating. If people could become more self-sufficient then definitely, and then it takes the pressure off the environment as well.”

Interestingly, several participants also made reference to alternative centralised water sources (i.e. recycled water and desalinated water) and offered their opinions related to this issue.

“Why they don’t just put it [recycled water] in now? I find that very hard to believe because it’s critical now when you [have] got less chance of people worrying about it because the dam’s at 70% now. Just put it in there, you know... if you did it when the dams were 20%, people would be more worried, you wouldn’t get the [support].”

“I would possibly try it [desalinated water] for drinking. It depends where the source of the water came from. I’d be very particular as to the drinking. I’d only use [recycled water] for the toilet. I have no problems with that but I certainly wouldn’t be drinking it.”

"I wouldn't want to be using recycled water for drinking at all. I know it's used in some countries but I just think you never know. There could be some sort of sabotage. I don't know, you just never know these days - but then that could happen with any water system anyway, couldn't it? I think I'd prefer to have the recycled water for the garden."

3.5.3. Barriers to Adoption of Decentralised System(s)

The main pursuit of enquiry among this group was to try and gain an understanding of the perceived barriers among Non-users, regarding why they have chosen not to adopt a decentralised system around the house or garden. The most dominant sub-theme was related to financial limitations associated with purchasing and installing decentralised systems around the home.

"I think it's about \$1800 and with it installed, \$2000 – that was a small one. That was something like 3000 litres and I didn't have that money to do it. I won't put up the money upfront."

"I'm all for it, I just don't know how we do it. Or a person in my [financial] situation, I don't know how else I can do it [reuse water] other than buckets. That's about it for me."

"I think if they want people to really do these things and to save water then they have to subsidise a little bit, particularly for pensioners and people on low income. Maybe it should be means tested or whatever, I'm not sure."

Financial barriers also included references to the water tank rebate process and typically, respondents reported having poor experiences in dealing with this process.

"I'm for them [decentralised systems]. I think they made it far too complicated to get the rainwater tanks. I feel it should be a system similar to your rubbish bin, just deliver one to you rather than have to go through all the process of doing the finance up first."

"It just seems to be so hard, the same as the solar. I thought, oh no. Why do they make things so difficult? Perhaps I think too simplistically but I thought how [do they] ever get the rubbish bins to people. Why couldn't it be a system like that? Just drop them off and I would happily get it installed at my cost."

In addition to financial restrictions, the perception that a large amount of space was required to house a water tank was a frequently cited hindrance, due to many respondents feeling that their property area was not sufficient for such a large system.

"I'm a bit limited for space here, either side. I've only got a small access each side so that sort of makes it a little bit hard to. I've probably got two metres or whatever to the boundary each side. So I haven't put a big tank or whatever [because] where do you put it?"

"Space is a huge problem."

Prior negative experiences of attempting to install a decentralised system were issues that were also identified as barriers to adoption.

"I tried to use the grey water but it came back into my washing machine. I lost my washing machine through it so I decided that's not a good idea. I actually put it in to just give me an idea of trying to gather water from the wash hand basin upstairs. We were connected and the rest of it, but it back-fired big time because it came back [into the machine]. I didn't understand [the] washing machine mechanism that it came back in rather than going out."

A change in the general public's perceptions about water shortage was also cited as a factor influencing people's desire to adopt a decentralised water system in the home. Increased rainfall and rising dam levels combined to change opinions related to necessity.

"A few times I saw it [water tank] and we were debating about it but we didn't actually go ahead. They were really serious about it and it started raining. I know there was a stage where everyone was getting water tanks but it seems to have suddenly stopped now."

Finally, two other sub-themes related to the poor aesthetic value of water tanks and health concerns related to the materials used to make water tanks were also identified as barriers to choosing water tanks for the home.

"If you buy one you've sort of got to be comfortable as to where you can put it and be comfortable that it doesn't stand out or...it still fits in with your house, you know. If I got a tank here, it has to be exposed."

“It just depends on the cost of it. I’m not sure how much exactly and I don’t want a plastic water tank. I don’t like the idea that it leaks into the water. I was going to get one of the proper steel ones and I think they’re fairly expensive.”

3.5.4. Curtailment and Efficiency

Among non-users of decentralised water systems, curtailment and efficiency behaviours were cited frequently and comprised a major independent theme within the analysis. Although participants did not use water tanks or grey water systems around the home, they cited efficiency-related changes made around the home, to limit their water usage.

“I’ve got a – I don’t know what you call it – a diverter on that roof and then use it for my pool.”

“I have had all my plumbing audited and every time it’s audited they put the pressure down. Yeah, and the toilets have changed, the shower heads have been changed three times now and the toilets, the whole cisterns have been changed twice.”

“We got a new washing machine that saves water. I don’t know how many, four stars or something like that. We changed the toilet so the cistern is more efficient.”

Participants also described engaging in curtailment behaviours around the home, describing past behaviour during the severe water restriction period. Interestingly, due to recent changes in the severity of water restrictions, some respondents acknowledged that they now discontinued strict water-saving practices, whereas others felt that they would never go back to using water without automatically engaging in these curtailment behaviours.

“I was forever saying, just a couple of minutes shower, couple of minutes shower. We got a little timer but now like I said because the dam is up there, I think we’re having longer showers and watering the garden a little bit more and that type of thing ... when the drought was on I couldn’t water it, it was really hard.”

“Well I was [reusing water at home], but I’m not doing it at the moment. I just saw it’s [the dam] at 75% and they’re sort of talking about increasing the number of days you can hose and all those things, so I thought, well, it’s not an issue at the moment.”

“I think a lot of people now since all the restrictions came in you will never use the amount of water you used before ... if the dams got to 100 per cent, there’s no way I would ever go back to, I don’t know, five years ago ..., you just wasted it.”

3.5.5. Trust and Confidence

Participants described public mistrust of Government and local council institutions and personnel, as well as decisions made by the Government.

“I found them totally disinterested ... when I was trying to get the tank.”

“I’m absolutely confused in regards to usage of water.”

“Yeah, I’m definitely the cynical type. I think generally speaking the Australian Government at local and state levels are reasonable ... but at the same time I don’t think we get to hear everything.”

The second sub-theme related to lack of trust in decentralised water technology. Non-users cited numerous concerns related to the quality of water that could be provided from a decentralised system, such as a water tank, due to wariness stemming from perceptions of ineffectual water tank filtration technology.

“That’s what I was saying before about the water tanks. There’s [sic] mosquito larvae and all that type of thing and it’s an issue whether you can actually use the water, but then there are people out in the country who use that water all the time don’t they?”

“I remember drinking it [tank water] and I did live in a property for 10 months that only had tank water. I boiled mine first, I boiled it a few times. Yeah, you couldn’t just use it as is. You’d have to use power which I think really you defeat the purpose. I would only use it for the garden or for the pool.”

“I don’t know about drinking it, I’m not sure. Yeah, I don’t know about that but I’m sure you could build it into your toilets, your washing machine, I’m not sure about how that works ...”

Participants also made reference to potential maintenance issues of water tanks should they get one, and most Non-users believed that they would need to get an external service provider to maintain their private water tanks.

"I think with a water tank you'd need somebody to be looking after it,"

"It would depend on how hard the maintenance was I suppose and what you had to do, because it's always a case of if someone did it and they did it wrong or they did whatever. But I think you'd have to get someone to look after it. Who would be responsible or how do you make people responsible for that. Yeah, I think it would be very hard to manage."

Finally, a minor sub-theme related to one's confidence in the ability to utilise appropriate resources if and when the individual decided to learn more about decentralised systems. All respondents indicated that they were confident in their ability to do so.

"I think so. If I wanted to go ahead with it I'd find about it and go on the internet and look up the information and get some brochures from the council, go to the library or whatever like that."

"[I am confident in] as much as I care to go into, yeah. I wouldn't go into every detail. I've read about it and I understand it. There's no point for me to keep going [on] reading into it when I can't have it."

3.5.6. Social Awareness

Although this group of participants did not have decentralised systems on their property, respondents were aware of others in their immediate neighbourhood who did have them. The first sub-theme to emerge referred to perceptions of decentralised systems usage in the area. Participants believed that the installation of rainwater tanks was a common occurrence and perceived considerable benefits regarding the quantity of water available to individuals with rainwater tanks on their properties.

"I'm probably the only one that hasn't got one [water tank] to be honest."

"The gentleman over there's got probably three tanks, they love it. They've got far more freedom than I have - to do the garden, washing the car, things like that, washing the windows."

"Yeah, you still are aware that if you see someone out there hosing or doing whatever. You'd want to hope that you can see the sign for rain water on the [lawn], yeah."

Respondents' perceptions of others using water tanks were also accompanied by attributions relating to why these individuals had chosen to use a decentralised water source. Primarily, respondents believed that maintaining property aesthetics and gardening were the biggest reasons for others adopting an additional water source, such as a water tank.

"Yeah, they use it [water tank] for the garden, trees. They're generally quite a sort of, I guess, middle class, two car, [nice] driveway, very conscious of their property..."

"The people on that side have got a water tank and I know he waters the grass because they're quite keen on having their grass nice and green so obviously they must have thought about it."

"I really think choosing a tank is people who are - I really think its people conscious of their house or whatever. So they either want to keep their house tidy, they want to do their grass, they want to do their plants, whatever. People who don't get a tank aren't fussed about the presentation of their yards. Myself, I think it's important, it doesn't take much but if you could just have sort of a neat garden, a small garden or a large garden doesn't matter, but just by having a simple garden, be able to keep it going and keeping it green or whatever it's important for people. But some don't care, you know."

3.5.7. Equity Issues

Finally, the theme of equity emerged after participants in this group were asked whether, if given a choice, they would prefer to have a private decentralised water supply (e.g. individual water tank or grey water system) or whether they would consider a communal scenario, where a cluster of houses utilised the decentralised water supply. All the Non-users close to Location B answered this question similarly, with their primary concern being the issue of how to divide up the water and associated costs. Responses indicated that most participants believed that individual decentralised water supplies would be better, so that individual households could manage their own water. Alternatively, Non-users were also happy if the communal water supply was used for communal property.

"I don't know. It depends because some people use an awful lot of water and some people use little water so I think it probably should be a personal responsibility."

"If they could do that type of system [community rain water tanks] for sporting clubs or parks, I think is a good idea. So you could actually ... have those communal collections of water and use it on the communal

spaces rather than back onto people's individual sites. I think ... it's still important to try to keep your communal areas. You still want people to go out and go to parks or go to whatever. So, if you can still make those parks or whatever attractive for people to go, it's really quite important."

3.6. Non-users: Close to Location C

Individuals comprising the Non-users group lived in the locality surrounding the matched Users group. These Non-users lived in private, separate dwellings and did not have a decentralised water system on their property. Centralised water for Location C is sourced principally from groundwater supplies, being received from a combination of treatment plants (Banksia Beach treatment plant, Caboolture treatment plant and North Pine treatment plant). No public information regarding water levels or availability is available for these supplies. Many of the themes that emerged in interviews with decentralised system users in location C were not evident in these non-user interviews, likely due to limited knowledge about alternative water supply schemes.

3.6.1. Knowledge of SEQ Water Issues and Information Sources

Interviewees were asked about their household water use and about water issues in SEQ more generally. Interviewees demonstrated a fair level of knowledge about their current water supply and general water issues covering a range of topics from desalination to water recycling and dams.

"Well given what I've read about the about the Tugun one, we also know that it's costed. Not that that would affect us at Bribie, but as a Queensland resident, I'm not in favour of desalination plants ... I don't want to see them at all."

Participants reported very little knowledge about decentralised water supply options.

"I'm sure [unclear] would have told me at some stage. I believe that [with] the grey water system ... there is a component that is like a [bug] that's inside. Maybe that's not that..."

3.6.2. Acceptance of Decentralised Water

Participants indicated that they would consider installing some types of decentralised water systems, particularly if they were building a new home, and that if they chose to retrofit a rainwater tank, there should be permanent subsidy by the Government. However, the Non-users in this locality had differing opinions as to whether the installation of rainwater tanks should be voluntary for new homes. This was interesting in light of recent Government legislation mandating that all new homes built after January 2007 must install a water reuse device, such as a rainwater tank.

"I think it should be voluntary. I think that council should always supply water if people don't wish to spend the money [on water tanks]. I think it should be a voluntary system. I think having incentives for people ... I think there should be. Maybe it should even be means tested, so that the people who would really like to have it done and who can't afford to should be able to put it in, and people like myself, who should be able to afford to do it,..."

"I think it [water tanks] should be mandatory for new homes."

Different types of decentralised water systems were discussed with interviewees, including rainwater tanks, bores, grey water and recycled wastewater systems. Of all different types of decentralised systems discussed, rainwater tanks were the most preferred option; grey water and recycled wastewater were the least preferred types.

3.6.3. Barriers to Adoption of Decentralised Water Systems

A number of possible barriers to the adoption of decentralised water systems were identified during the interviews. These included space, aesthetics, water quality concerns, a perceived need for alternative supplies, and a general lack of motivation.

"It just was impractical. It becomes too narrow just to walk around ... and it is a bit silly to have a 500 litre [rainwater] tank."

"We've not got the space for the bore which we - sort of ventured down that path but it's still we had to find out it where do we put it. We were tempted for a while, I must say, and so were some of our friends."

Retrofitting difficulties were also noted by interviewees as a barrier to adopting a decentralised water system.

“If the showers are upstairs, you would have to – it might be more difficult [to install a grey water system].”

Participants felt that retrofitting decentralised systems into existing homes would cause pipes to be revealed and would, therefore, be aesthetically unpleasant.

“I think in a new house with the plumbing and everything concealed, yeah, I think it’s great. But I wouldn’t be going down that path with the existing house because, you know, I’d hate to see pipes and hoses and things. Wouldn’t you?”

For decentralised systems to be acceptable, participants felt that they should be aesthetically pleasing.

“If you live on a canal you can’t have your tin sheds and this sort of thing. You’re not supposed to. But I look across [the canal] and see a big water tank. Right? Why that water tank isn’t in the ground is beyond me. Because the cover, we’re not allowed to have these sorts of things. So I find that an eyesore ...”

Cost was also seen as a potential barrier to adoption.

“Cost is always an issue to a degree. It is probably not a main [issue] – it wouldn’t stop me if I was going to get it done.”

“An incentive always works just like that, as an incentive. It gets people who are hovering and not getting around to it to do it. If it is something that the Government really thinks should be brought on board, then I think an incentive is a reasonable way to go.”

Water quality was of particular concern in the decision to adopt grey water for garden irrigation. Interviewees also expressed reservations about using recycled wastewater as they did not know much about the water.

“I think grey water is a bit suss for the garden, I don’t know, I’m not sure. I think it would have to be done properly and have a bit of a filter, wouldn’t it, for the garden. I think with the right detergents and stuff because that’s a concern. Because I know we did actually, didn’t we try it?”

“Recycled [water] would be all right for gardens and things, wouldn’t it? I think it would have to be pretty safe as far as drinking it would be concerned. Which is exactly what Toowoomba were doing, weren’t they? So many large cities around the world rely on it. So that has worked in the past hasn’t it? I’d have to keep reminding myself about that.”

One interviewee expressed interests to utilise bore water at home. They were, however, concerned about the environmental impact of bore water extraction.

“I think if everyone had bores then it would affect the [water] table. I think the water table is already probably compromised to a degree.”

One interviewee mentioned that they did not have any decentralised system as their partner was not motivated to install them, suggesting a diffusion of responsibility.

“...I would consider putting a bore down and also putting a water tank in. If I could get my husband motivated...”

3.6.4. Curtailment and Efficiency

Interviewees were asked about whether they had done anything differently around their home to save water. Both interviewees felt they were more aware of their water use around the home. As an example, they had been taking shorter showers, were mindful of their dishwasher use and ensured that they only did a full load of laundry washing.

“We’re certainly more mindful. We don’t use the washing machine [or] dishwasher very often. We never really have. We’re very mindful showering, both of us.”

One interviewee reported undertaking water saving activities (e.g. bucketing laundry water) when the dam water level dropped very low last year. They stopped doing these activities when the water levels again increased. However, the efficiency measures that participants had undertaken also lead to a reduced perception of a need for alternative water supplies.

“We’re fairly frugal anyway, you know, with our consumption. So we didn’t feel – if we had four children running around then it would be different. But there are only two of us and we work. So, you know, our demand’s not great. So that’s another reason why we didn’t buy, isn’t it?”

3.6.5. Trust and Confidence

The degree of trust expressed by participants about using water from a decentralised water system was dependent to a large extent on the intended use of the water. Little else emerged in relation to trust or confidence in the water supply options.

“...the only concern I would have is if you were going to plumb it to your drinking water or something like that, then, you know, I’d want to make sure it was safe.”

“...it is difficult to use it inside from my understanding because then you have got to have the plumbing coming in, etc. I would be happy to use it for the washing machine whether it was out there or just plumbed into the washing machine that would be perfectly fine. I probably wouldn’t – I don’t know – use it for drinking water but then it’s not going to have any fluoridisation. I would be a little bit more concerned about it but, goodness me, people out bush have been living on rainwater tanks forever.”

3.6.6. Social Awareness

Participants were prompted to discuss reasons why others might consider adopting, or rejecting, decentralised water supply systems. Participants believed that others would consider adopting decentralised systems for environmental reasons, with responses focusing on the conservation of mains water.

“Oh yes, I think people will use less town water and that’s always a benefit because it is a scarce resource that we have to look after.”

Decentralised water systems were also seen as a way for people to cope with water restrictions, and to have more water for outdoor use.

“Oh, eventually I think it will outweigh the initial cost. It would have to wouldn’t it? You know you’ve always got a supply of water on hand and you wouldn’t have to worry about it too much.”

“...you’re not worried about restrictions.”

“[people adopted decentralised system] mainly for their gardens and swimming pools.”

Both interviewees had friends with decentralised water systems at home, who were reportedly happy with their water systems as well.

“Well they love it; it just goes straight into the garden. They don’t have any filter system where it comes back and they use it, you know in the house. They’re only using it for the garden.”

Their decision to adopt, or not adopt a decentralised system did not seem to be influenced by their friends, or family.

3.6.7. Equity Issues

The issue of equity emerged in the context of preference for individual or communal decentralised water supplies. Both interviewees preferred individual household water systems than for equity reasons.

“You would have the problem of who uses how much water out of it. I think a system that is just for each household. Unless it is very strongly monitored, I suppose in that there’s a system that allows X amount to come out to this house and then no more, that would be valid. I would have no problems with any of that.”

“You know, we do believe in user pays, don’t we? There’s only two of us. So we pay for our water and a family of six should pay for their water.”

4. DISCUSSION AND CONCLUSIONS

Results from the qualitative interviews carried out in SEQ yielded interesting results, contributing to a greater understanding of the thoughts, values and knowledge of users and non-users of decentralised water systems. Among both groups, respondents indicated that choosing a decentralised water system and/or other sustainable options around the home were desirable qualities and those that should involve conscious and active processes of engagement. However, in many instances, the decision to live sustainably was influenced by uncontrollable factors, such as property development regulations (e.g. Users) and financial limitations (e.g. Non-users). The following discussion will address the impact of these factors on choosing to adopt decentralised systems.

Participants using decentralised water sources as their primary water supply believed that living sustainably using decentralised water systems was a significant lifestyle commitment. Interestingly, most Users in Location C reported that they did not actively choose to live in their housing development because of its sustainable potential. Rather, the decision to have a decentralised supply simply came with the specifications of the property. In fact, respondents in all three locations admitted that their primary reason for choosing to live in a “sustainable” development was due to the property location, rather than their desire to become more self-sufficient or the proposed environmental benefits of the development site.

Issues such as property outlook and spatial orientation were cited as dominant factors for choosing to live in their current home and locality. The environmental benefits of sustainable living perceived by Users were of secondary importance and, in most cases, considered to be a “bonus” rather than a deciding factor for living in the area. Interestingly, some residents, when asked about the environmental benefits of utilising decentralised water sources, did not immediately offer tangible environmental benefits in their reasoning, but rather, tended to cite the positive affect associated with helping the environment and “doing the right thing”. For example, one respondent described experiencing a “nice feeling” when using decentralised water and made no mention of how reusing water influenced the environment. When asked to elaborate further, some respondents mentioned the environmental benefits associated with harvesting water that would otherwise be wasted, and this was the most common tangible environmental benefit cited among Users. Therefore, environmental sustainability, in general, was a factor in moving into the area, but not always the main reason or concern for Users.

Responses explaining the reasons why individuals chose to live in developments with sustainable water practices contribute new information to the existing social science literature on decentralised water systems (e.g. Brown and Davies, 2007; Marks, Cromar, Fallowfield, and Oemcke, 2003). Previously, the issue of choice had not been empirically examined and the issue of acceptance was seen as more important. Anecdotally, when choice was of interest, it was almost assumed that individuals choosing to live in these types of “green” developments would be driven by their desire to live sustainability. However, the interviews conducted in SEQ tend to suggest an alternative appeal of these developments. Specifically, although the affect associated with conservation and “saving” the environment was important to residents, of crucial consequence was the location of the development itself. All three greenfield developments studied were located in picturesque localities and offered residents generous blocks of land on which to build large houses. Although the set-up of the decentralised water systems varied between the developments, residents seemingly could be involved as much or as little as they liked in the supervision and maintenance of their water systems. Thus, individuals with varying environmental interests tended to buy into these developments; however, the one consistency among buyers was their concern for the location of their property.

This likely explains why environmental conservation was not found to be the most important driver of decentralised system adoption. Interestingly, given the varying management options, residents in Location A, a wholly self-sufficient development, did tend to attract like-minded individuals who were more articulate about their environmental interests than residents in the other two developments. Results suggest the less reliant households were on town water, the greater their motivation to manage their own systems.

Perceptions of community and a desire to live in a development full of like-minded individuals were further reasons cited by Users, particularly in Locations A and B, as important when choosing to buy into the development. An interesting phenomenon that seemed to emerge within these close-knit communities was the development of community identity and in-group norms. Residents within the community appeared to have standards for which they judged each other, and they evaluated co-residents' behaviour within the development based on these implicit in-group guidelines. Responses from Users in Locations A and B also indicated concern for newcomers moving into "their" development, with the building of new homes within the established community. There appeared to be a strong emphasis on an "us" versus "them" mentality, with much of the concern seemingly related to equity issues surrounding shared resources such as communal water tanks.

This feeling was outwardly manifested in the way participants expressed concerns about how like-minded the new residents would be and how strictly the new residents would adhere to the community values of sustainability. It seemed as though there was a perception among existing community members that an increased number of residents would negatively influence the balance of community spirit, which the researchers believe referred to a growing concern within the communities that the division of shared resources would be less controllable. Existing literature on phenomena related to group processes and the development of social identities among group members would be of interest here. Given that a discussion of these theories is beyond the scope of the current report, it is recommended that future research could incorporate social identity concepts to explore these relationships further.

Users cited many advantages associated with using decentralised water sources for potable and non-potable uses around the home. The superior quality of drinking water provided by decentralised tank supplies, compared to that offered by council water, was the most dominant advantage to emerge among respondents living in Locations A and B. A lack of chemicals in the drinking water, such as chlorine and fluoride treatments, was appreciated by respondents, who enjoyed drinking what they perceived to be untouched, pure water. The taste and composition of the water (e.g. termed soft water) were also deemed to be superior in most cases and viewed as additional benefits. This finding extends past research (e.g. Brown and Davies, 2007; Marks, et al., 2003; McKay and Hurlimann, 2003), which has previously reported low acceptance of potable applications among residents using or intending to use decentralised water sources.

Much of this past work has prospectively surveyed residents who were living in greenfield developments, which were to receive decentralised water systems for non-potable applications. In the present study, not only was the data from individuals actually using decentralised supplies for domestic purposes, but many were also using tank water for potable applications. Data from this group of participants indicated high acceptance and preference for drinking decentralised tank water. Respondents in Location C had less to contribute in terms of using decentralised water for potable uses, but reported being very happy with having a decentralised water supply for non-potable applications around the home, such as using tank water for gardening and laundry.

Immediate financial advantages of having decentralised water were consistently cited among participants from all three locations, with respondents from Location B paying significantly fewer government fees for their water supply, and those in Location A not paying any local government water rates at all. However, the general consensus among all respondents was that the true financial benefits would only become apparent after at least ten years of continuous use, and this was thought to be even longer for those living in Location C, where their decentralised water supply was limited to non-potable uses. Consequently they were still paying council rates for town water and the financial costs associated with buying a property with a water tank would far outweigh the benefits for some time.

The advantages of having a greater quantity of water around the house and garden through the use of decentralised water were also identified by Users in all three areas. Residents were thankful that they were not held to the same water use restrictions as the general public and could use the water in any way they deemed appropriate. However, it was noted by all three groups that if there was no rain, then their supply would obviously diminish just like the town's water supply. If this were to happen, then residents in Location A would need to have water transported into their homes via costly external companies, and residents in Location B would be utilising their back-up town water supply, which

would also be subject to water restrictions and increased financial costs. As a result, all Users appeared to be very conscious of the water they used and were not wasteful with their supplies. However, despite the negative factors associated with a decentralised supply in the event of poor rainfall, Users were quick to note that, unlike town water supplies, it only took one short sharp burst of rain to refill their water tanks, and this was seen as a significant benefit.

Non-users, too, cited the increased quantity of water around the home as a potentially significant benefit of having a decentralised supply. Non-users' perceptions of neighbours and peers who had water tanks installed was that these individuals were fortunate to have extra water to tend to their gardens and keep the property aesthetically pleasing, despite the rest of the properties being subjected to water restrictions. This apparent belief among Non-users that only people who were avid gardeners or conscious of their home's façade would bother installing an additional water supply is potentially concerning to water researchers. It likely reflects an existing perception among members of the general public that water tanks and other forms of decentralised water systems are simply additional water source primarily for recreational purposes. There was seemingly no consideration, among the current Non-user sample, that decentralised water sources could contribute to a more sustainable lifestyle.

These potentially inaccurate social attributions are likely related to poor education among the general public as to the many and varied uses of decentralised water. At present, it seems as though Non-users believe that decentralised water can only be used for non-potable applications such as gardening, and that it does not really have any other domestic applications. Clearly this is a knowledge gap that needs to be addressed and could be approached using Brown and Davies' (2007) framework for educating the public and facilitating receptivity to alternative water. Their approach recommends that there are four levels associated with decentralised water education: 1) Awareness, the ability of individuals to gain relevant knowledge; 2) Association, the recognition of potential benefits to the individual, community, and/or environment; 3) Acquisition, the means to adopt a particular system; and 4) Application, the ability to apply knowledge and receive support to do so. It is argued that, by addressing these key issues, the general public will have the means necessary to sufficiently understand decentralised water options and the uses for water obtained via these methods.

Interestingly, despite having limited knowledge of the various decentralised water options available, Non-users' awareness of water issues seemed to be reflected in the curtailment and efficiency behaviours they reported engaging in around the house and garden in order to limit their household's water consumption. With regards to efficiency behaviours, the majority of Non-users indicated that they had low-flow shower heads and dual-flush toilets installed in their homes; some also reported having water efficient dishwashers and washing machines. Several respondents mentioned taking advantage of the government incentives to have these newer fixtures installed in their homes.

In terms of curtailment behaviours, most Non-users retrospectively described their behaviour during the severe water restrictions period and reported being mindful of the length of time they spent in the shower, reusing water from the bathroom and/or laundry where possible, and limiting the amount of water used for their gardens. Many respondents indicated that they continued this behaviour despite many of the water restrictions being lifted in their respective areas. Some respondents described it as a mindset that had forever been changed due to the extended period of drought and water restrictions around SEQ. They reported never being able to use water in the carefree way they once did and the idea of wasting water was something they felt very strongly about.

However, there were some individuals who felt that, because of the increased rainfall, there was little threat of water shortages "these days", and reported consequently having longer showers and watering their gardens more than they used to when the drought was "on". These findings highlight a potentially alarming perception among the general public that drought conditions are seemingly solved by greater rainfall, rather than viewing drought as a terminal consequence associated with the larger issue of projected water shortages and unsustainable living. This belief seems to be reflected in the simplistic and casual parlance used by some respondents, as they referred to the drought as being "on", the drought being "fixed" by more rain, and now, referring to the drought as being "over".

Again, these findings demonstrate a clear gap in the general public's knowledge related to water issues in SEQ and the direction of the Queensland Government's water strategy. Some Non-users cited feelings of mistrust directed towards the Government and its water initiatives. However, this could be attributed to residents being poorly informed on the crucial water issues facing SEQ as well as Australia as a whole. What these findings emphasise is that education campaigns throughout Australia should focus on promoting use of decentralised systems as central to long-term environmental sustainability, rather than just as a response to water shortages.

Based on responses, it appears that Non-users, at present, have the impression that decentralised water systems are a short-term water management strategy and now that water shortage is no longer an immediate issue, the need to adopt decentralised water systems has also decreased. However, this hypothesis could be an inaccurate assessment of the general public's opinions, given that the two main barriers to adoption of decentralised systems around their home were related to financial limitations and space constraints, rather than a belief that water shortages were over and additional water systems around the home were no longer necessary.

Many respondents described that they could not afford to cover the up-front costs associated with retrofitting decentralised systems, such as rainwater tanks. Even the rebate system was believed to be inadequate by Non-users, due to lengthy delays for reimbursement, as well as the perceived complexity of applying for a rebate. Many respondents believed that, to promote wider adoption of decentralised systems, the government or local councils should subsidise the system and its installation on a means-tested basis, so that lower income households and pensioners could still afford to install decentralised systems if they wanted to. Even respondents in the Users group agreed that to install additional systems to those that already came with the property was an expensive prospect and something that many were not prepared to do. There was suggestion among both groups related to the idea of economies of scale. In other words, the more households that adopt the system, the cheaper the cost becomes to each household individually because certain costs, such as infrastructure, do not increase with the number of households connected to the system.

Another leading barrier to adoption of decentralised water systems identified through the interviews with Non-users, was related to a lack of space surrounding existing properties to install water tanks that were within their financial means. As mentioned in their discussions of financial issues, retrofitting an underground rain water tank was the most expensive option for installing a decentralised system. Consequently, the only tanks that typically fit into people's budget were the larger outdoor tanks, which, in addition to being perceived as too big for the available space, were also deemed to be unattractive and, in some instances, made from materials of questionable quality. A consistency among responses was that most Non-users, if building a new house, would opt for installing an underground rainwater tank at the building stage, despite the greater capital costs, rather than installing one outside the new home. An underground tank appeared to be the most appealing decentralised option for Non-users.

Amongst Non-users, the intended purpose for installing a rainwater tank was for non-potable uses. There was a general perception among this group that tank water and treated grey water were for external uses, such as gardening, and most were not keen on the idea of using tank water for drinking and cooking, unless it had been boiled first. The primary reasons for this were negative perceptions of tank water storage being unhygienic, fear of contaminants in the water, and poor filtration during collection and treatment. This perception alludes to the limited knowledge of Non-users highlighted in other responses they provided, particularly related to knowledge of technical issues such as water sourcing and treatment.

The belief among Non-users that rainwater was for non-potable applications only is in contrast with respondents within the Users group, whose praises for the superior quality of tank water were numerous. Apart from one participant experiencing extenuating circumstances, all Users in Locations A and B were very confident in the quality of water supplied by their water tank systems in terms of taste, colour and odour. One issue that seemed to reinforce residents' beliefs and confidence in the quality of their tank water and grey water systems within Location B was the regular water testing carried out by scientists from CSIRO and the Department of Environment and Resource Management. The presence of these regular assessors seemed to increase trust in the decentralised systems themselves and facilitated a positive relationship between the technical and social aspects of the water

systems. The information-sharing relationship between the scientists and residents was seemingly important for Users in Location B to have greater acceptance of their systems and it is hypothesised that this type of initiative would have been beneficial for residents in the other two locations also, due to the many teething problems experienced by Users, particularly in Location C.

The main disadvantage of using decentralised systems, according to residents in Location C, was the poor installation of the water tanks, which led to problems such as leakage and back flow and caused tensions between the water system providers and the residents. Although the plumbers installing the tanks in Location C were recommended by the property builders and had supposedly received specialised training to ensure proper installation, there was little faith among residents that this training has been done correctly. Therefore, residents in Location C were not confident with the quality of their water and were not happy with the systems themselves. There was even some suggestion among residents that the plumbers, despite their training, had misunderstood the orientation of the tank and connecting pipe set-up; consequently they had inadvertently reversed the connections of the pipes during installation, leading to these problems. There was also dissatisfaction and mistrust among the User in Location C regarding the amount of information they were receiving from their body corporate, despite numerous requests and high fees.

Users in Locations A and B also cited some disadvantages associated with their systems, though not to the extent of those found in Location C. The main disadvantage cited in Location A centred around maintenance issues of the decentralised grey water system, which was a communal resource supplied to all the homes within the development via a separate outdoor tap. Residents were concerned with the level of chlorine in the water, which was being used to treat the supply, and as a result the water could not be adequately used for gardening. Many residents in Location A had food crops in their gardens, and so believed that this issue was a significant disruption to their household activities.

In Location B, the disadvantages were related more to sustainability issues, such as the amount of electricity required to pump the water from the underground water tanks into the household taps, as well as the energy required to pump water from the communal water tanks, which were located on-site but further away from, and below, the main housing precinct. Residents found that this also contributed to a higher electricity bill, which some residents believed negated the financial benefits of using low-cost, environmentally sustainable decentralised water. Some Users in Location B also cited maintenance issues as financially problematic. The annual maintenance costs of the grey water system were reported as being very high and there were concerns among some residents at the thought of eventually having to replace such an expensive device in the event of system failure. Most residents did not believe that there were any financial benefits associated with the grey water system.

Taken together, these disadvantages are informative for researchers looking to improve decentralised water systems from a consumer-driven perspective. Feedback from participants who are actively using the systems on a daily basis can provide invaluable information which engineers can use to design more user-friendly systems. Based on discussions with residents in each of these three locations, a key improvement that could immediately be made is the appointment of a qualified individual on-site to monitor the quality of the water systems and report back to residents on the characteristics of their water and deal with minor quality issues that may arise. This is something that the respective body corporates could look to incorporate in established and new “sustainable” developments, as a way of facilitating greater acceptability of decentralised water systems and increase consumer confidence in the technology.

The effect of social influence was demonstrably high among Non-users, who reported a great deal of social awareness of friends’ and neighbours’ experiences with decentralised systems and likely used others’ experiences of tank water to influence their own perceptions of acceptance. There was a general belief among Non-users that, within SEQ, there was broad acceptance for devices such as rainwater tanks. Although they themselves did not have a tank, all Non-users knew of someone who had at least a water tank on their property. By all accounts, the experiences Non-users had observed vicariously were positive, possibly explaining why the present data highlighted such high acceptance for decentralised systems among Non-users. Interestingly, however, the most consistent finding among the sample was that their acquaintances who already had water tanks on their properties primarily used the tank water for outdoor applications. This finding may help to understand why there was such

conditional acceptance of decentralised water among Non-users, with their collective belief that tank water was only viable for non-potable uses around the home, such as laundry and gardening.

Non-users' limited exposure to the varied applications of tank water may have influenced full acceptance of decentralised water for varied purposes, particularly applications that involved close contact. Overall, it seemed as though social awareness influenced acceptance of decentralised water, however, did not influence Non-users' decision to install a system at their own property. The importance of social influence that emerged from this data set reiterates recommendations highlighted by Radcliffe (2006), which emphasise the need for decentralised water service providers to administer greater control over the public's perceptions of health risks associated with decentralised water sources. This means greater transparency with regards to informing the public of filtration methods and treatment processes utilised by various decentralised systems and clear indication as to the appropriate applications for each type of water source. As Radcliffe (2006) outlined, it would only take one unfortunate public incident to negatively influence social acceptance in the community. Simple measures, such as keeping the public informed of correct practices for decentralised water, could go a long way in controlling any potential fall-out from such incidents.

Social awareness was also evident among the Users group, leading to strong perceptions of community and in-group identity, in this instance, within the housing development. Social observations among residents within these locations seemingly served to highlight normative in-group behaviour and maintain perceptions of social identity (i.e. how individuals perceived themselves within the context of the larger group). This contributed to perceptions of like-minded behaviour and, to some extent, ensured that residents – particularly in Locations A and B – were engaging in behaviours that were aligned with the community's sustainable ethos. A shared fate was also a factor that seemed to unite residents within their respective developments, such as joint reliance on communal systems as at Locations A and B, and common installation problems at Location C.

Findings associated with cultural identity also emerged during interviews with both Users and Non-users, with the theme of country-living and having a hardy Australian culture featuring as key characteristics of decentralised water acceptance. An example of this was when one User household, in response to their neighbour's concern with the brown water coming from their water tanks, attributed their neighbour's dissatisfaction to them being "European", and therefore unfamiliar with using discoloured drinking water, something they believed that most country Australians were used to doing. This cultural perception reflected both in-group favouritism (i.e. local versus foreign) as well as the belief that most Australians are hardy and would not be bothered by a little water discolouration. This perception is interesting in light of past research (e.g. McKay and Hurlimann, 2003; Hurlimann and McKay, 2004) which shows that many Australians are concerned about health risks associated with water that does not look clean. Future research could examine whether demographic factors, such as past urban versus rural living experiences, influence acceptance of decentralised water.

Limitations

The most important point to note is that, owing to the limited empirical literature available, much of the discussion is specific to the present context. Several references to existing literature are made, where possible, however a discussion of these findings is primarily aimed at informing researchers and practitioners and recommending future directions for research in this area.

This qualitative study had several limitations, which should be noted. The main limitation occurred concurrently with the study's delimitation of recruiting participants from three particular areas. These locations were chosen based on work by Cook and colleagues (2009), which identified these developments as "sustainable". This meant that all residents were required to utilise decentralised water systems as their primary and/or supplementary water supply. Consequently, it was deemed appropriate to recruit the Non-user sample from these same three localities to ensure consistency between the two groups on general demographic factors relevant to the current study, such as social class and similar exposure to rainfall and water restrictions. The number of Non-users recruited for the study was also potentially a limiting factor; however, data saturation was achieved with this small sample size, therefore no additional interviews were conducted unnecessarily.

Another issue to consider was the high number of retired participants who took part in the study, within both groups of participants. A possible explanation for this could be the recruitment method, which involved recruiters visiting houses during working hours. However, the present study design attempted to overcome this limitation by leaving contact details in the mailbox for potential participants who were not at home during the door-knock timings, as well as scheduling interview times for the weekend. The high number of older participants involved in the study suggests that caution should be taken when making conclusions from the findings, as the perceptions and opinions reflected in the present study, within this sample, may not be completely representative of those that exist in the general public.

Finally, a discussion of the current findings was limited to studies which have been conducted in an attempt to understand public acceptance of recycled water systems and desalinated water. Consequently, it is difficult to contextualise these results in terms of past decentralised systems social science literature, of which there is very little. These findings are novel and exploratory, and must therefore be interpreted as such.

5. RECOMMENDATIONS FOR FURTHER RESEARCH

The current study represents an important addition to the existing literature on the use of alternative water supply options. The results highlight a number of important considerations for moving forward with this research and also confirm the importance of looking at specific systems with users and non-users. Recommendations for future research are presented.

The first consideration is the disparity between Users and Non-users on several themes. Generally, as would be expected, Users had more knowledge of decentralised systems and were more capable of discussing these systems, or even systems different to their own. Non-users, on the other hand, had some difficulty in conceptualising decentralised systems and therefore may not have been accurate in identifying views towards the possibility of adopting such systems. This has important consequences for future research. While it is important to sample broadly enough to ensure that the extrapolation of results to the general public is reliable and appropriate, there is a need to ensure the views of those who have experienced these systems are captured.

The most prominent reason given for choosing to live in decentralised communities was the location of the development. This superseded any environmental benefits, although most participants also maintained some desire for environmental sustainability. More research is needed to quantify this effect and assess the degree to which this might be an important consideration for developers in planning future sustainable developments. One possibility is to incorporate geospatial data into potential future modelling endeavours, to essentially “map out” acceptance, intended behaviour and actual adoption behaviours.

One advantage of the current study over similar studies is the incorporation of people actively engaging in the behaviour of interest. From the comparison of actual and intended behaviours, it becomes evident that there is at least some disparity between the groups. It is possible that this relates to level of knowledge, and difficulties in conceptualising what could be quite a complex range of options. The adoption of decentralised systems could be conceptualised along a continuum, ranging from: full adoption (zero reliance on, or access to, centralised water supplies); to partial adoption (for example, grey water diverters, supplementary water tanks); through to no adoption (complete reliance on scheme water). Differences between groups in this qualitative study show the importance of capturing people on all ranges of this spectrum, in order to truly assess or predict adoption of decentralised systems. Limiting studies to the examination of intended behaviour, or even the adoption of just one type of alternative system, can be problematic. To this end, it is proposed that future research could focus on this continuum of adoption, along with theoretically pertinent predictor variables, in order to assess actual adoption behaviours as well as intended behaviours.

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