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Predicting support and likelihood of protest in relation to the use of treated stormwater with managed aquifer recharge for potable and non-potable purposes

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ABSTRACT

Managed Aquifer Recharge (MAR) of stormwater has been deemed technically feasible in augmenting the total water supplies of the Adelaide region however, a major obstacle to implementation of new water schemes, particularly for potable reuse, can be gaining public acceptance and political support. The present survey of 1043 Adelaide residents addressed factors identified in the literature such as satisfaction with the quality of water, the importance of cost, perceived effectiveness of the recycled water distribution system, perceptions of community acceptance and trust in the water authorities to manage the system. The study compares three options for the use of stormwater through MAR: non-potable use through a third-pipe system, potable use whereby the water from the aquifer is pumped to a reservoir, and potable use whereby locally treated water from the aquifer is pumped into the mains system. Although respondents were positive about the reuse of stormwater via MAR for both potable and non-potable options and the likelihood of protest was less than ten percent, respondents clearly preferred the non-potable to the potable options. The results suggested a need for public education on issues such as the cost of third-pipe systems, the risks associated with the potable option with localised treatment, and the actual rate of community acceptance, which was higher than they believed. However, there was also evidence of psychological bias, which is not easily moved by the provision of information alone.

1. Introduction

With increasing population and decreasing supplies of reliable rainfall, many regions of the world are exploring the use of alternative water sources for both potable and non-potable use. One alternative, the use of stormwater through managed aquifer recharge (MAR) has a range of benefits in urban areas that have access to local aquifers. For example, aquifers provide a natural filtration which leads to low filtration cost and low energy treatment. Depending on the quality of the runoff and the end-use of the water, monitoring and further purification are usually required by relevant authorities before and after the water is stored in the aquifer. They are often located close to the point of water capture and water use reducing the energy required for water transportation and building water storage facilities. Further, by filtering and storing run-off from urban areas they reduce the amount of pollutants in rivers and coastlines (Dillon, 2011; Dillon et al., 2010). As with all decentralized systems however there is an increased cost in managing multiple sites.

Australia is an interesting site because, although it is the driest inhabited continent, there is relatively little use of alternative water sources for potable use and there has been considerable community outcry at proposals involving recycled sewerage (Price et al., 2012). In studies initiated by the Australian Water Association (Ogilvy Earth and Ogilvy Illumination, 2010) over 70% of Australians surveyed were found to be concerned or very concerned with present water supplies, but were reluctant to consider augmenting drinking supplies with recycled water. However a few small Australian cities have augmented potable supplies with treated stormwater eg Mount Gambier in South Australia (Vanderzalm

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et al., 2006) and Orange City Council (2010) in New South Wales. Only Perth, capital of Western Australia, is introducing potable reuse of wastewater via managed aquifer recharge. In contrast, Australian communities have been generally accepting of reuse of water for non-potable purposes (Sydney Water, 1999; Water Corporation, 2003), with successful implementation of many small scale, non-potable water reuse projects for landscape, residential, agricultural or horticultural irrigation, as well as industrial water recycling and toilet flushing (Po et al., 2004). So a question arises about the drivers of acceptance of alternative water sources for potable and non-potable uses. Focussing on stormwater avoids the simple "yuck factor" (Russell and Lux, 2009) that might apply for treated wastewater and the present research examines attitudes to the use of stormwater for potable and non-potable purposes. It investigates potential drivers of those attitudes and thus how greater acceptance of potable uses might be fostered. The specific site is Adelaide, capital of South Australia, which regularly experiences water stress.

From an evaluation of an existing scheme, the storage and treatment of stormwater through MAR has been deemed technically feasible for augmenting the water supplies of the Adelaide region (Dillon et al., 2010; Page et al., 2010). As with any new water scheme, a major obstacle in implementing MAR, particularly for potable use, can be gaining public acceptance and political support. From one of the few surveys that address stormwater, respondents preferred stormwater for augmenting drinking supplies, if they were compelled to use alternative water sources, and also favoured stormwater over other alternative sources for internal domestic uses. Knowledge about treated recycled water increased the likelihood that some people would accept using recycled water treated to drinking water quality and/or desalinated water (Ogilvy Earth and Ogilvy Illumination, 2010).

In Australia, communities have high expectations for the security and safety of their water supplies and citizens are extremely sensitive to any risks that may affect public health (Dolnicar and Schafer, 2009; Hurlimann et al., 2008; Mankad and Tapsuwan, 2011; Marks, 2006; Nancarrow et al., 2008; Nancarrow et al., 2009; Nancarrow et al., 2010). In their review of drivers of alternative water acceptance Mankad and Tapsuwan (2011) found that risk perception was the most dominant social factor to emerge from the literature. Specifically, acceptance for alternative water schemes was dependent upon perceived risks associated with personal contact and interactions with the water source. A number of studies suggest that people are adverse to personal skin contact or the possibility of ingestion of recycled water, preferring external uses such as outdoor irrigation, for recycled or other treated non-traditional water (Marks, 2006; Syme and Nancarrow, 2006). This concern for personal contact with treated water was thought to be elicited by a feeling of disgust arising from perceptions of the non-traditional water source and a feeling of revulsion at the prospect of oral ingestion of a contaminant (WateReuse Association, 2010). Therefore, while risk perceptions of technical experts are often based around the probability of harm to human health (Doria, 2010; Hurlimann et al., 2008), community concerns are more likely to be based on emotional reactions formed in response to distrust and fears emanating from uncertainty (Mankad, 2012). Although perceptions about the acceptability of risks to human safety and health are often the dominant issues when recycled water supplies are rejected by the public, most research has been conducted on attitudes to recycled sewerage which is seen as less desirable than stormwater (Ogilvy Earth and Ogilvy Illumination, 2010).

In the extensive research on recycled sewerage schemes, other factors found to have influenced peoples' attitudes include, function and maintenance of systems, environmental factors, equity, justice, fairness, transparency and inclusion of community views into the decision making process (Dolnicar and Hurlimann, 2009; Marks, 2006; Marks and Zadoroznyj, 2005; Nancarrow et al., 2010; Russell and Lux, 2009; Syme and Nancarrow, 2006). In particular, descriptive norms about what others in the community would be willing to accept seems to influence personal acceptance for alternative water and its appropriate uses (Dolnicar and Hurlimann, 2009; Gockeritz et al., 2010). Further acceptance for the supply of recycled water can be impeded by ongoing inertia caused by historical, technocratic, institutional power and expertise, values and leadership and the structure and jurisdiction of the institutions involved in water supply (Brown and Farrelly, 2009; Moglia, 2011).

Even in the absence of perceived dangers to public health, particularly among citizens of affluent nations such as Australia, the reputation of a water utility can still be damaged if water quality expectations important to the consumer (e.g. characteristics of taste, odour, clarity) are not met (Hrudey et al., 2006). Further, the public is likely to be more accepting of treated water if appropriate risk management frameworks are implemented and followed to assess issues such as water quality monitoring, validation of process performance, design of equipment and long-term evaluation of the reliability and quality of the water supply. Thus, the credibility and role of government institutions and regulatory frameworks are critical to the implementation of water recycling schemes (Brown and Farrelly, 2009). Public trust in the governing bodies (e.g. the water utilities), the science underpinning the recycled water schemes, and how the media portrays the alternative issue have all been identified as extremely important to community acceptance of proposed alternative water schemes (Doria, 2010; Moglia, 2011). It is not yet clear however whether the findings for recycled sewerage translate into attitudes to stormwater.

Willingness to pay for alternative water sources has also been identified as a key driver of public acceptance (Mankad and Tapsuwan, 2011). In the case of stormwater, sustainable operations require sound financing for both the initial construction and implementation of a system, as well as continuous maintenance. Newer housing estates are more likely to implement stormwater harvesting technology because of the relatively easier financing arrangements, through lot levies and other similar property fees. However, for retrofitting such technology in existing neighbourhoods, financing is much more difficult and unlikely because of the heavy cost burden (Marsalek and Chocat, 2002). Efforts to assess the cost of diverse stormwater systems in Adelaide have shown that there are a number of complexities (Dandy et al., 2013) and therefore difficult for the public to assess whether they would be receiving value for money.

A small scale intervention ($N = 36$) involving input from MAR experts not only identified Adelaide residents' main concerns about MAR but also measured the change that occurred pre and post intervention (Leonard and Alexander, 2012; Mankad et al., 2015). The participants' main concerns were the lack of fairness if only new estates had access to MAR systems, trust in the systems, the cost, the effectiveness of the systems and future water security. They recognised how much they had learned during the short intervention and the need for public education. Their attitude to MAR changed markedly from 35% supporting and 43% having no opinion prior to the workshop to 93% supporting MAR after the workshop. Further, participants preferred the potable options (97% supported) to the third-pipe option (25% supported) because of concerns about the cost or lack of fairness associated with third-pipe systems.

The present survey addressed key aspects identified in the literature such as satisfaction with the quality of water, the