CHAPTER FIVE

Potable reuse: a social dilemma

When drinking water, think of its source.

Chinese proverb

Introduction

This chapter presents the experience of potable reuse investigated through case study research. A triangulation of methods to source the data includes ethnographic research undertaken in the USA involving site visits and interviews with key people in the industry; a review of archival data such as media articles and survey reports; and industry literature and documentation collected in the field and obtained through industry contacts. The conceptual basis for this part of the study is informed by Bruvold (1985) and other pertinent industry literature; the trust framework proposed by Sztompka (1999); Giddens' (1991) active trust and the related theory of Habermas's (1990) communicative action which emerges from the review of previous surveys (Chapter Four). An iterative approach made constant comparison between the narrative that arises from each of these minor case studies, relevant survey findings, and the emergent theories.

These case studies help to address both research questions, that is:

1. What shapes the industry's claims in relation to urban water reuse?
    a. What are the drivers behind water recycling?
    b. How is reclaimed water presented to the public as a solution to problems of water supply?
2. What is the public response to water reuse?
    a. To what extent is the response influenced by concerns about environmental and public health risk?
    b. What is the function of trust in the acceptance of reclaimed water?

Presentation of the case studies follows the order in which they were investigated with leading cases of existing potable reuse and potable reuse that has not been implemented being followed by several cameo studies to represent the extent of the

industry's interest in this type of water reuse and to focus on the industry's approach and evidence of public awareness of the systems.

Background

To encourage support for potable reuse, Bruvold (1985) advised the industry to present "understandable evidence that current wastewater treatment technology exists and is fail-safe and effective" (p.77). Rather than focusing only on the upper socio-economic strata of community leaders, it was recommended that educational programs should also target lower socio-economic groups and include tours of treatment plants, information in the school curriculum, marketing efforts through the mass media and brochures distributed with water bills (Bruvold 1985:77). He further recommended that low-contact, non potable reuse would be readily accepted by the public and should be introduced, however he later observed that closeness of contact may not define acceptability where water reuse has salience. Bruvold (1988) therefore underlined the necessity of researching salient options in the community (p.48).

The USA Committee to Evaluate the Viability of Augmenting Potable Water Supplies with Reclaimed Water et al (Committee et al 1998) summarises the opposing scientific views of potable reuse as follows:

> Opponents of the use of reclaimed water for potable use point out that communities involved in the practice are subject only to existing drinking water standards that have been developed exclusively for natural sources of water. No national standards exist for the variety of contaminants (many of them poorly characterized) that may be present in potable water derived from treated municipal wastewater. Meanwhile, proponents have argued that the planned reuse situation is no different (and possibly safer because of tighter controls) than that faced by many communities using water supplies that receive significant upstream discharges of wastewater.
>
> (Committee et al 1998:6)

In the USA and Australia, there are no federal regulations for water reuse. Guidelines have evolved from the US Environmental Protection Agency in response to the 1972 Clean Water Act. The Florida Department of Environmental Protection

has developed a rule framework governing indirect potable reuse[1] and in California, the State Department of Health Services has compiled draft regulations for groundwater recharge reuse.[2] Permits designating particular requirements for indirect potable reuse are issued on a case by case basis. Similar guidelines and permitting arrangements, based on Californian Title 22 standards, are in place in Australia at the national and state levels.

Established potable reuse sites

The pioneer of indirect potable water reuse in the USA is found at Whittier, Los Angeles in California. Community experience of this operation is followed by that in Fountain Valley and Carson in California, El Paso in Texas, Northern Virginia and Windhoek in Namibia, the only direct potable reuse site.

Los Angeles: Whittier Narrows

Three treatment plants operated by the Sanitation Districts of Los Angeles County (SDLAC) have recharged potable groundwater aquifers by surface spreading since 1962 (Crook 1990:180). The process allows highly disinfected, filtered secondary effluent to percolate underground at Whittier Narrows in the Montebello Forebay area. The dilution requirements for reclaimed water are 50% in any one year and 35% in any three year period. In the year 1999-2000, insufficient runoff meant that only 52% of the reclaimed water was used for groundwater replenishment instead of the normal two-thirds (SDLAC 2000:5). The balance is distributed for non potable uses. Reclaimed water for groundwater recharge incurs no additional capital improvement or operation and maintenance costs because the water reclamation plants are located along rivers or creeks that convey the effluent to off-stream recharge basins; there it percolates by gravity into the aquifer (SDLAC 2000:6).

Epidemiological studies on health effects were conducted over a fifteen year period by the University of California Los Angles School of Public Health through Rand Corporation funding (P1:27). The scientific assessment of the studies found that the

[1] Part V of Chapter 62-610, Florida Administrative Code 1999 revisions outline the rules for supplementing surface water, ground water recharge, augmentation of Class 1 water and wetlands in Class 1 Water.

[2] Title 22 California Code of Regulations, Division 4 Environmental Health, Chapter 3 Recycling Criteria (23 April 2001).

quality of the highly treated reclaimed water was "as good as or better than the current drinking water sources for most or all measures" (Committee et al 1998:6). However, Greene (2000) points out that the scientific advisory panel that evaluated the project concluded in its 1987 report[3] that alternatives such as non potable reuse should be considered prior to adopting the recharge for potable use option. Indeed, the Committee et al (1998) acknowledges the uncertainty surrounding potable reuse:

> However, limitations in methodology and testing have prevented many within the scientific and technical community from issuing absolute statements that planned potable reuse carries no adverse health-effect implications. (p.6)

The Water Recycling Coordinator advises that although soil aquifer treatment studies confirm that the effluent is highly treated, new contaminants are being identified by the EPA for investigation. Proteins, left over "metabolic bi-products, dimethyl 'double death', and new endocrine disrupting pharmaceuticals" are the latest concern and more tests are being conducted on pharmaceuticals for the "pollutant de jour" (P1:25). In the meantime, Los Angeles resident Erin Brockovich, whose investigations have made Hollywood fame, continually campaigns for safe levels of Chrome 6 (Blankstein 2000), feeding into "modern family man's worst nightmares" (P1:26). In these circumstances, the coordinator faces the problem of how to convey to the public the fact that their drinking water is supplemented by reclaimed water "without scaring them to death" (P1:27).

Groundwater recharge was implemented in Los Angeles at a time when approval was not subject to consultation with the public. What would the public think today of indirect potable reuse? The 2000 LA survey (Lawrence Research 2000) reviewed in the previous chapter indicates that a total of 65% agree with the concept in principle. Indirectly, only 38% indicate they would not be bothered about drinking the water. The fact that the Sanitation Districts of Los Angeles County has an established practice of groundwater recharge is not revealed in the survey and it is observed that the LA example is only mentioned in one of nine Californian surveys reviewed in the previous chapter. In relation to trust, the Sanitation District was ranked after the water provider, being the least trusted (ninth) of the main

[3] *Report of the Scientific Advisory Panel on Groundwater Recharged with Reclaimed Wastewater.*

agencies, reflecting a similar result for sewerage authorities in other locations surveyed.

Further illustration and comment

Central to the lack of transparency of this apparently successful example of indirect potable reuse is the historical factor. It was implemented prior to the minimal requirements of public consultation following the USA Clean Water Act (1972) and Safe Drinking Water Act (1974). With heightened public concern for drinking water quality following publicised contamination incidents, such as the 1993 Milwaukee *Cryptosporidium* outbreak, coupled with the industry's current focus on new contaminants of concern, there is a reluctance to disclose this practice for fear of causing public alarm. Another manager of reclaimed water who was interviewed acknowledged that some water districts allow treated effluent to percolate to groundwater and that "percolation ponds keep a low profile"; of this, he says he has "mixed feelings" (P2:17). A water supply manager clarified this view:

> We [water providers] are willing to tell them, but you can't get that message across. Sewer people are more likely to do it than water people – they [water providers] would get complaints about water quality. (P3:19)

From the industry's point of view, unplanned potable reuse is an established, historical fact (an oft-quoted example is London's Thames River), therefore, the fact that this practice is planned is a feature that appears to be suppressed in the interests of maintaining social order, for surely if the reaction of fear is anticipated, anger would follow. Disruption to social order would of course jeopardise the established, economical process of effluent disposal and supplementation of drinking water supplies. This situation resonates with Sztompka's (1999) structural opportunities for trust building. In this case, transparency is not the goal and the facts are clouded to maintain trust in sewerage and water providers. However, trust in the authorities appears to be relatively low and hence, would more transparency secure greater public trust? Another five examples of potable reuse are reviewed to compare to these emerging theoretical observations.

Fountain Valley: Water Factory 21, Orange County Water District

Since 1976, at this Orange County Water Districts demonstration plant, reclaimed water has been discharged into a series of 23 injection wells providing 81 individual injection points to form a seawater intrusion barrier (Crook 1990:181-2). Crook (1990) clarifies the dual objective of this application: while "some of the injected water" forms a seawater barrier, the "majority of the water flows inland to augment the potable groundwater supply" (p.182). It is claimed that this practice is cost effective, reduces the dependence on imported water from the State Water Project and the Colorado River, provides a continuous supply of water for the barrier, and reduces effluent discharge (OCWD 2000).

It is the success of Water Factory 21, featuring state-of-the-art processes such as micro-filtration and reverse osmosis (RO), that drives the proposed Groundwater Replenishment System (GRS). However, the link between the two projects is not made in the GRS promotional material. This established example is only noted in public opinion surveys conducted in San Diego and San Jose and is not mentioned in the Orange County survey research. Nevertheless, the connection made front page press recently (Mehta 2002a) when a new contaminant of concern, dioxane, was found in drinking water wells and was traced back to the effluent source of the Water Factory 21 groundwater injection process.

Carson, California

West Basin Municipal Water District introduced groundwater recharge in 1995 to create a barrier to seawater intrusion and to supplement potable groundwater supplies (Nagel et al 2001). The injected water is currently sourced by a 50:50 mix of micro-filtered, RO (reverse osmosis) treated effluent and raw water supplies. A Blue Ribbon Panel Review has agreed that the recharge water can be wholly sourced from recycled water providing that it is introduced in a step-wise manner (75%, then 100%) over a period of intensive monitoring, and that ultraviolet (UV) disinfection is added to the treatment train (Nagel et al 2001). The expansion of this system is promoted as a solution to remedy seawater intrusion rather than, at the same time, producing a new source of drinking water.

The West Basin Municipal Water District's website under 'Recycled Water' presents information on non-potable reuse for irrigation, 'barrier water' and industrial processes. Under 'Public Affairs' a link is given to the West Basin water recycling facility that provides further information on barrier water. This states that imported surface water was injected for 40 years and now part of this is being replaced by recycled water after receiving micro-filtration and RO treatment to meet EPA drinking water standards. No mention is made that some of the water will reach potable water wells or what proportion of the injection water is supplemented with recycled water.

El Paso, Texas: The Fred Hervey Water Reclamation Plant

This direct injection to groundwater operation has recharged the potable water supply in the Hueco Bolson aquifer since 1985 to alleviate groundwater depletion through over-pumping of the aquifer (Water Environment & Technology 2000:74).[4] It is reported that 60% of the reclaimed water is allocated to groundwater recharge and the remainder is supplied for coolant for power stations and golf course and cattle ranch irrigation (Jensen 1990:3; Texas Water Resources Institute 1997:1). Three additional reclaimed water treatment plants produce water at Type 1 rating, suitable for non potable uses, however, according to the El Paso Water Utility (EPWU) website, reuse of this water is currently at the project development level. The water is expensive but is cost effective when compared to other new sources. A grant from the EPA covered 65% of the capital cost, however, it is noted that operating and maintenance costs are $0.64/kL compared to around $0.25/kL for other wastewater and surface water treatment plants (Brosman 1999:11).[5]

The Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS) were undertaken between 1978 and 1982. In 1984, public consultation was not listed as one of the "eight criteria for judging potable reuse" for El Paso (AWWA 1984:14). However, in a report on the public health risk assessment that predicts less than one increased lifetime cancer death per 100,000 persons, it is stated that "extensive public review indicated that this risk is acceptable to the

[4] Following sewage treatment, the process includes powdered activated carbon and high-lime treatment; ozone disinfection (Texas Water Resources Institute 1997:8).
[5] Australian dollars quoted throughout. At the time of the research in the USA, August-September 2001, AU$1=US$ 0.52.

citizens of El Paso" (AWWA 1984:15-16). It is not known how the review was conducted, but based on the current sensitivity to health risks associated with drinking water, it is suggested that the "major drawbacks" listed against the eight criteria for evaluating potable reuse (AWWA 1984) would raise opposition to the project if it were to be introduced today.

Reviewing current information on El Paso's water supply in the public forum, few sources acknowledge the indirect potable reuse system. The description of water reclamation activities on the EPWU website does not include reference to the groundwater recharge operation (2001). Instead, it is claimed that as a result of advanced tertiary treatment, the EPWU has earned the reputation of "operating the first wastewater treatment plant in the world to meet drinking water standards for its reclaimed water." In the 2000 Drinking Water Report, reference to the system is not found under the sections titled "Where our water comes from", "Frequently asked questions", "How safe is your water?" and "What's in our water?". An on-line search of Texas newspapers results in one article that makes brief and misleading reference to the plan that "cleans wastewater to drinkable levels … some of it is returned to city taps; the rest is pumped into an aquifer for underground storage" (Segrist 2000:3). The article reports that Abilene is considering similar initiatives, although the director of the water utility is aware that the public may object:

> People have heart attacks at the idea of drinking their own wastewater … people say: "We're going to get cancer, we're going to get liver disease, we're going to get everything else in the world" … That's part of it. You have to accept it. (Segrist 2000:2, 4)

These comments convey the attitude that irrational fears dictate public perceptions of indirect potable reuse. However, the low public profile of indirect potable reuse suggests there is little transfer of information to the pubic and therefore feedback on what the public thinks is muted. Industry perceptions such as this are a matter of conjecture.

Northern Virginia: Upper Occoquan Sewage Authority (UOSA).

Since 1978, the UOSA Regional Water Reclamation Plant has discharged to Bull Run, approximately 32 kilometres upstream of the Occoquan Reservoir which serves Fairfax and Prince William Counties (Robbins 1993:2-4). Prior to the operation of the plant, sewage effluents from eleven secondary treatment plants were mainly responsible for the advanced stage of eutrophication of the reservoir, however, since 1978 phosphorus concentrations in the product water are consistently low (Occoquan Watershed Monitoring Laboratory 1993:4).

The in-basin discharge was reluctantly accepted in the 1970s subject to stringent safeguards, including an independent year round watershed monitoring program, limitations to expansion and provisions to export the reclaimed water "should the reclamation plant fail to protect the reservoir" (Robbins 193:6). The UOSA Regulatory Affairs Coordinator acknowledges that public consultation was a low-key process in the 1970-80s compared to more recent and much publicised efforts of community involvement in water management. If the proposal were to be put to the public today "there would be direct public involvement and the outcome might have been different" (P4).

Windhoek, Namibia, Africa

Population pressures on this arid country and the high cost of transporting water from the distant (400km) Okavango River, resulted in the establishment of Windhoek's first reclamation plant in 1968 (Martindale 2001:40-41; Williams 1997:48). This facility has delivered drinking standard water since 1968 in a direct potable reuse system that provides around 23% of the city's annual demand, and during the 1995 drought this increased to 30% (Martindale 2001:40-41).

Van der Merwe (1996) reports that modifications to the system are aimed at a four-fold increase to maximise capacity and that direct potable reuse is "generally accepted". Wiliams (1997) similarly reports that "the general public of Windhoek has readily accepted reclaimed water for domestic potable use" (p.48). However, Martindale (2001) asserts that:

> … despite 32 years of access to high-quality recycled water, the residents of Windhoek still doggedly oppose its use for personal consumption. (p.41)

For this reason, most of the product water is distributed for non potable uses (Martindale 2001:41). Anecdotal evidence from a former, short-term resident of South Africa explains why the project originally met with little opposition. When the reclaimed water plant was installed in Windhoek, Nambia was under the rule of the white South African government. The "mixed race population did not have much say in the decision to adopt this alternative source of water under the apartheid regime" (P5).

Further illustration and comment

There is no evidence available to suggest that existing potable reuse is a matter of public knowledge, except in the case of Windhoek. This direct potable reuse system has been 'on line' for over thirty years and there is still some doubt about the level of public acceptance. The other four studies confirm a reluctance to divulge details of indirect potable reuse or promote its practice to the communities which they serve. It is accepted, however, that some members of the community will be aware either through word of mouth, or knowledge of what may be regarded as the beneficial side effect of 'barrier water'. It should be noted that although the surface discharge Northern Virginia system is offered as a successful example of indirect potable reuse (eg 1998 San Diego survey; Tampa deliberations), others regard it as part of the normal operations of responsible effluent disposal.

These studies confirm that a lack of transparency prevails in California and Texas and this inhibits the building of trust in the community towards water reuse and water and sewerage providers. At the same time, the lack of communication builds misperceptions within the industry that the public cannot be trusted with information on potable reuse. The Texan water utility manager anticipates an irrational and emotional reaction. Following the pervasive, public silence on this issue, public disclosure could well induce an emotional reaction, but it would be far from irrational; the veiled practice may be viewed as a breach of trust. These aspects will be considered further below following the San Diego case study and seven similar projects.

Proposed potable reuse systems

The case of the San Diego indirect potable reuse proposal will be considered in detail prior to the presentation of another three cases in California where potable reuse has been abandoned or postponed; and one each in Colorado, Florida and Australia, and finally the case of Orange County where indirect potable reuse is being actively promoted for implementation.

San Diego Water Repurification Project

Potable reuse was originally investigated in the 1980s through pilot project operations from 1984 to 1993. It was the preferred option based on its economic feasibility; it avoided the need for the dual pipes required for non potable reuse and the cost of pumping and re-treating unused highly treated effluent for ocean disposal at the Point Loma plant (WateReuse Assoc. 1999:12). The Water Repurification Project was proposed by the City of San Diego (CSD) Water Department with support from the County Water Authority, the Metropolitan Water District of Southern California and the US Bureau of Reclamation as part of a capital improvements program. An advanced water treatment plant, using micro-filtration and RO, would be co-located with the newly built North City Water Reclamation Plant and a 37 kilometre pipeline would deliver repurified water to the San Vicente water supply reservoir for blending with imported water (WateReuse Assoc. 1999:11). However, the City Council would not raise the water rates to fund its share of the $1.5b program (CSD 2001). In 1995, leadership of the project transferred from the Water Department to the Metropolitan Wastewater Department and this is seen by some in the industry as a weakness in the public outreach strategy (P6:22).

An appeal for public support for the program was made through the formation in 1996 of a Public Advisory Group. Stakeholder interviews were conducted and based on this information, an "outreach program was structured to include areas where the public had misperceptions or no knowledge" of the program (CSD 2001:2). Officials "gingerly" explained that existing water sources contained treated sewage discharged by cities upstream of San Diego (Leovy 1997:1). Over a six month period, 1,800 educational kits were distributed, sixty presentations were made with town councils, civic associations and community planning groups and a

project information hot-line was established (CSD 2001:2-3). Finally, with the support of key community stakeholders and the media, the Council approved a rate increase in August 1997 to help finance the proposal (CSD 2001:3).

Opposition to the project was foreshadowed in the *San Diego Union-Tribune* in 1994 with a cartoon featuring a dog lapping toilet bowl water while his master stands in line asking him to "Move over" (Gagliardo 2002). Publicity was more positive in *The Los Angeles Times* with headlines: "Reclaimed wastewater may ease state's thirst" (Leovy 1997). The article reports that $288.5m would build a reuse system which would treat effluent to drinking water standard to comprise 10% of the supply by 2001. The phrase "toilet to tap" is quoted but not in a derogatory way. The article claims it is used by proponents to describe "a futuristic urban environment in which treated wastewater would be transferred directly to drinking water pipes" (Leovy 1997). Opposition to the high cost of the project is also reported. A retired geographer suggests the money would be better spent on other water sources (Leovy 1997). Nevertheless, in 1998, $736.5m worth of water bonds were sold in one day and this was seen as an indication of business and investor confidence in the overall strategic plan (CSD 2001:3).

Two surveys were launched in the San Diego area at the time the project was under consideration, as reviewed in the previous chapter. In 1993, up to 73% indicated they would support a system which repurified used water and up to 59% said they would use it for drinking. Later, in 1998, some 60% agreed that it was "a good idea" to blend purified wastewater with raw water but respondents were not asked if they would drink the water. Instead, they were given the opportunity to explain what information they needed to feel confident in using the water for drinking. Only 5% indicated they did not need any further information and most other responses were concerned with health risks and safety. When it was suggested that more than 200 agencies discharge into the Colorado River, only 52% indicated the information made them more likely to support potable reuse.

The level of trust in the San Diego County Water Authority and the City Water Department and is relatively low over this period, however, this roughly aligns with results for other US cities and Sydney. In 1993, the water agencies were trusted

(very trustworthy) by 28% and 24% respectively and were ranked fifth and sixth in 1993, and sixth 1998, as trusted sources of information, after five of the most trusted agencies (medical, health, science, EPA, environmental groups). The Metropolitan Wastewater Department was included in the 1998 survey with the result that it was ranked lower than the water agencies, following an established trend (see previous chapter). In the 1998 study, independent scientists were the most trusted and therefore it can be assumed that the findings of the national, broad-based scientific Committee et al published in March 1998 carried some weight in relation to this project. For example, the county's scientific community is reported as saying that it is "impossible to guarantee the safety of using treated waste water for potable use" (The Editor 1999). Of particular relevance is the conclusion of the Committee et al (1998) that:

> … indirect potable reuse is an option of last resort. It should be adopted only if other measures – including other water sources, non-potable reuse, and water conservation – have been evaluated and rejected as technically or economically infeasible. (p.9)

In San Diego, non potable reuse was not well established and potable reuse was preferred by proponents because of its comparative economic advantage, not because non potable reuse was not feasible.

Opposition to the project grew when two state legislators, who claimed they had no knowledge of the project, drew a large crowd to a public hearing by circulating "toilet to tap" labelled meeting notices (Hartling 2001:45). Among city councillors, an African American reverend, George Stevens, claimed that the sub-standard water was destined for his constituents located in poorer parts of the city (La Rue 1998). Although the potable distribution also includes part of a higher socio-economic region (P6:6), uneven distribution of the new water source was interpreted as unfair allocation – transferring the sewage of the rich (location of the treatment plant in an affluent area) to the poor for drinking - raising the issue of social justice and fairness. In October 1998, another councillor called a press conference to promote the recycled water concept of "showers to flowers" in order to "kill toilet-to-tap" (La Rue 1998). He claimed his constituents did not want to drink "other people's toilet water" and that:

> We built it and they didn't come … we built up this technology and people don't want it! (La Rue 1998)

Final approval was required for the project to progress, however, the Mayor gave budget allocation preference to a city library and the Water Repurification Project was not tabled for a final decision (P6:7). By January 1999, the local press pushed for the abandonment of the project in an editorial headlined "Flush it away: Toilet-to-tap project just won't wash" in which it argued:

> Not surprisingly, most San Diegans can't stomach the idea of sipping water that earlier was flushed down their toilets. In spite of the $400,000 [AUD 769,231] the city paid a public relations firm to sell the project, its reputation remains as unsavoury as ever. (Editorial 1999)

Tourist industry officials expressed fears that the concept would drive away visitors and the county Science Advisory Board questioned its safety stating that it is "impossible to guarantee the safety of using treated wastewater for potable use" and urged the Council to abandon the idea of "recycling sewage for human consumption" (Editorial 1999).

The issue came to a head when Councilman George Stevens called together fellow churchmen and members of the Catfish Club. The potable reuse project was seen as an attempt to use African-American and Latino people as guinea pigs, reminiscent of the Tuskegee incident in the 1920s and 1930s, when African-Americans were, without their knowledge, designated as the 'control group' to trial the effectiveness of penicillin (P6:8-10). Approximately 100 angry members of this minority group took to the streets of San Diego to strongly protest the plan to augment their drinking water with water sourced from sewage (P1:42). The fact that San Diego is a "multi-racial" city is cited as one of the reasons the project failed (P6:6), however the effect of this demographic characteristic was not explored in the survey research. The project was finally abandoned by the City Council in March 1999 and non potable beneficial reuse is now being promoted to serve industrial and commercial customers (Gagliardo 2001a:2-9).

Further illustration and comment

Although public outreach was undertaken, the timing, duration and quality of consultation suggests a program of information dissemination rather than an exchange of ideas and views. Consultation commenced after the decision was made to launch the overall capital improvements plan. Without exclusive focus on the water repurification project and considering the short six-month 'educational' period for this city of 2.8 million people, it is argued that insufficient time was allowed for proper public reflection on the proposed changes to the water supply system. Once the controversial nature of the project attracted media attention, public interest was stirred which invited political manoeuvring, especially in the targeted area that was predominated by a minority group. Public trust in water agencies is low and lower still for sewerage providers. By contrast, the scientific community enjoyed the highest trust in 1998, and their preference for alternatives was arguably more effective in shaping the public and political view.

The strategic nature of consultation that focused on education rather than collaboration exemplifies the theory of Habermas (1990) that distinguishes communicative action from action shaped by a narrow focus on desired outcomes. This quality of community interaction takes the form of a partnership fashioning the 'lifeworld' rather than 'the system' intruding into it. Such opportunities for trust building are manifest in Sztompka's (1999) model. Educational input to build awareness and knowledge in the community is encouraged, however, to be effective, this should be balanced by transparency of the social organisation. The problem of ageing infrastructure to meet increasing demands should be one that can be freely shared with the community to arrive at a solution that will ultimately be financed by community taxpayers. Instead, the problem is debated through the media under toilet to tap headlines, and at one stage an attempt is made to disarm the potency of this label (Leovy 1997).

Normative coherence is also relevant, so that 'unplanned potable reuse' evident in the Colorado water source becomes everyday knowledge rather than a secret that is 'gingerly' disclosed to the community. A water engineer observes:

> The general population think the water comes from mountain streams and is piped directly to us. They don't understand that sewage from other cities is treated and put back into the river. (P3:18)

Therefore, the need for transparency of this taken for granted system of water provision and sewage management is obvious. However, it poses a dilemma. During an industry symposium, a project manager explains:

> If we tell them the quality of water we currently have, there's the risk of scaring them. We will be seen to be doing that so they buy this [potable reuse]. (P7)

At the same time, a frustrated treatment plant engineer derides public ignorance:

> They don't think of what goes on behind the scenes. They think a sewage fairy takes water away. … They have no idea what goes on here. … A mysterious black box to them. They don't even notice as they drive past. (P8:43)

At a more recent conference in San Diego (2001) it was reported that the water industry has begun working with the school education system to introduce the next generation to concepts such as the water cycle, unplanned water reuse and the technological capability of converting sewage into drinking water.

As Giddens (1991) argues, in the general population, expert systems such as household water supply are imbued with basic trust which promotes ontological security. For today's rapidly changing world characterised by increasing risk and concerns of existential security, basic trust is a highly valued form of social capital. Sztompka (1996) advises that trust is a precondition for the "readiness to embrace new technologies" (p.15). However, operationalising accountability by informing constituents that their drinking water is partly sourced from sewage opens a Pandora's box, creating the conditions for what Giddens (1991) terms 'fateful moments'. Life as we know it is radically changed and demands action: either withdrawal from the system or educational as well as regulative support to renegotiate. Active trust (Giddens 1994b) describes the volatile nature of trust that is actively developed and can be withdrawn at any time. These concepts will be considered in light of the remaining studies.

San Gabriel Valley Groundwater Recharge Project

The Upper San Gabriel Valley Municipal Water District put forward this proposal in 1993 following a five year drought. Tertiary treated reclaimed water would be used to recharge the Main San Gabriel Basin aquifer, northeast of Los Angeles (Hartling 2001:45). The scheme met with opposition weeks before the environmental impact hearing when a citizens group published full page newspaper advertising features labelling the project "toilet to tap", in which citizens were warned it would cause "death, destruction and dementia across the valley" (Hartling 2001:45). Following this, the local Miller Brewing Company feared the groundwater recharge project might "taint its nearby wells" and therefore its reputation for fine beer and took action to stop the project (Leovy 1997:6).

A member of the Fund for the Environment wrote to *The Los Angeles Times* in 1994 to uphold the benefits of non potable reuse and applaud the decision by Miller Brewing to "err on the side of caution". The writer expresses concern for "new and more virulent, cure-resistant forms of viruses and bacteria" that may be introduced into the potable water supply (Harris 1994). The project was stalled for several years, scaled down, relocated away from the brewery's wells, and has not progressed from the planning and design stage (Hartling 2001:45).

Dublin San Ramon Services District (DSRSD): The Clean Water Revival Project

Located in the eastern San Francisco Bay region, the DSRSD plans to inject microfiltered and RO treated reclaimed water into highly saline groundwater to increase water supplies and reduce salt levels (Hartling 2001:45). However, a DSRSD proponent of the project explains that the main driver for the project is that the city of Dublin needs to match its projected growth with an increase in sewer treatment capacity and groundwater recharge is seen as an alternative to discharging effluent into the San Francisco Bay (P9:11). The plan is to provide irrigation water as well as the RO treated effluent (P9:12). Hartling (2001) reports that in September 1998 a local newspaper published 'toilet to tap' headlines as outraged citizens "marched on city councils and the groundwater basin manager's boardroom" to demand an end to the project.

Three cities are affected by this project: Livermore, Pleasanton and Dublin as well as a Flood Control District called Zone 7. Unlike Dublin that has a small population, Livermore and Pleasanton reached a point in the 1980s of desiring a policy of 'no or slow growth' (P9:5). It is argued by the informant that this purported value masks underlying racist sentiments: residents wished to avoid further development because "they did not want blacks moving into available new housing" from the Oakland, San Francisco Bay area (P9:8). And because "Dublin's General Plan would encourage 40,000 to 50,000 new people into the area" the other cities believe they will lose retail sales competition to Dublin's planned modern shopping centres (P9:7).

Two surveys revealed that while there was 85% acceptance in Dublin for the indirect potable reuse scheme (P9:14), 72% in Pleasanton and Livermore opposed the idea (Moy 2002). This followed an "extensive education program telling people about recycled and RO drinking water" (P9:14). Pleasanton and Livermore were given a choice: either expansion of the wastewater pipeline to the Bay "or RO" (P9:16). Both Pleasanton and Zone 7 took legal action against the project claiming they were concerned over possible health problems (Moy 2002). In May 2002, a San Francisco Superior Court judge ruled in their favour, finding that procedural justice was at issue and that the Regional Water Quality Control Board should hold a public hearing to allow public participation before putting the approval to another Board vote (Moy 2002). In the meantime, non potable water is being used for landscape irrigation with the RO component run one day per month to keep it in good working order (P9:18).

East Valley Water Reclamation Project

Promoted by the City of Los Angeles Department of Water and Power during the 1987-92 drought, this project involves groundwater replenishment in the San Fernando Valley, northwest of Los Angeles to decrease the city's dependence on imported water. Tertiary treated recycled water would be pumped to spreading grounds and the water would be monitored as it travelled through the groundwater basin to domestic production wells (WateReuse Association 1999:5). The first phase involves a capital cost of $100 million with 75% provided through state and federal funding.

Hartling (2001) reports that "days before" the reclaimed water was due to be pumped to the spreading grounds, 'toilet to tap' headlines of a small, local newspaper caught the attention of the public. The CNN website picks up the story: "Los Angeles officials want to turn wastewater into drinking water" (April 2000). The article explains that the $105.8 million "toilet to tap project" would recycle wastewater by passing it through a purification system before percolation to groundwater basins. It goes on to announce:

> The water would then mingle with normal groundwater before being pumped out the taps in the North Hollywood area, Studio City, Van Nuys, Sherman Oaks and Pacoima. … Experts say the water will be absolutely safe to drink. In fact, people have been drinking such water in other parts of the state, and similar water reclamation programs are also under way in Virginia, Texas and Florida.

No mention is made of the Whittier Narrows system, providing confirmation that the general public and the media are unaware of its existence in the city.

The CNN article states that a spokesperson for the Valley Villagers Homeowners Association had been interviewed by the *Daily News* saying: "This is human waste … I'm very uneasy about that." To assurances of safety of the water, she told the paper:

> They also said that about Love Canal. And they have said all these lovely things about Agent Orange. I don't like to think about this.

Another (male) resident reflects:

> I mean, I keep a pretty clean toilet, but you know, still, it's pretty disgusting.

The debate continued in *The Los Angeles Times* heightened by a political discourse:

> Sewer water reclamation plan comes under fire: Environment: Councilman Wachs says DWP failed to adequately inform residents that final product would enter drinking supplies. (Kondo 6 June, 2000a:1)
>
> Critics condemn DWP plan to turn sewage into drinking water. (Kondo 9 June, 2000b:1)

In response, a representative from the industry wrote to the editor to decry the irresponsible use of the term 'toilet to tap' and to remind Councilman Wachs that

his council approved the reclamation project and was in receipt of $71.2m federal and state grants to fund the system (Oliphant 2000:20).

Under the headline "Toilet to tap" *The San Diego Union-Tribune* specified that the wastewater would be pumped out of the aquifer as part of the first phase of the project to serve some "20,000 residents" and:

> If the system works and tests clean, it would be expanded to 11.4 billion gallons a year to serve 70,000 homes throughout Los Angeles. (Morgan 2000:3)

This 'demonstration' phase was arguably of no comfort to the residents concerned. Ellen Harris, the same representative of the Fund for the Environment who spoke out against the San Gabriel Valley Groundwater Recharge Project in 1994,[6] is quoted as saying:

> We now have microbes that are becoming resistant to treatment. … we could be introducing material into our water supplies that's not natural. (Morgan 2000:3)

Public consultation took the form of newspaper articles, public notifications and hearings (Hartling 2001:45). However, as already noted above, the 2000 LA survey found that although 65% of respondents agreed to the policy of potable reuse, only 38% were receptive to the idea of drinking the water. The intensity and extent of consultation remains in question when it is reported that the system is nearly built and water department officials have now "initiated a series of community meetings to gather public input" (Morgan 2000:3).

Denver, Colorado

Denver Water Department's Potable Water Reuse Demonstration Project was in operation for a decade commencing in the 1980s. The US$1 billion plant used an RO system to produce 2.8 ML/day (Gordon 2001). Eden (2001) advises that the Denver pilot project was implemented because of predictions of shortages based on estimates of population growth compared to levels of water sources from the Rocky Mountains. The eventual demolition of the plant is explained through contradictory

[6] Also a former member of the board of directors of the Los Angeles Regional Water Quality Control Board and the Metropolitan Water District of Southern California.

reports of the community's response to potable reuse and an economic rationalist approach.

Denver Water states that the outcome of focus group research conducted in the early 1990s was that people did not want to think too much about where there water comes from: "They wanted us to just get on with it" (Leovy 1997:p1). An industry informant reports that residents were not prepared to accept the potable reuse option unless all other sources of fresh water had been exhausted. In what he terms "avoidance action" community water consumption has reduced by as much as 25% and people have requested to be metered, consumers preferring to watch every drop rather than drink water sourced from treated sewage (P5). However, a spokesperson for Denver Water advises that potable reuse was abandoned because it was not economically viable: "It was very costly to produce drinking quality water from wastewater" (P10).

From early surveys, responses to approving "reclaimed wastewater for drinking" in 1973 resulted in 49% favouring the idea and 48% opposed. Ten years later, during the pilot project, 63% were opposed and only 32% gave approval (Bruvold 1985:74). Another two years later, the same researchers found that support had dropped to 29% (Bruvold 1988:46). Increased publicity given to the proposal may have fostered wider and deeper public consideration of the proposal. As well as the sewage source of the water, the cost of the investment may have been unpopular with service fee-paying Denver Water customers. Additionally, the public clearly indicated in these surveys that non potable reuse was preferred. However, as Denver Water's website advises, non potable reuse is only now being introduced (January 2001) to industrial and commercial users, some twenty years after water reuse was first considered.

Tampa Water Resource Recovery Project

The depletion of groundwater resources in tropical Florida and the projected increases in water use lead to the investigation of indirect potable reuse in the Tampa area during the early 1980s. A pilot plant examined the health effects of tertiary treated effluent and six internationally recognised water quality and health experts found that the effluent was as good or better than other sources of raw water

(Hammond 1996:7). By 1996 the Tampa Water Resource Recovery Project was proposed to provide a new source of water for the region as part of the overall plan to diversify water resources, including desalination, conservation and non potable reuse (Hammond 1996:2). The effluent would be blended with canal water and treated before distribution.

Proponents included the City of Tampa (Tampa Bay Water)[7], the West Coast Regional Water Supply Authority and Southwest Florida Water Management District who considered the project to be similar to that operating at the Upper Occoquan Sewage Authority plant in Virginia (Hammond 1996:6; Katz et al 1998:12). The focus of public outreach was to "develop the purification option as completely as possible, rather than compare it to alternative sources" (Katz et al 1998:12).

Interviews conducted with "external stakeholders" indicated that negative perceptions of the co-sponsoring agencies needed to be addressed and improved; the perceived risk, safety and cost of "purified" (reclaimed) water would be a concern; and that seawater desalination was popular although there were reservations about its cost, energy consumption and environmental impacts (Katz et al 1998:13). Katz and Associates, who also conducted research for the San Diego project, found that the term "purified" water was preferred to the "repurified" label identified by San Diego research participants because:

> They felt that "repurified" sounded as if the water had already been used and "purified" sounded more pristine. (Katz et al 1998:15)

This rationale succinctly illustrates the limitations of the marketing approach that masks the basic facts of the sewage effluent source of the water. Ultimately, the "purified" concept will be unpacked to reveal that, indeed, the water had in fact been used before and the source is far from being pristine.

While the aim was to promote indirect potable reuse as a stand-alone source of water, alternatives were acknowledged in the communication program with the idea

[7] Tampa Bay Water was created in 1998 comprising county governments members - Hillsborough, Pasco and Pinellas and the cities of Tampa, St Petersburg and New Port Richey in partnership with Southwest Florida Water management District.

that "purified water" would be accepted in addition to other sources (Katz et al 1998:16). Hammond (1996) reports results of a 1995 survey where 51% of respondents found the idea of indirect potable reuse appealing and 62% believed it was safe. Results of the 1996 study reviewed in detail in the previous chapter confirm that 46% support the plan to build a repurified water system, and 42% indicate they would use the water for drinking and are willing to pay more for this water source. However, a much higher proportion, 75%, support desalination with 77% believing it is a safe source of water.

Eventually, Tampa Bay Water decided to channel their resources into desalination in preference to indirect potable reuse. A spokesperson for the organization states that the Board was reluctant to pursue potable reuse because of the public's preference for desalination and also concerns about risks created through by-products (P11). Proponents of the potable reuse option lament that the proposal lacked a champion and others report that key decision-makers were against it (P12-P14). Another informant states that elected officials put it to a 'referendum' when they should have made the decision themselves (P15).[8]

Noosa, Queensland

In 1993, Noosa Shire Council decided to upgrade their sewage treatment plant to biological nutrient removal technology and that a strategy was required to address environmental effects of the disposal of effluent (Playford 1996:381). Public consultation from June 1993 included a stakeholder group drawn from thirty recognised community groups regarded as the opinion leaders of the community (Uhlmann 1996:382). In August 1993, engineering consultants developed several options with the group, including water reuse for irrigation of private lawns and gardens, and three were selected by Council: water reuse for irrigation of pastures, recharge of Lake Macdonald water supply dam and continuing to discharge to Burgess Creek (Chapple 1996:383).

Recharging Lake Macdonald was compromised because the UV disinfected or ozonated tertiary effluent would double the annual load of phosphorus entering the

[8]Possibly referring to the 1996 Tampa (Decision/Katz) survey.

Lake which was already subject to algal blooms (Chapple 1996:384; Simpson 1998:70). After reviewing the results of preliminary investigations, a fourth option – direct potable reuse of the effluent – was accepted by Council and the stakeholder group (Chapple 1996:384). Tertiary treatment would be followed by either RO or an ultra filtration process before being introduced into the water supply system or local water reservoir.

Public consultation took the form of a council newsletter/questionnaire and two public meetings. A total of 1,632 questionnaires were returned (response rate of 10%) and approximately 260 people attended either of the two public meetings (Uhlmann 1996:385-386). Based on survey respondents' ranking, 38% voted for direct potable reuse, 32% for continuing to discharge to Burgess Creek, 22% for pasture irrigation and 7% for the indirect potable reuse option (Uhlmann 1996:386).

A significant outcome of the newsletter, however, was that it caused alarm to residents who were not involved in the community consultation process and were therefore not aware of the Council's plans for direct potable reuse; "something of a 'hue and cry' developed in the media" (Uhlmann 1996:385). Finally in December 1994, a revised recommendation for tertiary treated effluent to be pumped to existing rapid infiltration basins was accepted and direct potable reuse was abandoned (Playford 1996:388). The outreach team concluded that the social change required for acceptance of potable reuse required more time for an effective educational program to reach all of the community, including Council members (for example, Simpson 1996:387).

Orange County: Groundwater Replenishment System (GRS)

The GRS, jointly proposed by the Orange County Sanitation District (OCSD) and the Orange County Water District (OCWD) will replace the existing Water Factory 21 system, delay pipe expansion and a new ocean outfall for peak wet weather periods, augment peak flow water demands and relieve the uncertainty of imported sources of water (OCWD 2001a). Groundwater provides 75% of North and Central Orange County water needs. An alternative solution, to expand the non potable Greenacres Project introduced in 1991, is considered to be too expensive (P16:51).

The GRS was authorised by the joint board in March 2001, at an estimated capital cost of $677m and annual operation and maintenance charges approximately $42.3m for the first phase of a $1.2b project that will produce up to 473.1 ML/d of "near-distilled" water (OCWD 2001b, OCWD 2001c:3-5). Funding is by way of grants, low interest loans, and low interest bonds for the remainder. The estimated average cost of the product water will be $807.7 per acre-foot (OCWD 2001c:5) compared to $288.5/af for groundwater and between $385-$962/af for imported sources (Carlton 2002).

The description of the end process is that the water will be "percolated through the ground into Orange County's aquifers" at the spreading facilities at Anaheim to blend with groundwater (OCWD 2001c.3). In addition, following the practice of Water Factory 21, a portion (approximately half) of the water will be injected into the underground basin to assist in maintaining the freshwater barrier against seawater intrusion and will ultimately supplement the drinking water (OCWD 2001c:2; P16:26). It is estimated that this water takes a year to travel to the nearest well, whereas the water applied to the spreading basins will take six months; currently Water Factory 21 injected water comprises 5% of the drinking water supply (P16:64-66).

The GRS is reportedly spending $1.9m a year on a public relations effort which is seen as an insurance against the system not going on line (Williams 2001). The PR team describe their outreach as a 'top down' process. One member states: "I don't think the electorate know we are doing the project" (P16:24). Staff persuaded a reluctant Board to "go public" with the project and since then they have held personal meetings with community leaders and groups to explain the system: "educating" 23 city councils, state and federal officials along with Rotary, Kwinanas, Chambers of Commerce and other groups. The promotional material explains the treatment process for the GRS in detail (GRS undated:a-c; 2000). The team reports that it has "educated 10,000 people" to date, there is "no organised opposition" at this point and now their task is to "get awareness down lower into the community" (P16:45). The cost for the project will be introduced slowly: "For now, we say the cost is equivalent to adding two postage stamps to the water bill – a very small amount for a reliable and competitive source of water" (P16:26).

Once it is explained, it is claimed that "99.9% of people are OK that the science is good" (P16:43). Information has been channelled through libraries, posted in newspapers, and mailed to 80,000 households. The team reflects:

> People don't care until there's a problem. When we had the EIS open hearing, people didn't show up. (P16:54)

Four workshops were held throughout the county and "only 100 people in total turned up" (P16:58). They thought this response was abysmal. The team is confident that Orange County residents will accept the system because it is "a pro-business community". (P16:59). Additionally, they believe another advantage is that unlike the San Diego project which involved only one city, their outreach spans 23 cities, indicating that political interests are less concentrated (P16:31-32). By 2003: "it is hoped that the public will be behind it" so that the system will go 'on line' in 2005 (P16:55).

Results of the two telephone surveys conducted by Lawrence Research (1997, 2000) have been analysed (see Chapter Four for detail). Between the first survey and the latest results, there has been little or no change in public opinion on the main questions. In each case, 500 Orange County residents were randomly selected and the sample was split for the short and long descriptions of the GRS. The two versions are set out below:

> Short version:
>
> Treated waste water that is now discharged into the ocean will receive additional treatment to remove impurities and will then be pumped to basins where it will be allowed to settle into our underground water reservoirs.
>
> Long version:
>
> At the present time, our sewage and waste water flow to a sewage treatment plant where it is treated and then discharged into the ocean. Under this proposed project instead of discharging this water into the ocean, it will be further treated through a sophisticated, advanced water treatment process that will include microfiltration, reverse osmosis and disinfection. The first stage uses a series of microscopically fine filters to remove impurities. The water is further cleansed by reverse osmosis, which is the same process used by bottled water companies. Then the water is disinfected. After these treatments, the water will be pumped into basins where it

> will be allowed to settle into our underground water reservoirs, a natural filtration process similar to the rainwater cycle.

It is noted that neither description mentions the direct injection of water at Fountain Valley in Orange County, the focus is on the natural filtration of water to underground aquifers or storage basins which will occur at the spreading grounds. To the first description in 1997, 51% agreement is indicated and 65% agree to the second description. In 2000, the same level of agreement is given for the short description (51%) with 67% supporting the second description. Therefore, the longer description appears to encourage more support in the treatment process.

Respondents were not asked directly if they would use the water for drinking. In the 1997 survey, the closest question to assessing acceptance is:

> I just have a hard time with reclaimed water because it really does go from toilet to tap.

A total of 37% disagreed, giving some indication that they accepted this source of tap water. A similar question was asked in 2000 and resulted in 39% disagreeing. Another question received higher support for the system water with 47% agreement. Overall, the difference between policy support and consideration of actually using the water for drinking is a sharp decline in support between 20-28%, similar to other survey findings in California.

Of central interest are the responses on whether participants trust certain agencies. Respondents were asked if they favour four agencies, including OCWD and OCSD. A total of 19% in 1997 and 23% in 2000 indicate they "strongly favour" the OCWD. A lower proportion strongly favour the OCSD: 13% in 1997 and 19% in 2000 suggesting a slight increase in this measure of trust in the proponents of the indirect potable reuse system. Trust in these agencies correlates with support for the GRS, as shown through an analysis of the 1997 data in the previous chapter. In 2000, a revised level of trust is evident whereby only 13% of respondents trust the agency to go ahead with the project instead of informing constituents while 83% want information sent to every householder.

Around a quarter of the reasons given for support in 1997 and in 2000 are based on trust or belief in the technology. The majority of reasons are anchored in beliefs that there is a water supply problem or that the environment will be improved. This represents a weak foundation when alternatives are considered to solve these problems. For example, desalination and non potable reuse to supplement water supply and non potable reuse to effect zero discharges, similar to many examples in Florida. Conversely, the reasons for opposing indirect potable reuse convey distrust in the technology and the source of the water: 70% of reasons for opposing in 1997 and 90% in 2000. During the three years, there has been a 54% rise in concern about the sewage source.

People in the Southern part of the County will not be affected by the GRS because they are supplied by surface waters and it is significant that their response is the most positive of the three areas. As time moves on towards the commencement of operations of the GRS, it is anticipated that the issues surrounding indirect potable reuse will gain more salience as awareness grows in the receiving population, which may result in stronger opposition. In 1997, 75% of respondents had not heard of the GRS, and this improved to 58% in 2000. Of those who were aware in 1997, a preliminary question on support attracted agreement from 51% of those with prior awareness, and in 2000 this fell to 46%.

Media attention was given to the project in a recent press release in *The Los Angeles Times* on 22nd January 2002:

> Water reclamation project to filter drugs, pathogens; Infrastructure: Under Orange County's $600 million [AUD1.2b] plan, extra levels of treatment will remove unmetabolized pills and potions flushed down toilets

A spokesperson for OCWD was quoted saying:

> Our ground water replenishment system will include microfiltration, reverse osmosis and [ultraviolet] disinfection, and that should handle any pharmaceutical compounds … We're very confident that these [technologies] can take the pharmaceuticals out. (Mehta 2002b)

However, this reassurance was potentially threatened only eight days later when the same paper announced that dioxane, one of the new drinking water "contaminants of concern" listed by the EPA had been detected in Orange County wells:

> Orange County; 9 OC wells closed; Environment: Water District says it mistakenly added a possible carcinogen to drinking supply. Levels were far below the point at which the state closes facilities. (Mehta 2002a)

OCWD stated that the chemical possibly originated from its highly treated sewage water from Water Factory 21 injected into the underground aquifer. Previously, in 2000, a possible carcinogen had been discovered in two wells which resulted in the water district building an ultraviolet light/hydrogen peroxide treatment facility. The same treatment but with a higher concentration of peroxide would be used to treat the dioxane "and possibly other, yet undiscovered contaminants" (Mehta 2002a). A state health official is quoted, saying:

> Recycling programs such as this – we'll look more closely into those.
>
> (Mehta 2002a)

The publicity continued (for example, "Cities seek restitution for tainted well water" Mehta 2002c) until 7th March in *The Los Angeles Times*. Finally, the issue faded after it was reported that there was no health threat, and some of the cities had reopened wells while five remained closed. However, it was stated that $19.2m would be spent over two years to build facilities to clean the water once it has been extracted from the ground (Mehta 2002d).

A flow-on effect from this publicity subsequently surfaced on 2nd May in relation to the Dublin San Ramon Services District project. The Zone 7 general manager was sceptical about the groundwater injection plan as "new research shows trace carcinogens have been found in Orange County's reverse-osmosis-treated water" (Moy 2002). More recently, in "From the toilet to the tap" headed publicity, *The Wall street Journal* explores the arguments for and against potable reuse projects such as the GRS and draws attention to trace amounts of the chemical dioxane in water "the agency had already run through reverse osmosis" (Carlton 2002). It also announces that the GRS is due to be operational in 2006, not 2005 as previously planned.

Further illustration and comment

The San Diego case found that minority African American residents felt threatened by the proposed change to their drinking water. Ethnicity was not explored in the two surveys undertaken and the [African American] Catfish Club was possibly not among the civic associations targeted for educational presentations. A racial effect of a different kind surfaces in the Dublin San Ramon study. Here, it appears that two of the three communities are against growth in development that might attract African American residents. Regardless of the reasons, these cases again highlight the importance of consulting with the communities involved. Otway and Winterfeldt (1982) caution that despite the fact that a risk may be essential zero, there are other social factors involved in opposing technologies, such as avoiding a dependence on technical elites and anti-growth values, both of which are relevant in these cases. Of significance also is trust – trust in the proposal, the technology, the proponents, or providers.

Poor attendance at public meetings is not necessarily a reflection of disinterest but more a lack of trust in the consultation process. The Decide Advise Defend (DAD) nature of the industry's public outreach is common to each of these case studies. Community education was only attempted after the decision had been made, and in several cases, while the technology was being built (San Diego, Dublin San Ramon, East Valley, Denver, Orange County). An engineer reflects on the number of abandoned potable reuse projects:

> They did not give people the long history. Engineers decided themselves it was cheaper than other ways and announced: 'This is what we are going to do.' (P17:16)

Certainly, most communities have been deprived of the long history of non potable reuse which Bruvold (1985) recommended to help build awareness and familiarity with water recycling. In California, residential reuse, involving private garden irrigation, is only now being trialled by Irvine Ranch Water District. Toilet flushing with recycled water is not a widespread practice but has been introduced in high rise buildings in Irvine and is in the planning stage at Oakland, near San Francisco. Non potable reuse was not seriously considered as an alternative in any of these studies until potable reuse was rejected.

In relation to the Orange County case study, strategic action again characterises the outreach to date. An OCWD manager's reflection on project management helps explain this approach: the goal for project engineers is to "get the job done, on time and under budget" (P16:60). Apart from the DAD approach, (a) the top-down public outreach provides a false sense of achievement, avoiding the more difficult and time consuming task of working with minority and lower-socio economic groups, (b) survey descriptions of the system do not include direct injection, and (c) other options are not included in surveys. These issues add to the opaque quality of the social organisation, thus inhibiting informed judgments. Instead of institutional transparency, acceptance is being shaped by artificial trust-building marketing concepts that focus on nature (natural filtration) rather than full facts, creating the risk of jeopardising the project. Tampa and Noosa are the only cases where alternative options were included in the public consultation program. In both cases, the desired outcome for proponents was not achieved, but the process was arguably more successful in that alternatives were considered by some of the public.

Inevitably, politicisation of the issue cements both sides of the debate, however, it is suggested that this development would not occur if proponents and the community were more of one mind on the matter. The greater the disagreement between experts on an issue, the more the border of science is pushed towards the political arena (for example, Douglas 1982:65). For potable reuse, there is a sense that, even for experts, there is the risk of the unknown involved. The Committee et al (1998) recommend that potable reuse be "an option of last resort" (p.9). Okun, a well known advocate of non potable reuse and Emeritus Professor of Environmental Engineering at the University of North Carolina, Chapel Hill, cites the principle applied by the US Public Health Drinking Water Standards in 1962, adopted by the US EPA in 1976 for Drinking Water Regulations:

> … priority should be given to the selection of the purest source. Polluted sources should not be used unless other sources are economically unavailable.
>
> (Okun 1998:7)

Later, Okun's claim against potable reuse is further strengthened by the public's reflexive response to the quality of drinking water, he asserts:

> It is not now an acceptable practice nor is it likely, with the growing concern for drinking water quality. (Greene 2000)

Takashi Asano, winner of the 2001 Stockholm Water Award and Adjunct Professor, University of California, Davis, Department of Civil and Environmental Engineering, recently announced at an international conference under the heading "Not clear enough!" that pesticides and pharmaceutical products are difficult to treat (reflecting a growing literature, for example Lim, Gale et al 2000 on endocrine disrupters) and contribute to public distrust of recycled water. Therefore, groundwater recharge could not be proposed with the same level of confidence that can be invested in non potable uses (The Editor 2002:5).

Conclusion

This collection of case studies provides substantive data that demonstrate the risks involved in maintaining barriers to open communication with an increasingly informed and wary public. All the established potable reuse systems claim to be safe, however, there is a measured hesitancy in sharing the details of these sites in mainstream public notices, such as specific websites, survey and promotional literature. At the same time, proponents criticise the public for being unaware of unplanned potable reuse, yet recycled water managers admit their belief that freely divulging this information may scare the public and water managers fear they would be inundated with customer water quality complaints.

The lack of communication on details of the existence of unplanned and planned potable reuse is compounded by the strategic, marketing approach to public consultation in the case of proposed indirect potable reuse systems. Except in the case of Tampa and Noosa, wide dissemination of the proposals and all other options to overcome the industry's perceived water supply problems was not undertaken. Although San Diego and Noosa potable reuse proponents established a group to represent prominent community organizations, the involvement and opinion of the select panel did not represent or offset the concerns of the general public. Survey data reveals that between 41% and 80% of respondents in the USA sites and 73% to 87% in Australia are not willing to drink water sourced from sewage. At the same time, levels of public trust in water and waste water authorities are low.

The drivers for proposing potable reuse all point to economic efficiencies. No extra capital or operational costs are involved in the Whittier Narrows application than would be required to treat sewage to the secondary treatment level for surface water discharge. Although the capital cost involved in developing more recent examples or proposals is high, this is offset by state grants promoting water reclamation, making the final cost more attractive for the local water agency. In addition, cost efficiencies affect both wastewater and water supply operations, saving on infrastructure and operational costs for effluent disposal as well as the cost of raw water imports or the capture of water. The perception of some in the industry is that the infrastructure for distributing non potable water is too expensive. Accordingly, non potable reuse has not been fully developed in any of the sites reviewed, including Orange County where the GRS is proposed.

In relation to the environment, on the one hand, environmental concerns influence acceptance of potable reuse. Choices given to constituents such as the framing of the Groundwater Replenishment System in Orange County surveys and literature, and the ultimatum given to Pleasanton and Livermore in the Dublin San Ramon project, suggest that potable reuse is the only way to curb discharge of treated effluent. On the other hand, recognition of the unknown ecological side effect of the reuse of water sourced from effluent not only shapes community concern (for example, San Gabriel Valley, East Valley, Orange County), but is driving both new research and uncertainty in the industry. A more widely observed response however, is the concern for public health risk. As the previous chapter shows, the majority of populations do not accept the product water for drinking and the main reasons for this stance reflect underlying health concerns.

It is argued that health risk concerns in relation to ingesting water sourced from sewage directly reflect a lack of trust in this application of science and technology, the ongoing operation and maintenance of the highly technological system, the motives of the proponents, and an overall lack of trust in water and sewerage providers. Grounds for this conclusion are found in these data and the secondary data for previous surveys. Opportunities for water and sewerage agencies to build trust in the community have not been developed possibly because the need to do so has not arisen. Therefore there is weak structural support for water reuse, mainly

due to the lack of transparency, familiarity and accountability. Two-way communications and partnerships are not realised and result in a lack of knowledge in the community in relation to unplanned and planned potable reuse, the changing nature of risk involved in the use of effluent, and the range of alternatives for achieving solutions to water supply and sewerage problems.

This experience illustrates the futility of strategic action in the case of implementing potable reuse and confirms the relevance of the theory put forward by Habermas (1990) in the concept of communicative action. Without community partnerships where people are free to explore full information, both technological, environmental and social, the validity of claims for or against certain beneficial proposals is in question. To turn around the level of trust in providers, a change in the objectives and goals of project management will be required. The characteristics of structural opportunities for the 'social becoming of trust' outlined by Sztompka (1999) help guide and encourage community partnerships. The basic trust already invested by the public in water and sewerage provision, can be built upon by encouraging collaboration between industry and 'consumers' to meet service challenges posed by environmental and structural constraints. In this way, accountability for sustainable solutions can become a community based process, fostering active trust in innovative technologies. These findings, the emergent theoretical framework, and implications for the industry will be considered further in Chapter Nine.

CHAPTER SIX

Foundational context for residential reuse

Introduction

There is a growing interest in developing the potential for residential water reuse in Australia. Water consumption for garden irrigation accounts for roughly half the annual household water use on a typical suburban block and reduction of this level automatically boosts the overall available supply. Therefore, household garden irrigation is the first target of urban water restrictions in times of drought. Replacing this supply of drinking water with an inferior quality of water while at the same time reducing effluent discharges to surface waters is an initiative that is now well established in Florida. There is no prior published research on the experience of residential reuse and this chapter presents the findings of primary data collection at four sites, two in Adelaide and two in Florida.

An embedded case study, grounded theory approach to this qualitative research sought to determine the social factors involved in sustainable use of recycled water. Beck's (1992) risk society suggests growing public awareness of the ecological side-effects of modernity, such as water scarcity and pollution while, at the same time, drawing attention to the reflexive nature of technological solutions, with particular emphasis on invisible public health risks. Giddens (1991) highlights the importance of trust in risk society and particularly the function of basic trust in expert, technological systems such as household water supply. Central to the conceptual background to this study is the assertion that trust is a prerequisite to adoption of new technology (Sztompka 1996:15).

Therefore, while this analysis addresses both main research questions, emphasis is placed on the influence of environmental and public health risk concerns and the role of trust in securing or deterring the sustainable use of recycled water. The constant comparative method in the iterative grounded theory approach identified valid compatibility between the results of the first case study, New Haven, and Sztompka's (1999) framework for the social becoming of trust and Giddens's (1994b) concept of 'active trust'. The value of the framework was then confirmed

individually for the three subsequent case studies. Data was not forced to fit the theory but instead the theory complemented the logical ordering of the data that narrated the development of trust in water reuse.

This chapter considers contextual social influences on the experience of residential reuse that coincides with the historical and structural conditions of Sztompka's organising framework and introduces the characteristics of actors involved in managing the system and using the water. The summary background profile of social mood and collective capital at each site presages evidence presented in the following chapter of knowledge, attitude, behaviour, experience and trust in relation to water reuse. The extent to which people with non potable reuse experience are prepared to accept potable reuse completes the analysis in Chapter Eight. Relevance of the emergent theory will be clarified throughout the presentation of these data.

Presentation of the background data begins with a summary of the case study sites. The research participants are then introduced along with the social demographics so that participants' voices can illustrate the experience and build the background social mood of actors. Historical considerations and the salience of water issues at each site comprise the background context. Current structural conditions that support residential reuse complete the contextual data followed by the observed prevailing social mood and additional considerations that make up the collective capital for these developments.

Case study sites

At the commencement of research in March 2000, apart from the well established although self-described 'rudimentary' distribution system provided in Wagga, New South Wales, for residential garden irrigation, New Haven in Adelaide, South Australia, was the only community identified with a fully operational reclaimed water service delivered to each residential property for toilet flushing as well as garden irrigation. Research for this study therefore began at New Haven and a second study site, Mawson Lakes, was selected because it features another decentralised, dual pipe system but where the treatment plant is not yet built. The

expectations of residents who had chosen to live in this eco-residential development would be compared to the emerging theory from the New Haven study.

The sites in Florida, the city of Altamonte Springs and Melbourne, Brevard County, were chosen because residential reuse for household garden irrigation is an established way of life for many in this part of the USA. The dual system in St. Petersburg, Florida, similar to the two sites, has operated successfully for over twenty years, confirmed by data reported for an early evaluation study (City of St. Petersburg 1989). California also has a long history of reclaimed water, but not for residential use. Drivers for water reuse in South Australia and Florida are similar, being the conservation of potable water supplies and the protection of freshwater bodies from nutrient laden discharges of treated sewage. Although Florida has a tropical climate, its pronounced dry season compares to the dry climate of Adelaide and it is currently affected by a two to three year drought. The main difference between the sites is the fact that Florida residents use recycled water for garden irrigation only. A summary of the main features are set out in Table 6.1 below.

Table 6.1 Characteristics of the four study sites

Characteristic	New Haven	Mawson Lakes	Altamonte Springs	Brevard County
Established since:	1995	not yet on line	late 1980s	1994-5
Households connected	62 (completed)	approx .200 Jan. 2001, expanding to 3,500	5,477	2,700 and expanding
Organisation	decentralised, locally managed		centralised authority	
Scale	neighbourhood		metropolitan	
Tertiary treatment	activated sludge, sand filter, ultraviolet disinfection	activated sludge, BNR[1], stormwater aquifer storage & recovery	activated sludge BNR[1], chlorination	
Equipment costs in addition to irrigation.	WC connection, garden tap	WC connection, garden tap[2]	Special subsurface hose connection if required.	
Establishment costs	Nil	not yet on line	availability fee $6[3]/month	$240 connection fee
Charges	$264 pa ($13/m) equal to waived sewerage rates	not known will be metered	$14 [4] per month	$9.62 [4] per month

[1] Biological nutrient removal. [2] This cost ranges from approx. $700 to $1,200 at Mawson Lakes, depending on the number of toilets featured in the house design.
[3] Australian dollars (AU$1 = US$0.52.) [4] Plus the usual monthly sewerage charges

Research participants

The introduction to participants begins to construct the personal and collective capital of agents involved in using water reuse. The demographic characteristics of respondents in each case study introduce the 80 research participants. Twenty residents were interviewed at four sites. Fictitious names are used for the Adelaide participants where face-to-face in-depth, semi-structured interviews were conducted. Telephone interviews were held with the Florida respondents due to time constraints for field work. This section considers age; gender; whether households have children 12 years and under; socio-economic status operationalised through class of residential development and occupational level; and previous experience relevant to water conservation or acceptance of water recycling.

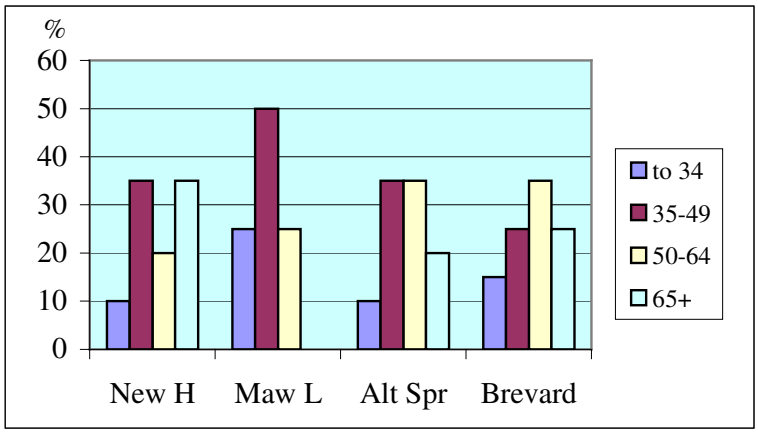

Figure 6.1 Age distribution at four sites

Figure 6.1 shows that participants at New Haven are older, Mawson Lakes has the youngest sample, age is more evenly represented in Melbourne, Brevard, and Altamonte Springs respondents are more middle-aged by comparison.

The literature and analysis of previous surveys (Chapter Four) indicates that men are more inclined to embrace new technology while women have greater interest in protecting the environment. The presence of at-risk persons such as children may also influence the level of trust placed in recycled water technology. Figure 6.2 depicts the proportion of males interviewed to females, as well as the proportion of female partners that shared the interviews at New Haven and Mawson Lakes, and households with children 12 years and under.

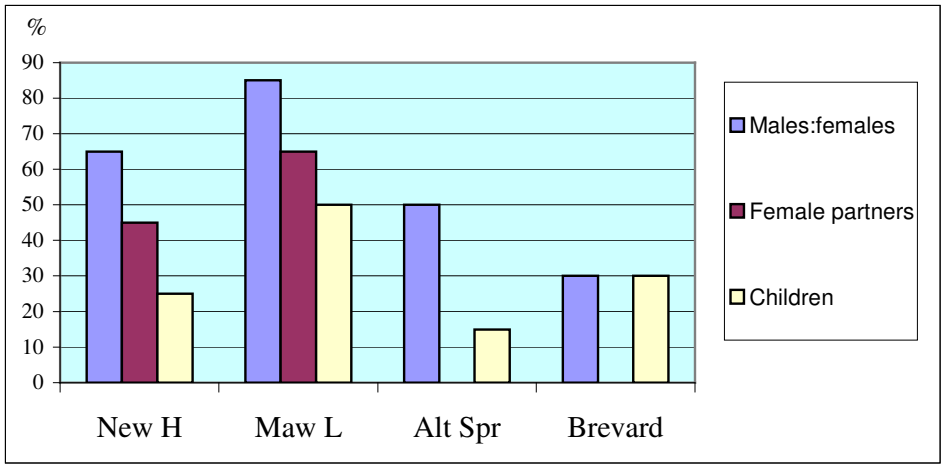

Figure 6.2 Gender distribution and proportion of households with children 12 years and under

Gender is evenly represented in the Altamonte Springs sample, only three respondents at Mawson Lakes are females interviewed alone, whereas seven women were interviewed at New Haven, and women are in the majority (14) in Brevard. In all cases where couples were interviewed in Adelaide, the male response was taken to give consistency when two differing opinions were presented. However, few differences were noted. Only one male dominated the responses in Mawson Lakes, and two in New Haven, but that is not to say that the women always contributed their views and they were encouraged to do so when the situation was appropriate. There are more households with children at Mawson Lakes which has the youngest group of respondents, followed by almost a third of households interviewed at Brevard.

There is social class variation between the four sites. New Haven is situated in a working class area and the South Australian Housing Trust was a key player in developing the predominantly small, economical housing, promoting sales to tenants. Five Trust houses are managed by a local welfare agency to provide rentals for the socially disadvantaged, one of whom is included in the sample. Additionally, three respondents are buying their home through a special Housing Trust joint purchase arrangement. In 1996, most house and land package prices ranged from $115,000 to $140,000. Mawson Lakes is a more up-market housing development with privately owned housing ranging from smaller houses by the railway to substantial double-storey dwellings with adjoining cottages situated by

the lakes. For this reason, the sample was stratified to include a cross section of this development where house prices range from around $150,000 to $300,000 plus. Both developments claim environmental features, but the overall architecture and prevalence of air conditioners does not represent eco-friendly housing. By contrast, developments viewed at Altamonte Springs and Brevard County are conventional, with standard sized gardens and more modest housing, comparative to the middle level range at Mawson Lakes.

A review of respondents' occupations takes previous occupations into account when these were made known by retirees or home managers. In this way, the sites may be compared because educational attainment was not canvassed in Florida. Professionals with a university degree at New Haven include a production engineer, instrumental engineer, a head teacher (males) and a female teacher. At Mawson Lakes, professionals are a systems analyst, an information technology training manager, a telecommunications engineer (males) and a nurse (female). Altamonte Springs respondents include two consulting engineers, an aerospace engineer, a finance manager and golf course consultant (all males), a musician and a nurse/scientist (females). In Brevard, professionals include an accountant, a public relations consultant (Masters in communication) and two teachers; all females.

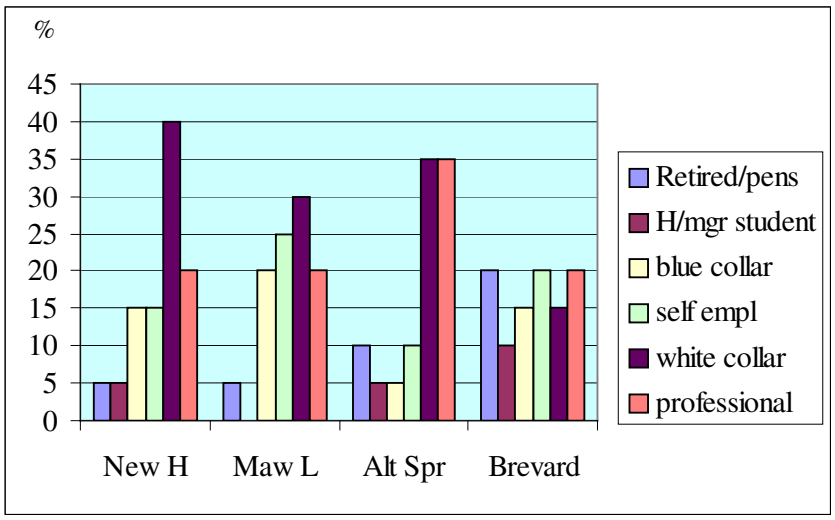

Figure 6.3 Occupational status

The distribution of people not in the work force, before previous occupations are considered, involve 40% who are retirees at New Haven, no retirees at Mawson

Lakes, 20% at Altamonte Springs and 40% retired and 30% home managers in Brevard County. From Figure 6.3 it can be seen that Altamonte Springs respondents indicate the highest socio-economic status based on the high proportion of professionals (35%) relative to the other sites. The remaining samples have the same proportion of professionals (20%) and a varying mix of white collar workers or self employed. The difference in housing suggests that Mawson Lakes has the next highest socio-economic status, but of a socially mobile, up and coming feel of this new community, followed equally by the more conservative context at New Haven and Brevard where more people are retirees.

Background experience that may influence trust in water reuse is noted. There are two sewage treatment operators, one at New Haven and another at Brevard County. Engineers are among participants at New Haven, Mawson Lakes and Altamonte Springs, and one Brevard respondent demonstrated his knowledge of water chemistry. Four homeowners' association presidents were interviewed at Brevard and three at Altamonte Springs together with four city staff members. Rural experience is represented by a retired farmer and farmer's daughter at New Haven and a previous farmer, current orchardist and two women from the land at Mawson Lakes. Previously drawing underground water for irrigation is more widespread in Florida, and this was not questioned in the more limited time available there; four people in each Adelaide case study have previously used a bore. At Brevard, one resident has been connected to recycled water at different locations for over 24 years, and a business woman says she has lived in places "where water is not running through the faucet" (B15). Finally, two older couples at New Haven and one at Mawson Lakes have war-time European backgrounds and three residents at Altamonte Springs and one at Brevard are of Hispanic origin.

Historical tradition

Historical factors of significance emerged during the interviews and were sought in the ethnographic research undertaken. These data suggest a background context of established trust or distrust in water and sewerage providers and governance of the residential reuse developments. In Sztompka's framework for trust as process, contextual background implies an inherited culture of trust.

New Haven Village and Mawson Lakes are located in the capital city of Adelaide, where the water authority was recently corporatised and the operations of the agency were outsourced to a part local, part foreign-owned company. The way in which this was brought about, where details were not made public and lower water rates were promised and were not later realised, resulted in a detectable sense of anger and distrust in the community. This feeling surfaced during the interviews at the Adelaide sites. The main complaints were that the water agencies, SA Water and United Water, were only interested in profit, and that now the services had been 'privatised', people were unfamiliar with the new structure and were confused about who to contact for service queries.

Eleven of the twenty residents interviewed at New Haven expressed their opinion in relation to the corporatised water utility. Responding to the level of trust he had in SA Water as a source of information on the environment and water, Tom, a 69 year old retiree and former retail business owner replies sarcastically:

> Yes I'll trust them all right! Like Mr Olsen said that water wouldn't go up. Yeh, that's right - I trusted them! (N1:231)

Like most Adelaide respondents, he thought that SA Water and United Water were the same organization and, even when their different roles were explained, his anger did not soften towards United Water:

> Yes, well they'd colour things to suit them. They wouldn't tell the absolute truth. If something happened and they pumped some sewage out in the street they'd deny it was their fault. They'd find an excuse. (N1:237)

A former SA Water employee, David, the sewage treatment plant operator, believes the corporatisation of government departments is flawed:

> They pay people $100,000 and $200,000 a year to head a department. Then they bring in and pay someone a million dollars as consultants. Now what are they getting paid $200,000 a year for? They shouldn't be there if they can't do the job. Why bring in consultants? That's why they're there. (N3:223)
>
> … United Water. Well, I don't know how they got the contract. The experience, well, I never had experience with United Water. I retired the day they signed the contract. (N3:226)

Confusion arising from the new structure behind the water supply in Adelaide was voiced by some, for example: "You just lose track" Warren explains, a 40 year old school teacher (N5:224); "You don't know who to contact when something goes wrong because things get sold off" comments Hilda, a former tailor of 73 years, originally from Holland (N14:254). However, opinions on the lack of trust in the corporatised structure were stronger. Warren explains: "There's just been too much we don't know, we haven't been told, or we get told too late" (N5:221). Megan, a 39 year old clerk states:

> I would have trusted them more five years ago than now. Yeh, not a lot of faith. (N15:440)

Sandy, a 56 year old retired farmer explains: "I just don't trust them; they made too many waves" (N6:148). A 40 year old mother, Belinda, working three jobs claims: "I don't think you'd take a real lot of notice of what they said … hard to pick the truth … they're talking through their pocket" (N9:196). Another mother, Mandy, a 28 year old medical secretary refects: "I wouldn't believe a lot of what they'd say" (N13:78). A self-funded retiree, 55 year old Ross, evaluates SA Water and United Water:

> In my books, they're in it for the profit aren't they, really. So I don't think they deliberately tell you an untruth but I think that they're very economic with the truth. (N17:172)

At Mawson Lakes the response is very similar from thirteen participants. Corporatised confusion is expressed by Vaughan, a sales representative: "I'm not sure who is supplying us with what anymore - as in electricity, gas, anything" (M3:109). Leigh, a 50 year old builder states:

> They have a different function but most people are confused as to exactly what - who is who and what's what. I deal with both and still don't quite know who's doing what. (M4:102)

A nurse, Carla, asks for an explanation of their roles:

> I've got confused now… so what does SA Water do? Do they look after the sewerage side of things and United Water supply the water? (M10:73)

Her husband, Hugh, a 53 year old disability pensioner and voluntary community advocate in this new housing development, tries to clarify the arrangement:

> They're the ones that actually the CEO operate, they're the board [SA Water]. That's how it is - but they're the ones that tell fibs; the other ones [United Water] have to fix it. That's how I see it. (M10:76)

Others find difficulty in accepting the new regime. A 40 year old systems analyst, Simon, suspects that higher prices for water will not benefit the water supply system:

> But if people are paying extra, where's that extra money going? Is it actually going back into the water resources area or just profits for some multi-national company? Its not really going back into water research generation. (M9:46)

Ivan, a 64 year old retired transport operator originally from Germany, also fails to see the advantage of the corporatisation:

> You see SA Water is with the government and all this baloney that they are doing. They're telling us how much money they make in a year from overseas investing in other countries. And then when you see they have a burst main, it takes them 24 hours to fix it. (M5:189)

Dennis, another transport operator of 47 years, is not impressed:

> Their costs have gone up really high haven't they. First of all we were given 136 kilolitres of water for free and then SA Water took over. They said costs won't go up and they have gone up, and they're going up all the time. So I don't think they're doing a good job at all. Pipes bursting … (M7:131)

His wife Kate, a community nurse, adds:

> It depends where they're getting their resources from too. Are they just doing it as an election plot to sweeten things up, or is it the truth? All that fiasco with that guy that was the head of SA Water - I mean, all that wasted money. (M7:133) … With the water, are they really putting the money into it or do they cut costs or what? The money they are getting from the consumer and all that, is it really going back to water? (M7:152)

Robert, a 32 year old information technology training manager thoughtfully weighs up the situation:

> They are the operations side; they are the ones that come out and move your water meter and charge you $400 for it. I agree with the concept of privatisation but … the point is that I don't think the water outsourcing was handled that well. I don't think it's worked that well. My perception is that, without having data to prove it, is that I'm paying a lot more for water now than I was. Whether that would be because of the [failure of the] government organisation anyway … therefore the government sells it off and someone else wears it. (M8:148, 157)

An orchardist, Vince, 30 years, is antagonistic about the change to the water utility. When asked how much he would trust information on the environment or water supplied by SA Water he replied:

> SA Water? I'd tell them to go back to their country - go back to England or France or where the hell they came from. I think we can manage on our own. (M20:176)

Did he object to privatisation in general? His reply:

> I'm just so against it. They basically sold an asset of the people - they sold it to a private company. OK that's to pay off some debt, but really, I think it wasn't actually government's to sell. (M20:180)

When it was explained that the assets were not sold but only the operational side of the utility had been outsourced, Vince said: "Well I still think its completely wrong" (M20:184) and referred to the case of California's recently privatised electric power system and the severe power disruptions experienced there.

In contrast to the South Australian historical context, the City of Altamonte Springs and Brevard County are served by long-established government run utilities. The supply of potable water is provided by a different city government department in Altamonte Springs and another county provides most of the water supply in Brevard. The price of water services is seen as a very sensitive political issue for these two sites and others visited in Florida and California. The general attitude towards government taxes and charges of any kind in the USA is that prices must be kept to a minimum, as one manager puts it: "to what people will pay". This differs from the 'user pays' principle applied recently in Australia. Funding for maintaining public utility services in Florida is usually available through government, low interest paying bonds and this convention is reflected in the rates charged to residential users of recycled water where the original monthly flat rate

has been maintained in Brevard, and with only two increases in the monthly rate at Altamonte Springs over the past twelve years.

A further historical factor for New Haven is that it was originally designed to be the pilot project for a high-tech, Multi Function Polis. The main financial developer withdrew and sales and construction were handed over to one of the developing partners, the State Housing Trust, and its ongoing management was left to the recently merged local council. General interest in this high-tech, environmentally friendly village quickly diminished. The sub-contractor, who operates and maintains the treatment plant, reports that budget constraints caused design modifications which are overtaxing the reclaimed water system and make it difficult to maintain optimum treatment efficiency. In addition, it was observed that the potable water meters are not remotely read as originally designed, and there is no on-site or off-site building supervisor to familiarise building contractors with the in-ground recycled water pipes to avoid damage and disruption to the distribution system.

While New Haven has been neglected and is little-known, the newer and larger housing development that arose from the ashes of the Multi Function Polis, Mawson Lakes, receives wide media attention. This disparity in acknowledged value is noticed by some disappointed research participants at New Haven. By contrast, Mawson Lakes respondents are ignorant of the existence of New Haven and bask in the television publicity which reaffirms the wisdom of their house purchase in this residential development.

Very little background dissatisfaction was indicated by the Florida respondents with respect to local government management of the utilities. In Altamonte Springs, one respondent, a 60 year old consulting engineer, had little general trust in the government, claiming that he had "been on a number of committees and unfortunately they do an awful lot of spoofing" (A16). In Brevard County, concern about the pressure on water resources caused by increasing urban development was expressed by three respondents, but only one raised the issue in relation to trust in the government. A homeowners' association president, a 54 year old woman, observes:

> To me, the County, with so much it doesn't seem the right hand knows what the left hand is doing most of the time. The problem is over all [departments], for example, the Sheriff's Department; development. Lots of deals made and nobody cares about what it's doing to the land. (B3)

Trust in various agencies was rated by respondents at all four sites and the results are presented in Chapter Seven.

Environmental context

Contextual factors relating to the water environment shape awareness, concern and have the potential to motivate conservation behaviour. Sztompka (1990) acknowledges the enabling and constraining influence of the environment and the fact that it shapes and is shaped by agency.

It has already been noted that Florida has recently suffered a prolonged drought. Water restrictions have been introduced in Altamonte Springs. Although Adelaide is reputedly the driest city in the driest state of the driest inhabited continent in the world, the quality of drinking water is a more salient issue. The Murray River has always been a highly saline source and supplies 40% of Adelaide's annual drinking water and this increases to over 90% during periods of drought (MDBC[1]:2000). *The Salinity Audit of The Murray-Darling Basin* (MDBC 1999) released in October 1999, alerted the public to the likely irreversible damage to this resource. A well promoted media campaign "Save the Murray" has run in the state and national press for some years.

The massive publicity devoted to the 'Sydney Water incident' that occurred in 1998 is another issue that may influence the views of Adelaide respondents. On the 29th July 1998 potentially fatal *Cryptosporidium* and *Giardia* parasites contaminated the city's drinking water (Doherty 1998a:3). Between that day and 19th September, Sydney residents were warned to boil their water and then given the all clear on four separate occasions. A Nielson poll[2] suggests that 40% of respondents blamed the newly corporatised Sydney Water (Hogarth 1998:1). No one became ill, however, those who otherwise could have been infected, boiled their water as directed or

[1] Murray Darling Basin Commission
[2] 347 sampled; 5 per cent margin of error.

drank bottled water. Three Sydney Water inquiries resulted in a separate Catchment Commission being established and a public daily report on water quality (NSW Health 2000) being published. Immediately following the Sydney incident, SA Water reported high counts of *Cryptosporidium* in its Happy Valley water treatment plant and closed the system to remedy the problem.

The structural context

Normative coherence

The socio-legal structure governing the rules and obligations of water reuse constructs what Sztompka identifies as 'normative coherence' in the system of law. The social institutions providing the rules governing the safe implementation and use of recycled water enhance trust by encouraging norms that promote existential security. Have these rules or guidelines exerted influence on the management of these residential developments? In addition, to build trust, these laws need to be non-contradictory, simple, transparent and persistent (Sztompka 1999:134). Therefore, have the rules infiltrated the information supplied to user residents?

There are no national regulations for reclaimed water in the USA or Australia. Australia's *Guidelines for Sewerage Systems: Use of Reclaimed Water* (2000) are part of a National Water Quality Management Strategy and, like the US EPA guidelines, are intended to be interpreted in the light of local conditions. However, recycled water is regulated in Florida through the Florida Department of Environmental Protection[3] while, in South Australia, the national guidelines are used in conjunction with state guidelines, rather than regulations, produced by the Environmental Protection Agency, Department of Environment, Heritage and Aboriginal Affairs, and the Department of Human Services.

Permitting criteria for New Haven was derived from these guidelines and, in addition, special conditions were stipulated by the permitting authority, the Department of Human Services.[4] However, at the time of the research, May 2000 to November 2001, the Department had insufficient resources to monitor individual

[3] Part III of Chapter 62-610 of the Florida Administrative Code.
[4] On 27 October 1994 by the then Central Board of Health.

site compliance and had not followed up the five-year long experience at New Haven.[5] Mawson Lakes had not yet applied for a permit to treat and recycle waste water because water reuse system planning is not yet finalised.

The New Haven reclaimed water system is described in general terms in a sales fact sheet *Water & Waste Water Management* (undated) but gives residents no specific details of the guidelines or instructions on how to use the system. No reference is made to the existence of this innovative village on the managing council's website. Four participants are some of the original settlers at New Haven, having resided there for five years, and can recall seeing a model of the development set up in a display home.

At Mawson Lakes, an explanatory, interactive model is also on show in the sales office, however, information about the recycled water system is fragmented. The developers, the Government of South Australia and the Delfin Lend Lease Consortium, produced a package of promotional material and information on the development and services provided. The model displayed in the sales office is depicted in one leaflet (*Water cycle management*, undated). Mention is made of the source of the recycled water in the general literature (*Design for better living* 1999:36; Mawson Lakes undated:10, 14) and the encumbrance documentation gives the technical specifications for the system stating that recycled water is limited to toilet flushing, garden watering and car washing (Technical Specifications 2000:1).

However, a promotional feature on Mawson Lakes in the local *Adelaide Advertiser* (1999:11) gives incorrect details of the proposed reclaimed water system. It suggests the water will comprise storm water, not household wastewater including sewage:

> Recycled stormwater is being pumped into Adelaide houses to replace increasingly salty River Murray water. A trial is starting at Mawson Lakes in the northern suburbs, where 5000 houses will be using recycled run-off water for toilet flushing and gardens.

The article also quotes prices which are not yet charged:

[5] Steps were being taken to address this situation early in 2002 (Pers. com. Kayaalp, 2002).

> The recycled water's bottom price was 25c a kilolitre and top price 40c a kilolitre … This compared with mains water at a residential house costing 92c a kilolitre with an added connection fee which took it up to $1.28.

In fact, to the time of writing, the potable water running through the recycled water pipe is supplied free of charge, and the price of the recycled water has not been finalised.

In Florida, the Department of Environmental Protection (FDEP) is a strong and vocal institution for the promotion and monitoring of recycled water developments in Florida. The FDEP rules are reflected in city ordinances and county codes as confirmed in the reclaimed water information package provided by Brevard County to recycled water users and published on their website:

> The use of reclaimed water is regulated through Chapter 62-610 of the Florida Administrative Code and Chapter 23 of the Brevard County code. The following rules were derived from those regulations.

Throughout Florida it is general practice to ensure residential customers of reclaimed water know what the water is sourced from and the basic rules and regulations governing its use. Residents at Altamonte Springs and Brevard County are required to read through clearly set out information before signing a formal document acknowledging they have read and understand the rules of use and are aware of their obligations as well as the responsibilities of the provider.[6]

Stability of the social order

Strict managerial adherence to established policy, informed by the socio-legal institutions, promotes a stable social order to maintain the safe accepted uses of recycled water. Sztompka explains that a sense of permanence of policies rather than ad hoc, opportunistic changes or adjustments to policy will enhance stability of the social order. Constancy of this type should also promote a prevailing sense of justice and fairness in the implementation of policy.

Permit criteria for New Haven stipulated by the Department of Human Services are not being met by the local council management of the development. A continuous

[6] Detailed fact sheets are provided for residents at Rouse Hill and Sydney Olympic Park that came on line in Ausralia in 2001, however there are no formal protocols as outlined for the Florida sites.

readout NTU (turbidity) meter was required to be installed, wired to an automatic alarm and call-out system (Item No. 7, Central Board of Health 1994), however, a Housing Trust project team member overruled this requirement. Continuous water quality problems have been experienced, as documented in research conducted by a Flinders University Department of Environmental Health honours student (Thomas 1999), described by participants in the current research, and subsequently reported to the local council (Marks 2000). As a result of ongoing research efforts being brought to the attention of the Department of Human Services, a turbidity meter has now been installed.

The Department (Central Board of Health 1994) also required that:

> All occupants of the premises are to be advised of the use of reclaimed water and the need to ensure all irrigation pipe work and emitters to be installed below ground.

However, the original developers used sprayers as well as subsurface irrigation for display homes. The council has not taken ownership of the Department's rules of use for all public open spaces within the village which are managed by their Parks and Gardens division. These areas are irrigated with sprayers, not drip irrigation. In direct reflection of this laissez faire attitude, the council has not provided any information on reclaimed water for residents and has therefore not stipulated any rules of use. Contrary to the national and state guidelines, there are no signs installed in the open green spaces to notify the public that recycled water is being used to irrigate the lawns and gardens in the village or on the adjacent oval.

Some residents at New Haven are aware of the original permit conditions that stipulate sub-surface irrigation, however all four of the longest residing households use sprayers because they have found that drip irrigation is a high maintenance system that continually blocks up.[7] Three-quarters of participant households use above-ground sprayers, sometimes in conjunction with drippers. Although no above-ground connections are allowed, six participants have installed taps which are not identifiable as the new recycled water taps[8] allowed in developments such as

[7] This is a widely recognised problem and growers using reclaimed water or bore water overcome blockages by installing an on-site filtering device for their drip and micro spray irrigation systems.
[8] Purple or lilac colour with removable handle.

Mawson Lakes, Rouse Hill and Sydney Olympic Park for washing cars and hand watering. One resident interviewed, a tenant of one of five houses managed by a local welfare group, was not aware she had reclaimed water connected. This situation was confirmed by the most knowledgeable of the four original residents who had assisted the tenants.

A lack of knowledge also characterises the responses of residents interviewed at Mawson Lakes. Although building encumbrances specify requirements to the contrary, some builders have installed ordinary taps rather than purple, recycled water taps and half the households had no outdoor potable tap, and most respondents were not concerned about the implications of this. Some participants suggest it is not a problem because they know of others who have no potable tap installed for outdoor use, or ordinary taps instead of recycled water taps. Twelve householders were not aware that the reclaimed water would be sourced from sewage, thinking it would be grey water or storm water only. Five households also believed that the reclaimed water was already on line.

General stability and consistency is evident at Altamonte Springs and Brevard. Both have policies stipulating that permission must be obtained to use garden hoses. Only a special hose bibb is allowed for hand watering and car washing and it must be housed in a locked service box. Site inspections are made by the responsible Department to oversee this practice and non-compliance may result in disconnection from the reclaimed water service. A water restrictions policy introduced in Altamonte Springs, affecting recycled water, is also stringently enforced. Four residents complained that the policy was too harsh, confirming that this policy is in fact enforced. However, two Altamonte Springs residents named a City Commissioner who blatantly disobeys the restrictions on watering. His action, as a representative of the governing body that is also the law enforcing institution, threatens to undermine the community's sense of justice and fairness of this policy.

At both study sites, it was observed that signs were installed in public places irrigated by reclaimed water stating:

> This area is irrigated with reclaimed water. Not suitable for consumption

Transparency of the social organisation

Clarity and openness of the governing institutions develops an awareness of the rationale behind practices and policies. Sztompka recommends information be made public from autonomous institutions that provide reports on functioning, efficiency, levels of achievement as well as failures. This suggests that some indication of water quality, similar to reports generated for drinking water, would build awareness and trust. Encouraging input and feedback from the community further empowers actors and creates a sense of democratic ownership of the ongoing management of water reuse.

Of the four sites, the exemplar with regard to transparent governance is Brevard County. Not only are the County Government Board meetings advertised well ahead, but the public is invited to attend the meetings while they are televised live by the local station. Televised broadcasts are also relayed in the government office building to facilitate input from managers if and when required. There is no parallel to this in Altamonte Springs, however, both Florida sites use their website to provide information on their reclaimed water policies. Additionally information on potable water source and quality are provided on both sites, with a detailed annual water quality report published in line with national regulations. Brevard County also provides question and answer sites for all their services, including reclaimed water. Both managers also report public outreach efforts. Tours of the treatment plant are conducted for homeowners' association presidents and any other interested members of the public. Staff also have speaking engagements for association meetings and citizens academies.

Such transparency of governance is not evident in South Australia. Specifically, no mention is made of local government meetings or the recycled water system at New Haven on the local council website or in its newsletters. Mawson Lakes is still managed by the project developers and is not yet under the jurisdiction of the local council. Negotiations are still under way to decide if SA Water will manage the system in partnership with the local government. In the meantime, residents are not being kept informed of progress made towards the building plans, implementation and management of the reclaimed water system. Making the actual treatment process more visible through plant tours is suggested by a recent resident at New

Haven. Two or three residents there have seen the inside of the village treatment plant and this noticeably affected their confidence in the water.

At both New Haven and Mawson Lakes there is uncertainty with regard to the price of the water. Although New Haven are charged only the sewerage rate for the service, 25% expressed concern that council billing indicates that the recycled water costs a fortune to run and that the flat rate charged is subsidised. The relevant portion of a typical account, furnished by a research participant, is set out as follows:

Council charge for management of recycled water	$1,112.70
Rebate	998.70
Includes concession	150.00
Net rebate	848.70
Recycled water charge per annum	264.00

The first amount is a non existent charge; there is in fact no rebate. The concession referred to is one that SA Water provides to sewerage customers who are 65 years and over or drawing a pension. SA Water does not charge for sewerage services at New Haven because the development does not discharge to the sewer. The council strikes the rate to charge the village residents each year by aligning it to the standard sewerage rate charged by SA Water and, unlike SA Water, no concessions are made to pensioners. The council's response to the fictitious charges, rebates and concessions is that this anomaly is due to the limitations of their computing system.

In stark contrast, the monthly billing issued at Brevard County and Altamonte Springs is similar to SA Water billing, and features clearly defined charges for connection or access and the monthly flat rate. For example an excerpt from a typical bill raised by the City of Altamonte Springs states:

Service period: 6/25/01 to 7/25/01:	
Availability charge	USD 3.15
Reclaimed water use	7.35
Total reclaimed water	10.50

Residents at Altamonte Springs are kept informed about water restrictions, that include the use of recycled water, through the website, fliers, and articles in the local government newsletter *Kaleidoscope* (for example, the July-August-September 2001 issue).

Recycled water is supplied in Brevard on the understanding that it is an interruptible supply. This is set out in the rules provided to each resident and published on their website:

> Reclaimed water cannot be distributed for public use unless it meets strict treatment requirements. For this reason, the supply of reclaimed water may be interrupted for short periods, without warning, if the quality of the water drops below these standards.

The water resources manager explains that the drought has affected the supply of reclaimed water. Less water is being used, resulting in a lower volume of treated sewage for distribution. Golf course supervisors understand they only receive reclaimed water after every other customer. However, to ensure all residential developments are supplied, the Department periodically cuts off supply to ration the distribution:

> When supply is low reclaimed goes to just 1,000 houses on the north side. We supplemented reclaimed with well water to around 50% of flow this year. We also turned water off at night for two hours during the severe drought. We rotated a different period every night, for example 10pm to 12; 12 to 2am, 2am to 4am.

A reaction to these measures surfaced from three of the four homeowners' association presidents and was the only item of improvement they recommended for the system. One who appeals states:

> Do not shut it off in the middle of the night. The whole neighbourhood complains. (B1)

Prior notice is suggested by a second president:

> When they shut down it would be good to get notice that it would happen. (B8)

And the third suggests publishing a schedule:

> Designate a schedule. Even if they have to deviate from it occasionally, so we know when water is being turned off. (B3)

In addition, occasionally drinking water pressure fluctuation or pipe breakages results in official notices being placed in the paper and on local television, being a 'boil water' alert in case of a cross connection in the mains. Two women, a homeowners' association president/home manager and an Hispanic professional report that they are confused and concerned when these notices appear.

At New Haven, when occasional maintenance is undertaken, no prior notice is given to residents of when or how long the system will be shut down. This was initially the case at Mawson Lakes, however, advanced warnings are now provided in notices distributed to all letterboxes. These reports confirm the importance of ongoing communication with residents affected by interruptions to the water supply.

Familiarity of the social environment

Particularly in times of change, familiarity with the social environment can be obtained through informative, personal interactions between the governing organisation and the constituent or customer. Giddens's (1990) concept of friendly 'access points' is acknowledged by Sztompka (1999) as the key to building or dissolving trust in abstract, impersonal systems.

At New Haven, an early marketing survey includes feedback from seven original residents which reports their satisfaction with the Housing Trust "response to problems encountered" (Motivation Research Centre 1996:12). The current research confirms that the Trust representative helped early residents settle in. In contrast, the council manager responsible for the village conveys a sense of being overwhelmed by the responsibility of overseeing all the councils parks and gardens. For him, New Haven is just one of these, although he acknowledges its special significance. However, ongoing accessibility and friendliness has been achieved through the contracted operations engineer working directly with residents in the village. He has addressed concerns relating to the recycled water, following through on reported problems, even those falling outside his contracted responsibilities. In this way, three village 'Big Men', in anthropological terminology, emerge as the self-appointed community leaders who have assumed the task of liasing with the contractor, thereby creating a friendly access point to the system for all residents.

Don, a truck driver, has lived at New Haven for five years since it first opened and enquiries established that he is the key coordinator. He has been entrusted by the engineering maintenance contractor with a set of keys to the treatment plant. Because the contractor is three-quarters of an hour drive away and has a busy schedule, when a problem occurs, Don enters the small plant, phones the contractor and makes the necessary adjustments to the system by following instructions over the telephone. Although residents have varying regard for these unofficial access points, they use them nonetheless. A woman who has now moved from New Haven reflects on Don's role:

> One was the self-appointed Lord Mayor I think he thought he was … [part of the] original clique which would keep an eye on everything - which was good in a way because it was like a Neighbourhood Watch thing. … One time when it actually stopped he came down quite a few times to say that he had information and it would be on in such and such a time. There were a few little glitches like that for a time. (N16:24, 26)

Another woman reports:

> I was just walking towards the door and this voice yells out: "There's no loo water!" It was Don and he was going around banging on everyone's door to tell them there was no water and I didn't do anything about it because I knew he would, and it was on I guess two hours later. (N15:337)

Ross, who now rents out his New Haven house recalls:

> When you've got a blockage you only have sort of half [the level of] water in the [toilet] bowl at the bottom and then you knew there was something wrong. The lights used to flash didn't it [nodding to his wife] on the oval there.
>
> Don … he speaks very fast, he's very stressed out - well, he appears to be - and he used to leg it over there all hours of the day and night and try and sort it out.
>
> So there were a few breakdowns and then occasionally it used to smell then, but it really wasn't that often in the 18 months we lived there. (N17:252, 254, 256)

At Mawson Lakes, Delfin's good reputation in residential development attracted some participants to Mawson Lakes. Three mention that the developer's managing agent is accessible on an individual basis, but others note that he has only recently

accepted invitations to attend occasional meetings of the grassroots formed residents' association.

At neither site is there a clear access point through which builders and plumbers can be familiarised with the special requirements for installing recycled water pipes and fittings. Residents complain of the lack of coordination of these services and the confusion that the dual pipe system presents to workmen who are unfamiliar with this new infrastructure. Even the recommended plumbers do not always know where to locate pipes, whether the pipes belong to SA Water or United Water, and who is responsible for the recycled water pipes. A resident at New Haven claims that no one possesses site plans of where the two solenoids for each property are located. Only through trial and error has he been able to assist recently arrived residents figure out where to find their solenoids and on more than one occasion these have been concealed under the brick-paved driveways. At Mawson Lakes, two respondents report confusion. Sam, who runs a building business, had a potential cross connection detected after several visits from SA Water, United Water and the preferred plumber:

> And they were saying it was fed in wrong. When they eventually dug it up the pipes had been crossed down the street. So instead of coming in straight they had been crossed. So I said: "Jeepers! Good job we haven't got recycled water because instead of drinking water, we'd be having recycled water". (M1:203)

When a tenant at New Haven was interviewed and it was discovered she was unaware that recycled water was connected, the representative of the welfare organization involved was interviewed for comment. He gave a biased perspective of the matter, as follows:

> The problem is that some tenants have English as a second language, they are low income with mental illness and probably wouldn't be able to operate a unit like the irrigation system … they wouldn't even open the box. They could not even change a light globe.

Myra, the tenant interviewed, was from South America, a mother of a school child separated from her husband, was able to speak English quite fluently, and showed no sign of mental deficiency. She had suspected the water that flushed the toilet

was different from potable water because of the colour and odour detected occasionally.

In relation to ongoing access to management in the Florida sites, for over 17 years Altamonte Springs has employed a public relations person to orient residents to recycled water issues. She encourages residents to attend seminars conducted by the local Water District on irrigation practices to curb over-watering, and is available to talk at homeowners' association meetings, as mentioned previously. Brevard County, with a much smaller system, have not been as active in public speaking engagements and rely more on the information and contact details provided in their information package and on their website to encourage further communication.

However, a few participants conveyed dissatisfaction in Brevard. One resident reported that he had received conflicting advice when he telephoned the office. When asked if he could think of ways the system could be improved he replied:

> If the stadium has priority, to give the small property owners priority instead because sometimes in the morning, it doesn't come on. I called the Department and they said the stadium has top priority. When I called again they said: "Whoever said that - its a load of bunk." I don't know who is telling the truth. I don't know what to believe. We live in a deed restricted community and if the grass is brown, it looks ugly and we're in trouble and at certain times we can't get water. (B11)

Because the Florida sites are well established, the construction phase of the developments was not investigated. This aspect was instead taken up with a large residential reuse development under construction in California. There, the managing Water District employs two full-time cross connection specialists to oversee the installation of the dual pipes to each residential allotment. The operations manager reported that cross connections have been discovered by the inspectors and on one or two occasions this was due to the road curbs being incorrectly code-marked. Each violation was detected before house construction was completed. Cross connection checks are carried out every two years in Altamonte Springs, and upon occupation in Melbourne, Brevard.

As far as tenants are concerned, Altamonte Springs management reported that tenants are contacted in relation to connecting to recycled water and often choose not to incur the cost of irrigating the garden of the rented premises. Tenants account for most of the 10% who on an annual average choose not to connect to the system. Brevard County is not as sure of the status of tenants because the home owners may choose to take care of the water costs. They are therefore considering ways to keep track of the movement of tenants in houses that use recycled water to ensure they are aware that recycled water is connected. However, at both sites, residents are members of homeowners' associations and interviews with several respondents who are presidents of these associations reveal that they generally take an interest in the comings and goings of house occupants. This suggests that information about the reclaimed water system may be passed on to unwary residents.

Accountability of persons and institutions

Sztompka (1999) outlines that democratic values should ensure that both persons and institutions are made accountable through mutual checks and balances so that the structural framework is filled with "appropriate action" (p.136).

As most residents at the two study sites in Adelaide are either unaware, unsure, or do not feel obliged to follow any particular rules governing the use of recycled water, they are equally unsure of who is ultimately accountable for the quality of the recycled water and the system as a whole. During the interview period at New Haven, the local council manager had furnished his contact telephone number for publication in the village newsletter, put out quarterly on a voluntary basis by one of the residents. New Haven research participants had resided there from one to five years and this was the first effort made to provide access to management of the recycled water. Most participants relied on others to contact whoever could attend to regular problems, as mentioned in the previous section. In response to a question on the normal procedure followed in the case of a breakdown event, this resident who has lived at New Haven for two years replied:

> I would not call the council. If there was a major problem I would ring SA Water because they would know what to do. (N10:37)

SA Water have nothing to do with the system, and this respondent was unaware that the council is responsible for maintaining it and ensuring it operates according to permit conditions.

With three residents assuming the responsibility of contacting the engineering contractor or the council manager when problems occur, an informal structure is created that links residents to the system through these access points. As long as problems are dealt with in this way, as part of the normal routine of living with the system, there is less likelihood that the council will be held accountable and assume active responsibility for improving the system.

By contrast, the experience of residential reuse is more uneventful at the Florida sites. The way the information package is formally provided tends to ensure that all residents involved are aware of their responsibilities as users and the main rules governing the quality of the water supplied by the government utility.

Background profile of agency

The interaction between structural opportunities and the human actors involved produces agency, the driving force of social processes. The actualisation of agency occurs through social praxis whereby the actions of social actors transform existing structure. Therefore, in addition to the historical context and existing structure supporting residential reuse, influences on 'agential endowment' include the social mood and collective capital of each community involved.

<u>The social mood</u>

Sztompka (1996, 1999) suggests that a collective social mood emerges from personal characteristics that are sufficiently widespread in the community, projected by self-amplification through imitation and mutual confirmation. Personality traits such as a trusting impulse, activism, optimism, future orientation, high aspirations, success and innovative drive, have a positive influence on agency. Observations made during field work, detected the social mood through the conversation style of interviewing where responses to the range of questions often motivated discussions in certain areas of interest. Interviews and discussion were also held with managers

responsible for the recycled water systems and it is considered their outlook is an important influence on the social mood at each site.

At New Haven there is a mix of contentment and relief that the development has finally been completed; annoyance at the lack of coordination on building sites and disruptions to the recycling water service; disappointment that environmental features were not better promoted and implemented; satisfaction with the gains from using the water; and uncertainty in relation to the ongoing 'subsidisation' of the cost of operating the recycled water system and doubt about effective, ongoing management. The impression gained from several interviews and discussion with the responsible council manager is that he feels he has insufficient resources to keep abreast of the day to day management of the system. Environmental staff have not been actively involved and he feels quite alone in facing the responsibility for ongoing management. Early established residents mention that a previous manager took a more active interest in the reclaimed water system and therefore there is a sense of inadequacy of management from the point of view of both the local council manager and the research participants.

At Mawson Lakes, preoccupation with establishing new, prestigious homes was strongly perceived, particularly in relation to the lack of awareness of details of the recycled water system. Residents are proud of the distinctive ceiling heights and other encumbrances on design; disappointed at the delay in the establishment of basic services and a shopping centre; annoyed at the unanticipated level of aircraft noise overhead; either excited about the high technology, or exasperated over the lack of coordination and flow of information on establishing computerised home management systems. Most are keen for Mawson Lakes to be the success promised in the prolific advertising and few have given up on the developers following through to ensure this happens. Therefore, there is a general sense of optimism for the future at this site. The interview with management conveyed the approach of moving cautiously in relation to completing the building of the water reuse system. It was noted that, like the shopping centre, dates for completion have been proposed but are continuously pushed further forward.

Research participants in Florida have a more matter of fact attitude towards the reclaimed water system that validated the researcher's impression of the recycled water being a routinised feature of sustainable urban living. There was less time to delve into their background experience with the water, but water restrictions and fines for not adhering to restrictions were a source of annoyance for a few residents at Altamonte Springs. A professional engineer is responsible for the operations and management of the reclaimed water system and discussions and tour of the treatment plant revealed a distinct enthusiasm for his role and the success of the system, officially known as "Project Apricot".[9] He works closely with the FDEP regulatory authority and local water district and shared his ideas for future improvements and extensions to the system.

At Brevard, there is a positive mood associated with current management and confidence in the ongoing benefit of using recycled water. Occasional interruptions to the service during dry spells caused some to comment that prior notice should be given and two are unsure of boil water alert communication. However, as noted previously, information provided to residents confirms that the service to householders for garden irrigation is an interruptible supply. Residential reuse in Melbourne, Brevard and other water reuse initiatives, such as irrigation of sod farms and development of wetlands, were introduced by the engineer who currently manages the system. He is pleased with his successful accomplishments, that includes an FDEP award for the new reclaimed water treatment plant, and is excited about the future expansion of the system.

Collective capital

This quality of agency refers to the sum and effect of individual, personal capital resources. Personal capital includes cultural capital derived from higher socio-economic status, education and occupational standing, indications of which have been considered in the introduction to this chapter. For water reuse, personal attributes such as age and gender and presence of children in the household (reviewed earlier) are also relevant in considering the benefits and risk of high technology. Social capital arises from a plurality of social roles, the possession of

[9] APRICOT: an acronym for 'A Prototype Realistic Innovative Community of Today'.

power, and an educational level to more accurately assess trustworthiness as opposed to naïve, blind trust (Sztompka 1999:129). Social networks also support investments of trust, including a strong extended family, and friendly neighbours.

Homeowners' associations in Florida provide an effective point of liaison with managers of water reuse to the users. Feedback is provided according to the needs of the community or the initiative of the incumbent president. It has been noted that a residents' association has been formed at Mawson Lakes and is now establishing some credibility, having successfully arranged for the developing manager to attend one or two meetings. Three residents at New Haven have voluntarily created an informal supporting structure. They assist tenants and new owners and in times of system breakdown or interruption coordinate information between the engineering contractor and their nearest neighbours. Another resident has created a village newsletter to keep the community spirit alive.

A profile of all research participants is provided in Appendix 6.1 for each study site, listing the basic personal capital attributes of each participant. The Adelaide data includes number of years of residence at the development, fictitious names, age, employment status, occupation, whether children are in the household, type of housing and garden and observed outlook. Data for the Florida participants includes similar details but, due to the shorter interviews, the main indication of general attitude of participants is their response to the question of what water means to them. These summaries suggest the social mood and collective capital involved in each case.

Conclusion

This historical and structural context along with the summary profile of agency provides the variation in conditions that may nurture particular knowledge, behaviour and attitudes towards the environment, water services, and water reuse. Over half the respondents at New Haven and Mawson Lakes are disappointed, sceptical or angry about the corporatisation of the government water and sewerage authority. This situates the Adelaide sites in a different historical frame than the two Florida case studies which suggest continuity and stability in water services. There is also differentiation between the Adelaide sites with a lack of recognition

and attention of the New Haven development, compared to Mawson Lakes. Together these factors constitute Sztompka's inherited culture of trust culture that in varying ways may influence the trust placed in water reuse. In addition, environmental factors suggest salience of water shortages as an issue in Florida and salinity of the Murray River in Adelaide that may motivate attitudes and behaviour including trust in the solution provided by water reuse technology.

The structural context confirms the relevance of the five structural opportunities outlined by Sztompka (1999:122-125). An overall positive structure supports water reuse in the centrally managed Florida sites. The situation is less clear for New Haven and Mawson Lakes residents where the decentralised systems are managed and made familiar according to localised resources and less organised structure. While the industry's approach to water reuse is consolidated in the Florida case studies where it is centrally managed and public health risk is collaboratively controlled, the Adelaide examples of residential reuse are subject to a more fragmented approach that signals a less sustainable implementation of non potable reuse. The social mood and collective capital at each site reflects the structural context and the characteristics of research participants as well as responsible managers. A varying mix of satisfaction is found at each site with a more positive outlook suggested at Altamonte Springs, Brevard and Mawson Lakes compared to some uncertainty surrounding the future of water reuse at New Haven.

In Chapter Seven, the cumulative influences of these factors will be explored. Environmental awareness and the salience of water issues potentially shape attitudes towards conservation strategies of the drinking water supply. The experience of residential reuse is presented as social praxis that transforms attitudes and behaviour in relation to water reuse as well as the structural conditions. This is explored through recognition of benefits, knowledge and concerns arising from experience.

CHAPTER SEVEN

Experiential shapers of trust in non potable reuse

Introduction

The case study analysis of the experience of non potable reuse continues in this chapter with a focus on the knowledge, attitude and behaviour of research participants. The historical, environmental and structural context and the social mood and collective capital of social actors explored in the previous chapter contributes to agency. This chapter investigates the characteristics of agency in relation to environmental awareness, salience of water issues, drinking water preference, conservation attitude and behaviour, the experience of residential reuse, and trust in various uses. The way research participants experience residential reuse, represented as social praxis, enhances or inhibits their trust in the system and is a precursor to their consideration of trust in providers and acceptance of potable reuse, which will be the subject of the next chapter.

The historical context suggests that the Adelaide communities have a less trusting culture in water supply and sewerage services than their Florida counterparts. In relation to the corporatisation of the Adelaide water authority, the feeling of being disenfranchised surfaces and there is also uncertainty and annoyance about higher prices and allocation of profits. There is a lack of familiarity with the newly corporatised structure across the diverse range of people of different occupational backgrounds interviewed for the study. The environmental context suggests that Florida respondents may be aware of the significance of water shortages while the salinity of the Murray may influence concerns of Adelaide residents for the water environment. The Sydney Water incident and the similar, less serious event in Adelaide may have affected confidence in water quality and, together with corporatisation, an erosion of trust in the water supply system is plausible.

Sztompka's (1999) framework asserts that trust is an ongoing, transformative process produced by social praxis between social actors and their structural context. Therefore, trust can be revised upwards or downwards, depending on the current structural opportunities and the characteristics of actors. It has been argued that key

people at access points to the institutions managing recycled water within the structural context will influence the day-to-day experience that shapes trust in water reuse. The whole social context reviewed in the previous chapter suggests variation between the sites which may project contrasting attitudes to the expert system of water reuse.

Environmental awareness

Adelaide respondents were asked if they had any concerns for the environment before querying their specific interest in water issues; time did not allow exploration of this broader question with Florida respondents. Both sites produced the same high proportion of people concerned, being 90%. Few people nominate 'green' issues such as the extinction of species and the logging of forests, and most concern is for 'brown' issues (80%); for example, the pollution of rivers and global warming that threaten lifestyles and industrial development.

Salience of water issues

At New Haven and Mawson Lakes, the salience of the issue of the Murray was gauged by asking general and then more specific questions. If respondents volunteered the Murray in response to any environmental issues of concern, this early revelation was scaled 1: most salient. Respondents were later asked about water issues in their region or state and those who then volunteered the River Murray scored 2: salient. For the knowledge measurement, most knowledgeable were respondents who volunteered information on the salinity of the river when they either volunteered or were prompted on Murray River issues. Knowledgeable respondents were those who referred to the falling or fluctuating levels of the Murray and those having a general knowledge raised the pervasive problem of water pollution.

Figure 7.1 shows that 30% of participants at Mawson Lakes are very alert to the widely advertised issues of the Murray River. People who volunteered problems with the Murray at Mawson Lakes more than double the number of participants who raised this issue at New Haven (most salient/salient 60% to 25%) . A similar pattern emerges for those who are very knowledgeable: 50% compared to 25% at New Haven volunteered information on the most serious problem of salinity of the

Murray. However, eight New Haven residents are passionate about the plight of the Murray and five of these claim that not enough is being done by the authorities; for example, Warren reflects that there is "more posturing about the Murray River than there is actually action" (N5:150). Whereas, only one Mawson Lakes respondent comments that it is time to stop talking about it, and do something (M7).

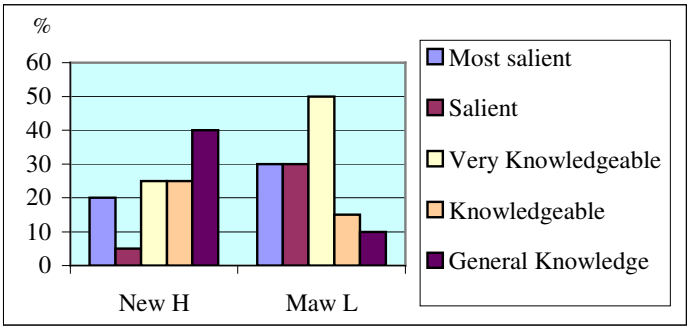

Figure 7.1 New Haven and Mawson Lakes: salience of the River Murray and knowledge of water issues

For participants at Altamonte Springs and Brevard, time constraints allowed only one question to explore the salience of water as an environmental issue compared to any immediate concerns about drinking water quality or the recycled water system. The question was therefore very general: Can you tell me of any concerns you have about water? None of the respondents mentioned recycled water and responses that mentioned the drought and water shortages indicated salience of this most widespread problem. The description of all answers given is summarised in Figure 7.2 as the drought (salience/water shortages), water pollution, drinking water quality and those who had no concerns..

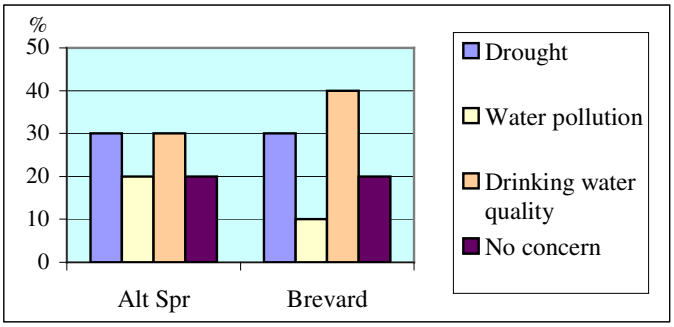

Figure 7.2 Altamonte Springs and Brevard County: salience of the drought compared to all responses.

The only difference between the two sites is that respondents at Altamonte Springs are more concerned about water pollution (20% compared to 10%) and the Brevard County sample have greater concern about drinking water quality (40% compared to 30%). The drought has salience with only a third of Florida respondents. For Melbourne, Brevard, this may be partly explained by the fact that it is situated on the coast and receives more rainfall than more drought affected parts of Florida, and there are no water restrictions on recycled water. However, the drought is still a well known problem for the whole state.

Salience of the Sydney Water incident was only explored with respondents in Adelaide when time permitted. It had little significance for eight householders at New Haven. No one volunteered the incident, and none of the eight were concerned about the implications for drinking water in general. Two participants thought it was just "bad luck" and another said they felt sorry for the people who had to boil their water. Another resident, Ross, took the opportunity to confirm his basic trust in tap water:

> I think that I certainly have been brought up with going to a tap, turning it on - all my life - and trusting the water that comes out; and I still trust in it. It was just unfortunate circumstances. It didn't bother us at all. (N17:126)

At Mawson Lakes, the issue was discussed with eleven respondents, and the response was quite different. Ten people were aware of the incident, three raising the subject during the interview. Another participant's wife, Carla (M10), was reminded of the Adelaide incident when water was contaminated by catchment run-off. Three people discussed filtration of the household water in relation to the Sydney Water incident. For 35 year old Stephen, in sales and marketing, it prompted him to install an under the sink filtration system (M13). Amanda is still considering the implications of this; a business owner who cares for her daughter with disabilities, she raised the subject as follows:

> We are going to get one - that was part of the plan. Now it's one of the things on the list. I want to get the real technological one that gets rid of every single grunge - in case we got what Sydney got or something like that. But then I don't know - my dentist said children should get fluoride up to 18 months. If we take every single thing out, it would be sterile and I'm not sure we want that. (M6:214)

This approach was confirmed when asked if her daughter drank water straight from the tap; she replied:

> She doesn't drink water. The only water she drinks is [swimming] pool water. She drinks Diet Coke and Strawberry Quick with Kieran Perkin's milk. (M6:216)

When Vaughan, a 45 year old sales representative, was prompted about the incident, his response was more straight forward:

> I think I was probably grateful that we have an under the sink filter and also wondering at the same time: 'Gee I wonder if that's enough to stop the *Giardia*?' (M3:151)

Implications of awareness

Widespread awareness of 'brown' issues such as water pollution, as found at the Adelaide sites, should prompt people to be more accepting of water reuse if they make the connection between effluent disposal to surface waterways and the closed loop effect of recycling water. Participants recognising salience of the main water issue of the salinity of the River Murray in Adelaide and the drought in Florida represent 60% of those interviewed at Mawson Lakes, a third in Altamonte Springs and Brevard, and a quarter of the New Haven research participants. Salience of water issues ought to motivate greater acceptance of water reuse to ameliorate the recognised stress on water resources. Additionally, those at New Haven who recall the Sydney Water incident when prompted, indicate that it has no affect on their confidence in tap water. There is a higher level of awareness at Mawson Lakes and the reactions of three people confirmed their reflexive response to the inferred risk of water contamination.

Drinking water preference

To gauge the extent of basic trust in drinking water supplied by mains water systems, research participants were asked to indicate their main source of drinking water. Adelaide has a long history of aesthetically challenged drinking water. Residents at New Haven describe this experience in detail compared to the general comments from the younger Mawson Lakes respondents. Years ago, they say the water colour was brown, "clean dirt" that stained washing. It is remembered as being "shocking" or "horrible" and tasting "dreadful". Although the water is now consistently clear, taste and odour are still noticed by some.

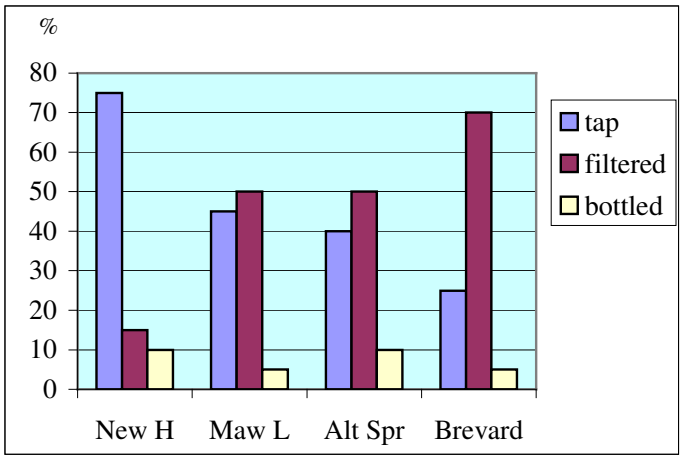

Figure 7.3 Drinking water preferences at each site

As shown in Figure 7.3 householders at New Haven have the most confidence in their tap water, whereas over half avoid drinking water straight from the tap at Mawson Lakes, almost on par with Altamonte Springs. Brevard respondents most favour home filtration of tap water. Some people who drink tap water also drink bottled water (one at New Haven, five at Mawson Lakes and three in Altamonte Springs), as do some filtered water drinkers (one at New Haven, six in Altamonte Springs and four in Brevard), but four of these at Altamonte Springs say this is only for convenience. For those whose main drinking water is filtered and/or bottled water, Mawson Lakes respondents are the most forthcoming on their reasons for this, some giving multiple explanations. Four of the eleven people have quality concerns (compared to one at New Haven, four at Altamonte Springs and two at Brevard), nine mention taste (compared to one at New Haven, and three at Altamonte and Brevard) and three cite odour (two at Altamonte Springs).

At New Haven, Candice, who expresses only a general knowledge of water issues, believes bottled water "is healthier" (N19). Another bottled water drinker at Altamonte Springs strongly asserts: "I don't trust tap water", earlier indicating that drinking water quality is the water issue of most concern to her because "I don't want arsenic in it" (A9).[1] No one else raised this issue. Those who drink bottled water as well as water straight from the tap mainly do so for taste but Simon, a

[1] More than likely referring to the recent publicity given to naturally occurring arsenic in drinking water whereby the USA EPA permitted levels are to be lowered.

Mawson Lakes resident who is very knowledgeable about water issues, finds quality is also a problem:

> Generally, we drink water from the tap but because the water tastes and quality varies considerably from time to time, we drink bottled water also. Very poor quality water over the last three months has forced us to use bottled water to fill the kettle to make tea and coffee. I don't mind paying higher water costs provided the product delivered is of high standard. What I object to is paying higher costs for water and receiving a poor quality that is not drinkable. (M9:167)

Two of the ten who filter their water at Mawson Lakes acknowledge that the Murray is a salient issue, are knowledgeable about water issues, and refer to the Sydney Water incident, saying filtration helps with the taste and quality. Vaughan exclaims:

> It tastes like crap, and you don't know what you're drinking. We are at the bottom of the pipe. (M3:81)

Another two who filter water comment: Naomi, brought up on the land, prefers rainwater and the wife of Ivan, with bore water experience, comments:

> It is very bad water. We've got a daughter in Melbourne and every time she comes here she says: "Oh, the water is terrible". The taste is absolutely terrible. (M5:95)

At Altamonte Springs, a conservative retiree (only one employer all his working life) concerned about water pollution, is particularly cautious:

> I filter every tap and the one I drink from, I filter twice. (A6)

Another resident, a 45 year old woman who expresses unease about drinking water quality ("What's in it? The taste! The smell!") confirms that she filters tap water "because of the smell and chemicals" (A15). Two women comment at Brevard. A 50 year old accountant is concerned about "chemicals in the water" (B8), and a 70 year old retiree cites pollution as the main water issue and she is worried about additives: "There are things in the water that we don't really need" (B19).

Implications of drinking water preference

In summary, health risk concerns in relation to drinking water affect only one research participant at New Haven, two at Brevard, four at Altamonte Springs and

five at Mawson Lakes. Hesitation and avoidance in drinking water straight from the tap and preference for alternative sources due to a lack of trust in water quality or because of aesthetics represent behaviours that are likely to be associated with less toleration for water sourced from sewage effluent.

Water conservation

Those who feel strongly about water conservation may be more inclined to support different levels of water reuse. Only the Adelaide respondents were asked if they use water saving devices or recycle water in any other way, however, all respondents were asked if they use more water on the garden because it is recycled. At New Haven, of 18 asked this question, 44% (eight) admit that they use more water and at Mawson Lakes, of 17 respondents, 24% (four) say they will probably use more water because it is recycled. In Florida, 30% of all Altamonte Springs participants admit they use more and 35% at Brevard. Looking for a relationship with salience of water shortages, except for Mawson Lakes, being aware of water issues tends to motivate conservation of recycled water.

Water saving appliances, such as efficient shower roses, washing machines and dishwashers, are used by a quarter of New Haven respondents compared to 60% at Mawson Lakes. However, another eight respondents at New Haven say they don't waste water, some monitoring it, whereas only one indicated this at Mawson Lakes. Of the water saving appliance users at New Haven, only one relates to water issue salience compared to eight at Mawson Lakes.

<u>Strategies for conserving water</u>

Participants well recognise the need for the public to be informed of the benefit of conserving water with all agreeing to the statement:

> The community should be educated about the long term effects on the environment if water is not conserved.

Strong agreement was indicated by half of all respondents at Mawson Lakes and Altamonte Springs, 60% at New Haven and 30% at Brevard. The above statement was one of a series introduced at the end of each interview.[2] Three further questions

[2] Following Roseth (2000) of Sydney Water to provide comparison with their survey results.

suggesting ways to effect water conservation were put to the respondents. The responses are illustrated in Figures 7.4, 7.5 and 7.6.

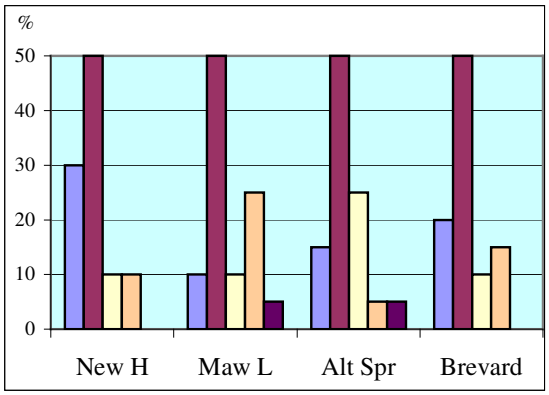

Figure 7.4 Business and industry should be required to use less water (See legend below.)

From 60% (Mawson Lakes) to 80% (New Haven) agree that water use should be restricted for commercial enterprises. People at each site queried the wisdom of forcing compliance, indicating that it may interfere with business operations and affect performance.

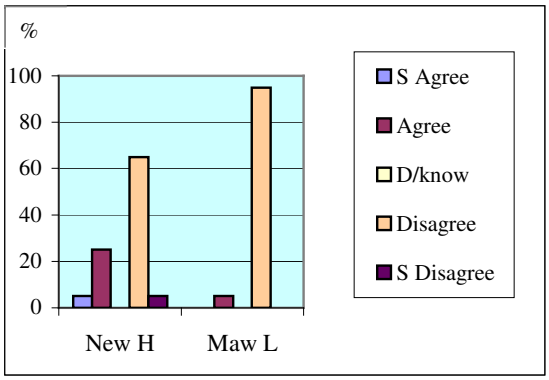

Figure 7.5 Water restrictions should be imposed on households at all times so that people use less water

Water restrictions are widespread in Florida so this question was not asked. Most people in Adelaide say water restrictions will disadvantage young families, validated by the response at Mawson Lakes which has the highest proportion of children.

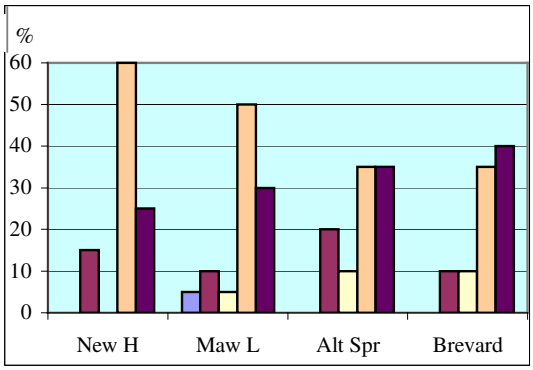

Figure 7.6 Water should be more expensive so that people use less (See legend above.)

Disagreement to a price increase is concentrated (Figure 7.6), with only 15% between New Haven (85%) and Altamonte Springs (70%). Parents of young children (24 households) are less inclined to agree with price sanctions than other participants. More people commented on this question than any other during the shorter interviews in Florida and all Adelaide respondents had something to say. At each site, a range of reasons were offered and more people cited unfairness than any other category. They argue that it would be an unfair

measure either for the poor, for families with children, or for those for whom the cost of water is already considered to be high.

Three New Haven participants - a conserver with war-time rationing experience, a teacher and a medical secretary - do not think it will be an effective strategy and another three offer recycling water as an alternative. The seven who suggest unfairness include an engineer who agrees but points to the fact that it is easy for people at New Haven to agree because their water "is subsidised" (N4), referring to the misleading billing for reclaimed water rather than the lower cost of recycled water. The extra expense (N2, N20) and the recent tax imposition "Not on top of the GST!" (N3) is supplemented by scepticism that the increase would be introduced by a monopolistic regime (N17). Others comment that water is a "basic necessity" (N5) and that poor people "don't need to pay more" (N14).

At Mawson Lakes, four people, including one who disagrees, admit that price sanctions would be effective. However, another six people say the strategy would fail, some explaining this is because it has not deterred people in the case of cigarettes (M13), nor petrol consumption (M19), nor the current usage under recent price increases (M20). Two suggest education as an alternative. One of these and another six raise unfairness, two suggesting people would be penalised when the fault lies elsewhere; Vaughan, a sales representative, blaming the overuse of water from the River Murray by other states (M3). The expense is raised by two and coping with children is mentioned by one, while Hugh, an invalid pensioner, stresses that water is an essential service (M10).

In Altamonte Springs, only four people agree with price sanctions but two indicate there will be opposition: "I would complain" (A4) says a City staff member, and a consulting engineer reflects:

> However, the rich would be using all the water; the poor would not have enough to wash their hands! (A8)

Another eight people of the fourteen who object, also raise the fairness perspective. For example: "low income residents need water" (A13), "people use whatever they need" (A18), from those who disagree; and respondents with strong opposition say

the "bills are so high already" (City staff, A2), "everybody needs water" (student, A17), and "Not fair!" from a homeowners' association president (A14). Another three comment, saying that there are alternatives or that it will not be effective.

Of those who comment at Brevard, less people refer to unfairness. Four of the fifteen who disagree say that it is because it will not conserve water and another two suggest desalination (treatment plant operator, B17) and education (teacher, B13) as alternatives. Five respondents articulate unfairness. Three say they should not have to pay any more: two retirees (B2 and B4) and a mother who is also a full-time shift worker (B18). Another teacher says its a necessity: "We need water" (B16), and a retired engraver advocates:

> They shouldn't sock it to the little people. Get corporate interest to pay their share. I'm from Wisconsin and down here the prices are higher and wages lower. The economy is harder on the average modest person. (B11)

He is amongst those who had agreed earlier that business and industry should be required to use less water.

The literature confirms that egalitarian attitudes are associated with risk avoidance or the desire for higher regulation of risk (Douglas & Wildavsky 1982, Slovic 1996, Marris & Langford 1996). Therefore, people who cite unfairness of water restrictions or price sanctions convey an egalitarian attitude, a concern for others' opinion, that may affect their acceptance of potable reuse, either because of risk concerns, cultural values or for any other reason. Disagreement with strategies of conserving water also relate to trust in the water authority imposing the restrictions and sanctions.

Non potable reuse

Research participants are recycling water, or plan to recycle as in the case of Mawson Lakes, because their chosen residential location was purposefully designed and built for this feature. Therefore, a certain degree of trust in this level of non potable reuse has already been demonstrated.

The practice of recycling water effects transformative actions on the natural and social world. Such actions occurring within a received structural context alter structures as well as actors' own characteristics "modifying the field of opportunities for future praxis" (Sztompka 1996:38). This social praxis can be mapped by firstly considering the nature of the recognised benefits of recycled water, and acceptance of recycled water in the context of water conservation strategies in general. The voluntary status of the risk in using the water is explored through awareness of the source of recycled water, willingness to handle it, awareness of risks, concerns in using it, and whether other's reluctance can be identified.

Benefits of water recycling

A range of questions were put to New Haven residents, such as: What are the benefits of living in this development? What features of water recycling work well for you? How do you think you personally benefit? How do you feel about being a recycler of water? Similar questions were asked of the Mawson Lakes participants about their expectations. Participants in Florida were asked to describe the benefits of using reclaimed water. The results are summarised in Table 7.1 below.

Table 7.1 Main benefits of residential reuse identified at each site

Benefits of reclaimed water	New Haven	Mawson Lakes	Altamonte Springs	Brevard County
Cost savings	60%	75%	90%	60%
Environment, saves natural resources	60%	30%	25%	30%
Supply, not wasting potable water	10%	55%	35%	35%
Nutrients/enables beautification	50%	10%	30%	10%
Feel good/responsible	45%	10%	15%	10%
Convenient irrigation system	35%	5%	5%	5%

Cost savings, which were expressed as savings made on the potable water bill or the cheaper rate, are highly valued at each site. The fact that New Haven respondents did not cite this as frequently as Mawson Lakes is attributed to the confusion caused by the inappropriate billing of residents. The beneficial effect on the environment is recognised at each site. However, this was expressed by most as a broad awareness of savings on natural resources rather than protection of waterways from effluent

disposal. Twenty percent of participants at New Haven and Brevard volunteered curbing of discharges as a benefit with 10% at Altamonte Springs citing this. New Haven more than any other site values the environmental benefit, the benefit of beautifying and nourishing the garden and the feeling that they are doing their part generally by recycling.

Awareness of sewage source

As mentioned above, twelve Mawson Lakes respondents were unaware of the household sewage source of reclaimed water and understood it would be grey water or storm water only. Five households also believed that the reclaimed water was already on line. Except for the tenant at New Haven, all other respondents there were aware that their household wastewater including sewage was being recycled for garden irrigation and toilet flushing. Similarly, at Altamonte Springs, all but one respondent, an Hispanic retiree who did not understand the question, were aware of the sewage source. Knowledge of the source was less clear in Brevard where two admitted they were unaware and five were hesitant in their response, for example: "sort of"; "vaguely"; "I guess I was aware because we can't drink it" (B8); "OK!"; Right!". The impression gained from these responses was that people have not thought about the source for some time, possibly putting the thought of sewage out of mind in line with the theory of cognitive dissonance and the rejection of discordant cues (Douglas 1966).

Prepared to handle recycled water

A proportion of respondents at each site are prepared to handle the water: 45% at New Haven, 60% Mawson Lakes, 55% Altamonte Springs and 35% at Brevard. Hand watering is carried out by at least 15% of participants at New Haven and one household each at Altamonte Springs and Brevard. Reclaimed water is used for washing cars at all sites, especially Altamonte Springs at 55%, compared to 15% at New Haven and 10% at Brevard, and half of Mawson Lakes respondents anticipate this use. Some Florida respondents indicate a preference for potable water for car washing because reclaimed water spots the vehicles. It is noted that the Brevard website advises that people should immediately polish-dry cars. Other householders use the water to wash down the house and driveway.

Higher uses

While the Florida respondents are aware that reclaimed water is not to be used for edible crops, a few households at the Adelaide sites use it, or intend to use it in the case of Mawson Lakes, for irrigating vegetables, fruit trees and as drinking water for pets and fowls. Strictly speaking, under the South Australian Guidelines, Class A water can be used for unrestricted irrigation. However, as earlier noted, there are indications that the New Haven reclaimed water system is not reliably producing water to this high standard and none of the respondents at either Adelaide site reveal they have knowledge of the Reclaimed Water Guidelines. In addition, 30% of respondents at Mawson Lakes are contemplating its use to fill swimming pools and all were previously unaware of the sewage source. The building encumbrances prohibit this form of potable reuse and stipulates that a potable garden tap must be provided and yet, half the households interviewed did not have a potable water tap installed outside and seven of these correlate with unawareness of the water source.

Strength of concern in using non potable reuse

For the more in-depth personal interviews in Adelaide, throughout the interview respondents were given more time and opportunity to recount any concerns they had about the recycled water. Relevant questions were spaced between other questions and matters raised by the research participant and included the following:

1. Is there anything not working as well as you expected in this development?
2. Can you describe any concerns you may have regarding recycling water?
3. What particular issues are important to you regarding water recycling?
4. How do you feel about being a recycler of water?
5. Are you able to identify reasons why people may be reluctant to recycle water?
6. Can you provide any ideas for improvement in water recycling projects?
7. Do you have any concerns about your children and recycled water?

Although time was more constrained for the telephone interviews in Florida, a similar range of questions was introduced throughout the discussion. Prior to asking questions 2, 5, 6 and 7 above, respondents were asked:

> Can you tell me about any concerns you have about water?
>
> Do you use reclaimed water for washing the car or for any other purpose?

Most residents initially reported no concerns about the public health aspects of using reclaimed water, even when asked directly (question 2); for example, 85% in Altamonte Springs and Brevard and, initially, 95% at New Haven and Mawson Lakes.

In Altamonte Springs, a 50 year old female musician considers the level of exposure:

> I know it's not safe to drink. I don't know if it's dangerous for bare feet. Health? (A7)

An Hispanic mother of young children, a nurse of 40 years, has a similar concern:

> I like to walk bare foot and I am not sure. When me and my children washing the car, I don't know what we are dealing with. (A18)

A consulting engineer in his sixties has some doubt:

> A concern if I had young ones about the yards – might access it, drink it. As I understand it – I'm not a chemist. (A16)

Three respondents in Brevard wonder about the safety of reclaimed water. A female retiree and a homeowners' association president states:

> I'm concerned about the dogs; they are house dogs and I don't know if it would be harmful, so I try to keep them from getting their paws wet. (B1)

A 40 year old Hispanic mother, formerly a teacher, has several worries:

> Yes. Is it being treated? What are we getting? What can we get from it? *Giardia* is in bad water. (B13)

A young mother, who has a Masters in Communication, cogently describes how she sees the issue:

> I am trusting they are being truthful; that it's not harmful. They would not want you drinking it. I often wondered if there is a residue of anything [so] kids running in the grass bare feet and 20 years down the line they may be saying: "We were wrong."

> So I am taking them on face value. They say kids should not have contact with it. Children like to play in water. (B6)

Further, two of the 17 people who initially said they have no concerns, qualified that this was because they "have no small children and no animals" (B19) and they "wouldn't let visiting grandchildren out in it" (B2), revealing concerns for children and pets.

At New Haven, Myra the tenant is concerned because she has not received any information and at Mawson Lakes, Robert, the information technology training manager, is worried about the risk to his children:

> But if the water is coming back onto my land, I want to be sure that the water that is coming back on is clean as it needs to be to not cause my kids to get bugs from going outside and playing in the garden. (M8:204)

When respondents at New Haven related more of their experience, it was revealed they had all noticed occasional problems with toilet flushing involving odour, a murky or grey colour, sediment, or a combination of these effects. Breakdown events of the system were recalled by most participants (80%) and 65% of participants described the event. Some qualified that events only occurred once a year, others remembering them happening about every six months and three saying it is more regular. Eight residents explain that buckets are kept handy to flush the toilets. The early marketing survey confirms that this has been a long-standing issue, reporting that "water recycling has had problems, buckets and hoses needed for toilets" (Association of Motivation Research 1996:12). Sandy the farmer recalls that at times the situation has been desperate:

> The thing's always broken down I suppose and one of the people here were going to buy it and run it privately at one stage. But I couldn't afford to do that. … That's why I don't like councils. They say all these wonderful things like we do this and that - but they won't spend the money on it you know. (N6:204, 206)

Megan, a clerical assistant, asks:

> Have other people complained about the smell that you get from it? … When you are brushing your teeth you want to throw up some mornings. It's coming up the drains and sometimes up the toilet. (N15:325, 330)

Belinda recalls a system breakdown experience:

> Once we broke down and I'll never forget - we were out for a few hours and it was my daughter's 21st and we were having forty people on the Sunday and it broke down on the Saturday. So I nearly had a heart attack because you know you've got to flush the toilet with a bucket of water. I thought that would be lovely! Anyhow they fixed it before - I was lucky it got fixed. (N9:4)

Both engineers recall system breakdowns. Bernard and his wife report:

> Karen: When it breaks down, it's dreadful.
>
> Bernard: Getting service … and the quality … When the water comes through, again, it's not very good quality and it smells in the toilet.
>
> (N4:92,93, 103)

As reported in the methodology chapter, Malcolm, an instrument engineer, was specifically included in the sample to be interviewed because he is seething from frustrations of technological features at New Haven not operating as promised. He relates a horror story building to an event that occurred in his bathroom when the system was back-flushed, a reoccurring nightmare:

> About every six months would be suspect I would say. You can tell because the toilets go all brown and dirty and the 'big event' was when we were getting absolute lumps - and I'm talking about 3 inch diameter … of thick, black … like the thick oil that you get in the - on aboard ship - floating on water …
>
> It meant that when I had guests and they were flushing the toilets, the toilet was dirtier than when they started. And this is a big embarrassment to you because people look at you thinking: "Why aren't you taking care of your house? What's going on?"
>
> They were there - every 24 hours you saw them. They tended to come down, it was if they cleared your tank, it all dropped out and then it would be OK-ish for 24 hours and then you'd get it again, and even to the point where it blocked up the toilet solid. No water would come through the pipes at all. And that's when I had the incident when we were trying to find out what was going on in the pipes and the whole lot

> blew all over the toilet! … It fired all over the room! To have a new house with a room destroyed, that's heart-breaking. I could clean it up. I'm the type of person that could put up with that and put it right, but you do to that to one of the other people here and you'll break their hearts. (N12:27, 31, 37)

In all, 40% of all participants who either described events, mentioned that buckets were needed, or recalled system failures, expressed particular concern about the ongoing management of the system.

Others' reluctance to accept non potable reuse

Most people think the public would welcome recycled water. However, only 30% of respondents at New Haven are confident of others' acceptance. Ross feels that although everyone should want it, he admits that his tenant at New Haven doesn't like it. Of the 40% at Mawson Lakes who think people will accept it, the reasons are projected from their own enthusiasm for its conservation of water, rather than from comments made by friends or family. At both Altamonte Springs and Brevard, 55% of participants have not detected reluctance in the general public and some give reasons that suggest it is in demand; at Altamonte Springs: "My daughter – she wants it" (A5); "Everybody hooks up to it" (A7); and at Brevard two homeowners' association presidents report: "People like it" (B1); "Haven't heard of anybody against it" (B2).

Half the fourteen participants at New Haven who perceive reluctance think this is due to apathy, or concern about the costs involved. This reflects their uncertainty about the cost of running the system. Another two think that people will be unsure or reluctant to accept change. Five people relate concerns about quality - the cleanliness and safety for three - as Kim, a young car manufacturer's driver explains:

> They may think because the toilet waste is going into it, part of that is coming back. (N10:53)

Two participants feel that others might think the use of recycled water will affect their drinking water, suggesting fear of cross connections. A 45 year old lab technician, Luke, states:

> I guess there's always in the back of people's mind that its possible to get a cross contamination. (N18:158)

Candice, a 50 year old medical secretary, reveals that she has thought through the possibility of a cross connection and puts her mind at rest on the basis that drinking the recycled water would not be fatal:

> Well I guess with somebody coming in and saying: "You've got grey water and what is it?" And I say: "Its the toilet – the water from the household is going back and being treated". They think: "Oh, you mean you're drinking toilet water!" I think probably what would happen is you may get slight stomach problems but I don't think there would be anything else because I think they wouldn't be allowed to use the chemicals that would make you violently ill. I wouldn't think so anyway, but I don't know what they use. (N19:162)

None of the respondents who later express concern for their children, cite health related concerns in relation to reluctance. Only two parents interviewed at Mawson Lakes raise concerns about water quality with respect to growing vegetables and fruit. Wayne, in export sales, says he has been reassured he can use it to irrigate all the garden, but he wouldn't use it on vegetables or herbs. Dennis, a transporter of wine presses advises he has received different advice:

> Well, I've been told not to: "If you have a 'vege' garden or fruit trees, don't use recycled water". There must be something in the water as well that's harmful to your health. (M7:182)

The sales office had cautioned him in this way. He then sought confirmation from the researcher that the water was sourced from stormwater. When the sewage and household source was explained his reaction was:

> Wow! What disease have we got in that? (M7:188)

The majority of those who identified reluctance at Mawson Lakes (seven of twelve) suggest that either the upfront costs or lack of price incentive will discourage acceptance. They expect a return on their investment within a reasonable time (two or three years) from the start of distribution of the water. Three feel people will be sceptical or reject change; Leigh, a 33 year old builder, raising the matter of trust:

> Yes, they won't believe the politicians and all those people we gave ratings of 2 or 3. They won't believe any of them. (M4:140)

Another two people refer to health risks. Simon, the systems analyst, says that it "depends on the cost and the quality of the water" (M9:135) Vince, an orchardist, wonders about the water quality:

> I would like to know what sort of bacteria lives in there. (M20:260)

He thinks both cost and quality will be important for acceptance:

> If it was only like 20% cheaper, a lot of people wouldn't even want it. It would have to be considerably cheaper I think. … Not just because it's a lower grade, but because a lot of people know what it is, I suppose. (M20:301, 303)

Of the 45% who think others may be reluctant in Altamonte Springs, all three homeowners' association presidents comment, and two consider the source and quality may be off-putting: "Because where it originates from" (A14), and "ignorance levels and the quality of water" (A19). Two of four city staff members interviewed have noticed reluctance; one through a survey but the concern is that "conservation had deteriorated" because people had access to recycled water (A1), and the other staff member thinks that people are just "scared of anything – changes" (A4). Three of the remaining four who comment relate reluctance to reservations about water quality. "Because it is effluent from wastewater" suggests a consulting engineer (A8); "Probably because they think it will smell, but it doesn't" observes a male student (A17); and an Hispanic, the mother who is concerned for her children, believes: "They afraid of quality. They don't care about cost or planet" (A18).

In Brevard County, the same proportion (45%) think that others will be reluctant and all indicate this is because of people's concerns about the quality of the water. Three comments relate to concerns for children similar to those quoted above, two being from households that have no small children. The other six respondents include only one of four homeowners' association presidents who says: "They think it will stain and smell" but she knows that it does not (B3). Two are mothers who comment on "the fear of chemicals" (B16) and "purity – how clean it is" (B18) and another woman says she has "heard a negative comment or two" (B12). The two men who comment, think the public will need to be informed. A former telephone

company manager recommends education so they "know it is safe" (B7) and the treatment plant operator observes:

> They just don't understand. Having seen the process, I know they test it. (B17)

The presence of children

Of households who have children twelve years and under, concern varies. A New Haven family who grow vegetables, herbs, fruit and run laying fowls on recycled water are not worried about their children's health because: "We don't let the children play around when we spray" (N5:100), and they also feel it is safe:

> We were given the impression that they don't advise you to sort of have the mist there because it could be a risk, but really they know it's clean, but they're not allowed to say it's clean in order to be safe. (N5:100)

Among the other four respondents with children, one parent is unconcerned, another is Myra the tenant who uses potable water on the garden because she has not been shown how to operate the irrigation system, and the other two have reservations. Malcolm believes everyone "should all spray [their gardens] at night" (N12), however, the researcher observed that this parent also has sprayers on during the day. A total of 40% irrigate after hours and another 20% say the time varies because of problems with water pressure. Mandy, a medical secretary, takes special precautions with her small children:

> If the kids get it on their hands or anything and likely to put it in their mouths I'd wash them. Not that I think they'd get anything drastic, but I'd rather not take the risk. (N13:92)

In addition, three respondents who do not have children at home say they are also concerned that several residents have installed recycled water taps that may be accessible to unwary school children taking a short-cut through the development.

At Mawson Lakes, except for Robert mentioned above, parents have little concern about recycled water and several explain that because it is not yet on line, they have not given it much thought. For example, a father comments: "Not at this stage because I don't really know what we're dealing with" (M12:136). However, another father who considers the risks adds:

> If I could smell it I'd be worried about it, yes. I'd be shutting the system down quite fast! (M19:167)

Two households with children are amongst the six respondents who feel reassured about safety because of the purple removable handles on the taps that can be put out of reach of children. Simon, who has an engineering background, explains:

> Maybe its like the electric power points. You can put plugs into these to stop having access. You just take the handle off the purple tap. (M9:116)

However, half of the ten households with children at Mawson Lakes are at some risk. Two households have only a standard tap connected to the recycled water line, three have contemplated using recycled water to fill swimming pools, and two of these households plus two others with small children have no potable water tap installed outside. An engineer who has no children at home considers the health risk involved for children running through sprinklers:

> With young children I would think that would be a concern if the only outside tap was a recycled water, and the kids were running under the sprinkler, because they would be taking some in their mouth. (M17:118)

Another father, Tony, previously a farmer is concerned about water quality:

> Because the sewage is supposed to be pumped into it … You would want the filtration to be pretty good. I suppose they'd have to be doing water quality tests fairly regularly. (M15:139, 143)

In the Florida sites, only the one parent (quoted above) of three households with young children in Altamonte Springs has concerns, but in Brevard County, four of six mothers express some concern. Two women were quoted earlier, and one uses avoidance tactics:

> I wait till the grass is dry before I let them play in the morning. (B13)

The other two have similar concerns about children playing in the garden. A teacher also takes precautions:

> No, they don't get near it. I don't let the children out until the sun has dried the garden. (B16)

A young full-time shift worker explains that she would like to feel more at ease:

> I wish it would be more safer so the children can go through the sprinklers or, if they sit down and drink it, it won't harm them. (B18)

Across this range of questions, those revealing personal concerns about the quality of non potable recycled water in relation to health risks total 60% at New Haven, 30% at Mawson Lakes, 15% at Altamonte Springs and 40% in the Brevard County sample. With regard to specific concerns for children, 25% at New Haven, 20% at Mawson Lakes, 10% at Altamonte Springs and 35% at Brevard express this.

Overall, the discussions regarding quality concerns, raised the level of interest in reclaimed water and many respondents said they would appreciate knowing more about it. A total of 60% at New Haven are eager for information about safety. The couple who produce the village newsletter, both teachers who have lived at New Haven for two years, are among these, with Natalie's story summing up the problem:

> I don't know whether it was just us or the pattern for new people coming in to this place, but we really didn't receive much education or information about how to use the water; the best way to use it, and that sort of vital information. We didn't really get a lot of that - it's mainly been Warren talking to people, asking what other people did, watching … common sense sort of thing. … There was no sort of educational input. (N5:108)

At Mawson Lakes, where less is known about the recycled water, including where the treatment plant will be located and when it will be completed, 80% would like more details about water quality. Only 15%, being those who had expressed concerns about safety, would like additional information at Altamonte Springs and 25% indicated this in Brevard County.

A summary of the relationship between structure and the awareness and concerns of research participants in relation to the provision of information and public consultation is given in Table 7.2.

Table 7.2 Information provided, source awareness, concerns and information required

Study site	Information provided	Awareness of source	Initial risk concern/ revealed concern	Information required
New Haven	Minimal documentation	95%	5% 55%	60% safety 65% other
Mawson Lakes	General literature, encumbrances, model.	40%	5% 30%	80% safety 80% other
Altamonte Springs	Detailed documentation upon connection	95%	15% 15%	15% safety 20% other.
Brevard County	As above plus comprehensive web site	90%	15% 40%	25% safety 25% other

Confirming acceptability of non potable reuse

Overall trust in non potable reuse was confirmed at the Adelaide sites, with all respondents at New Haven and all but one at Mawson Lakes agreeing to the statement put to them at the end of the interview:

> Effort and money should continue to be spent on technologies for recycling water for washing cars and watering gardens.

Of these, 35% strongly agree at New Haven and 30% at Mawson Lakes. The one dissenter, Henry, an air conditioning technician and father of young children at Mawson Lakes, believes that other households would be reluctant to be involved in residential reuse because of the initial cost of installing the pipes and special fittings, the ongoing charges for it, and because now some of his friends think the idea is strange:

> But, now, its like they're a bit put off: "They've got that funny recycled water reticulation system there - what's that all about?" (M12:146)

Acceptance of non potable reuse was not directly explored in Florida because their experience in using it is well established. All participants conveyed their general acceptance in recognising benefits of recycling. The policy of favouring reuse for irrigating parks and gardens, then agriculture, and finally industry, is confirmed by the scale of use which is higher than that for California. Across the state, 42% of reclaimed water is used for irrigation with public access (parks, gardens, golf courses), 18% agriculture, and 16% in industry (FDEP 2001).

Agreement to using reclaimed water for irrigating parks and gardens and for industry and agriculture was specifically queried at the Adelaide sites. The statements put to respondents were:

> Pubic parks should be watered with recycled water.
>
> Factories should use recycled water.
>
> Agricultural crops should be irrigated with recycled water.

All participants agree with irrigation of public parks, seven strongly agree at New Haven, and eight at Mawson Lakes. Both industrial and agricultural reuse is approved by 95% at New Haven and 90% at Mawson Lakes, with one at each site unsure and one disagreeing at Mawson Lakes for each use. Of the supporters of agricultural reuse, Mawson Lakes respondents are more enthusiastic with 55% strongly in agreement compared to 35% at New Haven.

Should this trust in non potable reuse be surprising, given the unfortunate events experienced at New Haven and the weakness of the formal social structure underpinning residential reuse at both Adelaide sites? To help answer this question, the interaction between agency and available structure is explored further. As outlined in the preceding chapter, the lack of accountability at New Haven is supplemented by an informal network of access to management of the recycled water system. While the local council manager is not known to most people interviewed, three residents have taken the initiative and established a good working relationship with the operations engineer. Thus, they have become key conduits of information for their surrounding neighbours. Additionally, the school teacher who produces the regular village newsletter, *NewsHaven*, facilitates greater communication between residents, with a recent inclusion of contact details of the local council manager. It is suggested that this social network for reporting trouble with the recycled water system has become an enduring though informal structure that influences the attitude towards the water recycling system at New Haven.

Another possible effect of this social praxis is that the interaction between system breakdown events and the people who put up with them over time via this informal structure, results in regular breakdowns becoming a ‘normal’, tolerable feature of the recycled water service. Additionally, in the absence of strict guidelines being

initially and continually put before residents, their adaptation of the irrigation system to suit their individual needs has also contributed to the evolution of the structural context. For a new resident, the normal appearance of recycled water now includes 'grey-water taps' – a distinct removal from the original, silent, but existing guidelines, for example:

> [A neighbour] said they weren't allowed to put taps out in the front garden, or on the front of the house with the grey water going through, for any passers-by that just happen to stop and drink it. So all of the taps concerning the grey water are located at the back, but there is a house across the road that has got a tap out the front and I don't know whether that's because they don't know, or its not connected to the grey water. (N19:166).

Thus at New Haven, the socio-legal structure of water recycling establishing normative coherence is driven by informal communication and social cues and not by formal rules set by management. Vague and misinformation is resulting in a higher risk environment. For example, apart from the illegal installation of taps, the reference to 'grey water' is in itself problematic; grey water being considered a more benign form of reclaimed water sourced from laundry, shower and sometimes kitchen wastewater only.

At Mawson Lakes, the residents have responded to the lack of structure in a different way. A residents' association is used to promote the development through media opportunities and to voice concerns to the development managers. Reactions to the question of whether residents have any concerns about the recycled water yet to go on line, indicate a social mood and collective capital which may work towards encouraging a higher level of service than has been the experience at New Haven. Sam, a foundation member of the residents' association, a builder who has a good relationship with the development manager, comments:

> I suppose that's trust again isn't it. No, I don't have any problems with that. If I'm only using it to flush the toilet and putting it on the garden, I'm not really worried about it.
>
> And, if they couldn't produce water good enough to wash my car, it would be pretty rough I would think.
>
> If it was offensive then I won't use it.

> I've got every expectation they will monitor the quality all of the time.
>
> (M1:265, 269, 273, 389)

Naomi, a mother of two who has not yet attended a meeting of the residents' association keeps up to date through her neighbour's attendance. Her response to concerns echo the reflexive nature of others' statements:

> I don't have any problems with it. I know it is going to be done correctly, and if it's not, there will be such a huge thing about it they will stop it straight away anyway.
>
> (M2:112)

As reported under concerns, Nick an executive manager who has made a substantial investment in one of the better areas of the development states:

> If I could smell it I'd be worried about it, yes. I'd be shutting the system down quite fast! (M19:167)

Thus, Mawson Lakes residents are creating their own formal structure that will be used to voice their concerns and contribute to the governance of recycled water and therefore the building of trust in the system at this new residential development.

Conclusion

Benefits of recycled water are acknowledged by all research participants. It is evident that the lower price paid for the water, and cost savings of potable mains water are widely appreciated. The influence of the salience of water issues is suggested in the acknowledged benefits to the environment and conservation of water supplies. A lower proportion of householders appreciate the nutritional value of reclaimed water for plant growth and its role in curbing effluent discharges to surface waters. When these volunteered accounts of beneficial reuse are considered, the future of residential reuse looks secure. Even at New Haven, residents convey that the benefits outweigh the disadvantages of interruptions to the service, which are also experienced to a much lesser extent in the encoded, interruptible nature of the service supplied by Brevard County.

Although participants in the Adelaide case studies are somewhat disadvantaged in the light of indisputable, poor structural support in the case of New Haven and the lack of ongoing information at Mawson Lakes, a secure trust in the future of

residential reuse is demonstrated by almost all residents interviewed. Despite this, public health risk concerns in relation to residential reuse surface during the interview process and a high proportion of Adelaide residents and a small number at the Florida sites would like to know more about the quality of water delivered. Amongst the three sites where people currently use the water, only at New Haven is adversity reported. Back-flushing incidents, odour, sediment in toilets and unanticipated interruptions to supply that force people to use buckets to flush toilets does not bode well as a positive demonstration of sustainable residential reuse. Perhaps it is for this reason, and therefore the understandable lack of publicity afforded New Haven, that residents at Mawson Lakes are unaware of the existence of New Haven, assuming they represent the 'Frontierland' of high tech eco-village experience.

This research confirms that the social praxis arising from the cultural capital of actors and the supporting structure of residential reuse does shape trust in non potable reuse. However, it is the informal, rather than the formal structure, that enables this level of confidence in the sustainability of residential reuse at the Adelaide sites. The 'Big Men' coordinating unforseen breakdowns, interruptions and then resumption of the service at New Haven provide informal support for coping with these events. A more formal arrangement has emerged to tackle day-to-day issues at Mawson Lakes, and the residents' association is likely to take an active role in ensuring that the recycled water service will operate according to expectations. Such voluntary organisations, also found in the homeowners' associations in the Florida sites, provide an important role in either the daily management of the system, as in the case of New Haven, or in two-way communication with the management structure.

However, it is argued that the more informal voluntary arrangement at New Haven, is in fact working against sustainable residential reuse. The self-management process cushions the accountability of formal management. And while the original rules and regulations of the system permit are not being enforced and adhered to, the normal order and coherence of the way recycled water should be presented and handled at New Haven is being shaped by the user community's adaptations and interpretations. A greater risk to public health ensues in the absence of signs

warning that recycled water is being used for spraying gardens and public spaces and in the practice of installing household garden taps that are not identified for non potable use. Therefore, in relation to sustainable residential reuse, a regressive rather than progressive form of agency is suggested.

The knowledge, attitude and behaviours considered in this chapter suggests possible influences on a reflexive consideration of potable reuse by those with non potable reuse experience. Experiential factors arising from residential reuse represent social praxis that transforms agency resulting in either a more trusting or less trusting disposition towards water reuse. This characterises the volatility of Giddens' (1994b) 'active trust' which is always subject to revision. The salience of ecological conditions defining water issues, confidence in drinking water straight from the tap, water conservation behaviour and attitude towards strategies for conserving water will also be considered in the next chapter in relation to the level of acceptance of potable reuse.

CHAPTER EIGHT

Trust in potable water reuse

Introduction

The historical background, contextual factors and experience of residential reuse are now considered in relation to trust in providers and the acceptability of potable reuse, the concept of converting treated sewage effluent into drinking water. The level of trust in water, sewerage and recycled water providers is considered in relation to other significant agencies. Responses representing four levels of potable reuse are presented with a focus on the highest level of use for drinking. The nature of the revised trust culture represented through the acceptance or rejection of high technology identifies the influencing factors arising from the social praxis between strong or underdeveloped structural opportunities and the individual and collective characteristics of social actors in each case study. The core relevance of Sztompka's (1999) framework for the social becoming of trust is confirmed along with the complementary significance of Giddens' (1991, 1994b) 'fateful moments' and 'active trust'.

The prevailing culture of trust

The revision of trust, if any has occurred, cannot be accurately drawn from the data produced by the cross-sectional, point-in-time approach of this research. A longitudinal, or pre-test : post-test research design would be required. However, the qualitative data already presented and to follow demonstrates that a reflexive process is used that may also take into account recent performance or reputation as well as the background level of trust that is more remote from respondents' current experience of water service provision.

It should be noted that the order in which respondents were asked questions on trust differed between the face to face interviews in Adelaide and the telephone interview approach in Florida. The experience of the recycled water system was explored in Adelaide following agreement to statements of trust and conservation practices. For the telephone interviews in Florida, experience was captured prior to questions on trust to get to the point quickly and keep the interest of participants. Exploring trust

prior to experience is preferred so that the prevailing level is captured rather than being affected by the research process. Therefore, ratings of trust in the Adelaide case studies are positively biased when consideration is taken of the concerns that were eventually raised in relation to experience.

Trust in non-potable water providers

During a discussion prior to conducting research at Melbourne, Brevard, the director of water resources suggested:

> We are doing our best job when we are taken for granted. When they have to think about us, then something is wrong.

Therefore, causing respondents to stop and think about the water services is a test of the strength of trust in the providers, regulators and associated agents of information on environmental and health risks. Based on the data considered so far, the dual pipe reclaimed water system is further along the continuum of being taken for granted in Florida than it is at New Haven, and is still to be experienced at Mawson Lakes. Therefore, is the level of basic trust in water services and the recycled water system reflected in the prevailing culture of trust at the four sites? Do respondents' negative or positive experiences support their evaluation of providers and associated agencies?

Respondents at each site were asked:

> Would you please give a score between 1 and 10 as to how much you trust information on water quality or the environment given by these agencies: 10 indicating that they are totally trustworthy.

The mean was taken of the scores given to each agency and therefore "don't know" responses are not included. Figure 8.1 illustrates the result for each site with respect to trust in information provided by reclaimed water providers for all sites, bearing in mind that at Mawson Lakes, the system has not been completed, is not yet on line, and the local council responsibility for the reclaimed water system is still to be negotiated.

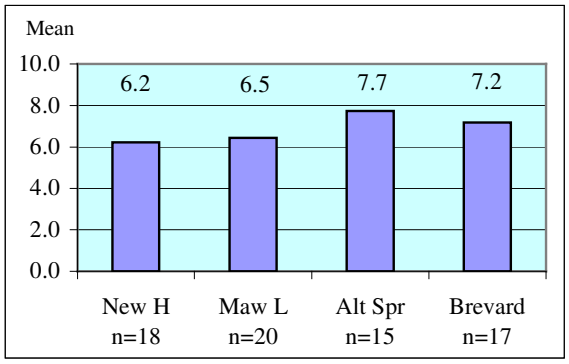

Figure 8.1 Level of trust in reclaimed water providers

The City of Altamonte Springs has the highest mean score, followed by Brevard County. As reported in the methodology chapter, because of time constraints following difficulty with the city's computer database, the sample of respondents in Altamonte Springs included a convenience sample of four with another 16 randomly selected. Of the staff member respondents, three rated the city 10, and the other, 7. This gives a mean of 8.1 for the sample (two responses missing, n=18). To remove probable bias, the three ratings of 10 have been eliminated from the sample, and the mean for the remaining 15 respondents is 7.7; still the highest score. High trust (measured as 8 or more out of the possible 10) in reclaimed water providers is confirmed at Altamonte Springs for 66.7% of valid responses (n=15), 41.2% in Brevard, 35% at Mawson Lakes and 27.8% of respondents at New Haven.

This result reflects the comments previously presented under concerns about the reclaimed water service provided at New Haven, the lack of detail known about the proposed service at Mawson Lakes, and the general low level of trust in agencies in Adelaide (see Table 8.1 and Figure 8.3 further on in this section). Low ratings are given by two residents at New Haven who describe recycled water events. Malcolm who vividly describes his nightmare experience rates them 4. Sandy rates the local council 5 and part of the quotation already presented points to disappointment in the way the system is managed:

> That's why I don't like councils. They say all these wonderful things like we do this and that - but they won't spend the money on it you know. (N6:206)

Of eight residents who give an account of using buckets to flush the toilet, half rate the council between 4 and 5. Explanations of why others rate the council more

highly is suggested in the low level of direct association with them when events occur. The managing councils' accountability is blurred. Yet, of the three coordinators, only Malcolm's rating (4) reflects the salience of problems experienced. Satisfaction in the advisory role they provide which assumes responsibility and offers reassurance to others may account for the other two coordinators' ratings of 7.

Trust in water and sewerage providers

Trust in water and sewerage agencies in Adelaide was also queried to capture the general trust in these expert systems and as a background consideration for trust in purifying reclaimed water to drinking water standard. This result can also be compared to the Florida findings. Both the City of Altamonte Springs and Brevard County provide sewerage services (the source of the reclaimed water service). Altamonte Springs is also responsible for the potable water supply and Brevard County provides potable water in the north country with the remainder supplied by another county government, Coco Beach.

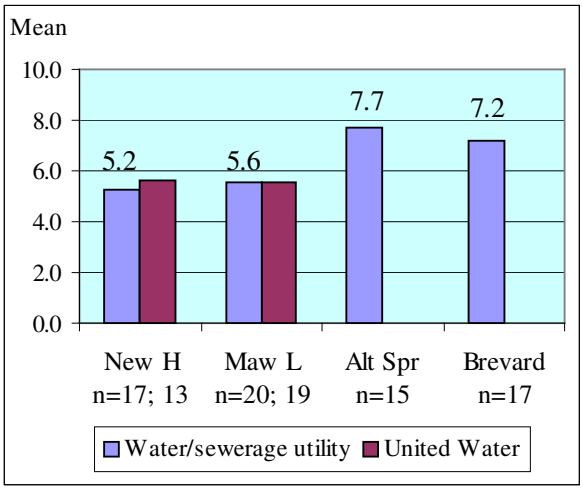

Figure 8.2 Level of trust in water supply and sewerage providers

The comparison shown in Figure 8.2 illustrates the lower level of trust in Adelaide for water supply and sewerage providers. Again, missing responses are those who were not sure what rating to give and, in the case of United Water, this was mainly because participants were not familiar with this new agency and had limited dealings with them; for example, all quarterly bills are issued from the office of SA Water. High trust is indicated by a rating of 8 and more and 17.6% of New Haven

respondents highly trust SA Water, 23.1% United Water, while at Mawson Lakes these results are 30% and 26% respectively . This compares to 66.7% and 41.2% who place high trust in the City of Altamonte Springs and Brevard County's information on the environment or water quality.

To further situate the level of high trust in this cross-national analysis, consideration is made of the results reported in Chapter Four for previous surveys. Trust, measured as 'very trustworthy' and similar highest levels in Likert type scales, reveal that between 12% and 24% trust water providers (San Diego, San Francisco, Orange County, 1993-2000), and 9% to 19% trust sewerage agencies. In Australia, the question put to Sydney respondents was used for the present study to provide direct comparison. Sydney Water is trusted (a rating of 8+) by 28% (1995) and 24% (1999). The trend noted across the surveys from California, Arizona and Sydney is that water and sewerage agencies are the least trusted, following medical, public health and science agencies, the EPA and environmental groups. The results for Tampa, Florida, can not be compared directly, but medical, science agencies and two regulators are more trusted than the water provider. Therefore, the indication of trust in the Florida residential reuse sites is at a high level compared to other USA and Australian findings.

In all, Adelaide participants were asked to rate fourteen different agencies. Florida respondents were asked to rate five agencies, including four of the most trusted agencies mentioned above. The means of the ratings for the four agencies and water and sewerage providers comparable for each site is shown in Table 8.1.

Table 8.1 Level of trust in agencies for information on water and the environment

Agency	New H	Maw L	Alt Spr	Brevard
Health Department	5.1	4.8	7.7	7.2
Scientists	7.5	7.7	6.5	7.1
EPA	6.2	6.2	7.7	6.8
Environment groups	5.5	4.8	7.3	6.9
Water & sewerage	5.2	5.6	7.7	7.2
United Water	5.6	5.5		

These results confirm the more trusting social mood at both Florida sites. Rather than being the least trusted, the water and sewerage agencies at Altamonte Springs

and Brevard are the most trusted, a position shared with the health department and, in Altamonte Springs, the EPA. Altamonte Springs participants have a slightly higher trust disposition than Brevard residents, but they are noticeably wary of the independence of scientists. In Adelaide, the results partially follow the trend found in comparative surveys. Scientists (the CSIRO) are highly trusted followed by the EPA. At New Haven, United Water follows, then environmental groups, SA Water and finally the health department. SA Water are more trusted at Mawson Lakes, followed by United Water and the least trusted are the health department and environmental groups. Adelaide respondents are very sceptical about the effectiveness of environmental groups and are generally disillusioned by declining health services.

As a final consideration of the trusting mood in Adelaide, the level of trust in nine agencies is compared to that obtained by Sydney Water for its water supply and sewerage customers in 1999. Figure 8.3 illustrates the similarity between the two Australian cities, comparing the small sample data from Adelaide with the stronger data for Sydney which is generalisable (n=1,300).

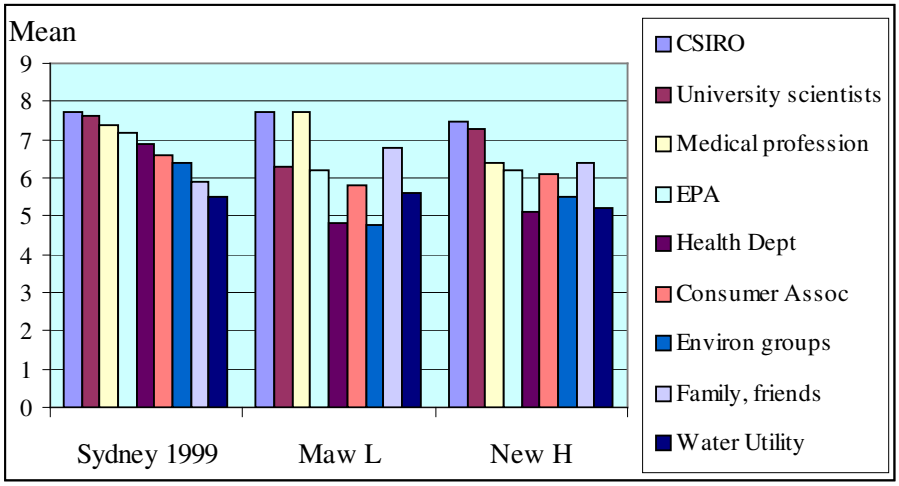

Figure 8.3 Level of trust in agencies: information on water or the environment

Results for Sydney, arranged in declining levels of trust, provide the comparator for the two Adelaide sites. There is a higher level of trust in the five most trusted agencies in Sydney that is similar to the level in Florida. Trust in Sydney Water mirrors that for SA Water in Adelaide where people trust the opinion of family and

friends over that of the water and sewerage utility. The media and politicians are the least trusted. New Haven respondents clearly trust scientists, represented by the CSIRO and university scientists, more than any other agency.

Revised trust

The level of background distrust in Adelaide's water and sewerage agencies by those who feel unhappy about privatisation is compared to the trust rating awarded to SA Water and United Water. For some, a high trust disposition accounts for the rating, however, for others a positive revision of trust is made reflexively, while negative experience reaffirms others' distrust of the new organisational structure.

At New Haven, of the eleven who comment on privatisation, six either trust SA Water, United Water or both (five trust SA Water and four United Water). Five of these have a high trust disposition across nine key agencies. Most drink tap water, only one filters the water and another drinks bottled water, and four of these five are males who give the highest rating (9, 8) to science agencies. Although Tom rates both agencies 6, he intends this to be a low score. By contrast, Belinda rates SA Water (7) above scientists and the local council.

A favourable revision of trust in the agencies is indicated by two participants. Ross separates the water services from the providers:

> But, as I say, I trust their products. I'd probably give them 7. (N17:174)

And for United Water:

> They are not going to give you a bad dose of water are they - not deliberately because it wouldn't be good for their company. Probably 7. (N17:180)

Although David the sewage treatment operator has a lower trust disposition and rates SA Water 2, he reviews his opinion of United Water and scores them 8 because they do not own the government assets and operate the potable water service:

> We haven't experienced United Water here in so much because we've got the recycled water, that's where we've had a lot of problems … which has got nothing to do with them. (N3:226)

The low background level of trust of three participants is substantiated in the light of recent experience . Warren, the teacher, scores both agencies 2 because he still remembers the "big pong" (odour from protracted problems with the Bolivar sewage treatment plant) in 1997 and further complains:

> Now, at the moment, it is 10 past 9 at night, there is one person on duty for this area right down as far as Willunga. There is one person that can be called out. Now, what sort of a commitment is that to the people of Adelaide? The only reason I know that, is the fellow who came here when a pipe burst, he got here in three quarters of an hour, and said: "I'm sorry, but I'm the only one on". (N5:224)

Megan, who scores each 4, hears of complaints from customers in her workplace:

> I know only that people complain that the customer service is pretty poor. (N15:444)

Lorraine, a teacher, expresses a low background level of trust before considering her score for any of the agencies:

> Not very much because of the disasters. I've just seen things over the years that they've said would be quite safe and seen the outcome. (N16:120)

A recent experience at an access point to this expert system cements her opinion; she is offended by the way misinformation was given and rates the agencies 3:

> I was there one day - and he said: "Oh .. there will be a key to unlock this thing [water meter box]."
>
> So I rang SA Water and they were really quite rude there: "Oh. There's no key! You just lever it up!" (N16:154,156)

At Mawson Lakes, low scores are given by half the eight respondents quoted in the background data. Six of the total of fourteen, who have a negative regard for privatisation, give a rating of 6 or more to SA Water and/or United Water. All six filter their drinking water and five have high trust in science. Two are among four in the sample of 20 who have the highest mean rating of trust (7 or more), yet confirm their distrust. Stephen indicates the rating of 7 is lower than that given to CSIRO and university scientists (9) because "they are tarred with the same brush" (M13). Brian, rates both 8 compared to CSIRO (9) and university scientists (8) and yet he suspects efficiency measures will result in "their lack of pumping in order to save money" (M17:84).

Three others trust the agencies because of their reflection on recent dealings or good outcomes. Ivan gives a high 8 to SA Water because he has recently received efficient service relating to builders' damage to a pipe:

> Once SA Water were informed they came. I had SA Water here. I rang him up and he came straight away - a couple of hours - at least the same day. (M5:195)

However, he is unsure how to rate United Water's unproblematic service because he has had no dealings with them:

> I've never had to. I turn the tap on and out comes the water so I've got no complaint. I flush the toilet and everything goes away. So somebody's in charge of it. (M5:206)

Vince, who is angry about the privatisation of water, considers the agencies deserve a high score (8 each) because the water quality has improved:

> All I would give them points for - the water supply, that's it - the quality of water supply, but I guess they are doing their job well because I suppose at the end of the day it wasn't their fault that they are running this SA Water. It was the government - politics - that got them to come in and control it, so its not their fault really. I guess the water supply is probably better than what it used to be. (M20:208)

Nick rates both agencies highly (8) but states:

> If you asked me that question say before they became privatised, I would have said very, very high. Now, I suppose they are still fairly high. (M19:80)

Sam also rates the agencies relatively high (7) but like two others who give them low ranking, he has not been impressed by recent performance. Sam is concerned about a near cross-connection and considers this a low score: "they've got agendas" (M1:194). Eric awards 5 each and explains that United Water "kind of mucked us around a bit" in relation to two taps (M11:206). Tony, as for Warren at New Haven, was unimpressed with the "big pong" and states: "because they had something to do with Bolivar - maybe 0!" (M15:109).

Reasons for low trust in the water agencies other than the link with corporatisation is explored for three participants at New Haven and two at Mawson Lakes. For the New Haven householders, the rating for two coincides with their low trust ratings overall and the third does not trust government agencies (N7, N12 and N20). Distrust of government also explains Henry's low score at Mawson Lakes (M12),

and the rating of 5 by Wayne is the lowest rating he gives and yet he highly values water and drinks water straight from the tap.

The small number of low ratings at the Florida sites reflect dissatisfaction at access points or a low trust disposition. Only two low ratings are given at Altamonte Springs: one from the engineer/homeowners' association president angry about fines for violating restrictions and a city commissioner not observing the restrictions (a rating of 1), and a low 3 from another consulting engineer who also reports on the commissioner. At Brevard, one low rating (2) is from the respondent who makes the comment that the county does not known what it is doing and she has a low average trust across the five agencies (a mean of 3.8; B3). Otherwise, 5 is the next lowest rating given by three. Two have no concerns about the recycled water, nor suggestions for improvement, but are among the four who have the lowest trust disposition (4.8 and 5 compared to 5.6 to 10). The third resident is annoyed at conflicting advice given by the county; suspects that the stadium is given priority of supply; and is concerned about additives in the water (B11).

Therefore, in relation to historical distrust suggested by participants, currently, a high trust disposition, belief in science and technology and recent services account for a positive revision of trust in Adelaide. Otherwise, for the majority, the inherited level of distrust towards these agencies and those in Florida is substantiated by low ratings and some of these reflect a low trust disposition, or dissatisfaction with recent experience at access points to these expert systems.

Trust in potable reuse

Research participants at each of the four sites were asked to indicate agreement through five-point Likert style responses to two statements:

> Effort and money should be spent on developing technologies for recycling water for showering and washing clothes.
>
> Effort and money should be spent on developing technologies for recycling water for cooking and drinking.

The results are compared in Figure 8.4 below.

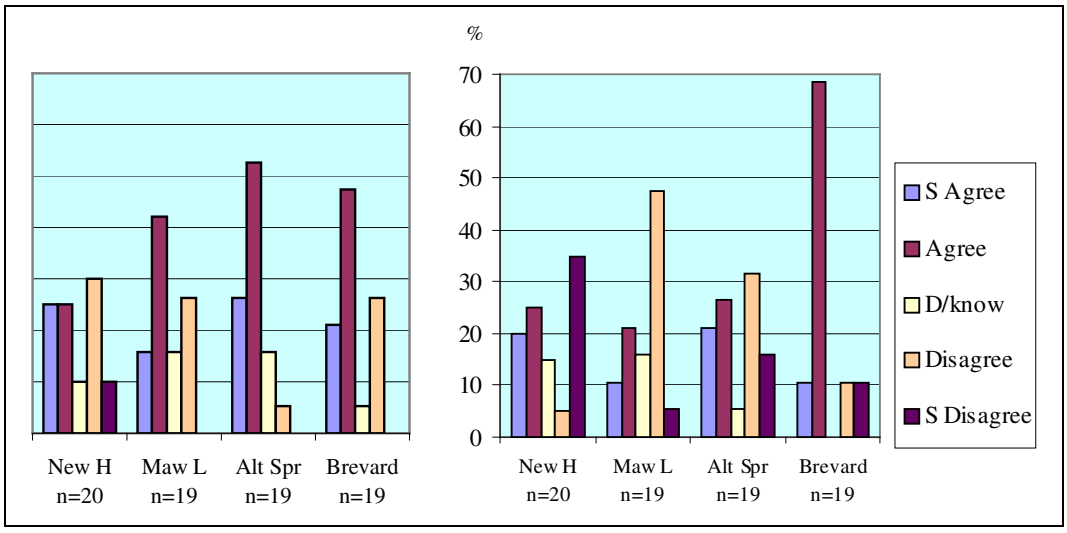

Figure 8.4 Agreement to investment in water reuse technologies for showering and laundry [left]; cooking and drinking [right]

At each site, trust in reclaimed water for showering and the laundry is relatively high and highest at Altamonte Springs (50% New Haven, 58% Mawson Lakes, 69% Brevard and 79% for Altamonte Springs). Once consideration is given to drinking the water, support falls, except for Brevard where, remarkably, it increases by 10.5%. Clearly, the participants at Brevard County have the greatest trust in the highest level of this technology (79%). At New Haven, support falls by only 5%, however, the proportion who strongly disagree more than doubles the results at other sites. Agreement at Mawson Lakes falls by 26% to 32% and Altamonte Springs has the highest downturn in agreement, from 79% to 47%.

Social and demographic influences

A range of socio-cultural and demographic influences are considered that represent the characteristics of actors. Based on the review of previous surveys and broader considerations, probable direct relationships with acceptance of water reuse for cooking and drinking include male gender, younger age, professional status, salience and knowledge of water issues, main drinking water source, support for water restrictions, and willingness to take risks (own business; handle the water). Previous experience and current behaviour in relation to water conservation, and strong agreement with non potable reuse for parks, industry and agriculture is also expected to correlate with agreement to potable reuse. Less support could be forthcoming from households with children, an egalitarian view (unfairness of water

restrictions and price increases), salience of the Sydney Water incident, drinking water concerns, previous unawareness of the source of recycled water, health risk concerns relating to residential reuse, and low trust in agencies.

The findings indicate that a higher proportion within several sub-groups accept potable reuse at the drinking level (Table 8.2 below, Appendix 8.1).

Table 8.2 Main factors associated with agreement to potable reuse

Independent variable	Percentage agree with potable reuse			
	New H	Maw L	Alt Spr	Brevard
Salience of water issue	60	42	83	100
- not salient	40	14	31	69
Drink tap water	47	38	57	100
- filter water	0	30	40	69
Handle recycled water	56	33	55	86
- do not handle	36	29	38	75
Price sanctions unfair	43	14	38	75
- not cited	46	42	55	80
Male gender	54	[25]	89	100
- female gender	29	2/3 [67]	10	69
Risk concerns relating to children	40	25	[50]	71
- no concerns	47	33	[47]	83
Restrict water for business	50	45	[42]	86
- do not restrict business	25	13	[57]	60
Trust CSIRO/ independ. science 6+	46	35	[50]	91
- trust <6	33	0	[50]	50
Trust Health Dept 6+	75	50	[50]	77
- trust <6	38	27	1/1 [100]	75
Trust Water & Sewage Authority 6+	50	40	[44]	10/13 [77]
- trust <6	44	22	2/2 [100]	4/5 [80]
Trust United Water 6+	57	40		
- trust <6	33	25		
Trust in local council provider 6+	58	31		
- trust <6	33	29		

Across all four sites, those for whom the main local water issue is salient, householders who drink tap water rather than filtering it, and those who are prepared to handle recycled water are more accepting of potable reuse. Participants who cite the unfairness of price sanctions to curb over use of water are less likely to support potable reuse. A pattern of trust emerges at each site although it is blurred for the Florida sites because of the high percentage of trust. Apart from confidence in tap water, trust in information supplied by health departments and trust in science is common to all but Altamonte Springs. Trust in water and sewerage providers clearly correlates with the drinking level of reuse in the Adelaide sites and is suggested in Florida and for the Adelaide providers of recycled water. Again, except for Altamonte Springs, those who agree to water restrictions on businesses

are more supportive while less support is given by those who have concerns relating to children and non potable garden watering. Men are more in favour of potable reuse than women, except at Mawson Lakes where only three women were interviewed alone.

Replication in findings for various combinations of two of the four case studies is found. The youngest age group followed by those aged 50-64 years give the most support in the Florida sites and the latter group is also the most supportive at New Haven. Only at New Haven and Altamonte Springs, is a relationship suggested between less agreement to potable reuse and households with young children, compared to households without children (7% less at New Haven, 17% for Altamonte Springs involving only two of three households). At New Haven and Brevard all self-employed respondents support potable reuse (three at New Haven, four at Brevard), and there is an association with white collar workers at Mawson Lakes and Brevard. Trust in the EPA also correlates with more support at both Florida sites.

In the Adelaide case studies, a higher proportion of those who have lived at the sites the longest (four plus years at New Haven and 2 years at Mawson Lakes) accept potable reuse compared to those who are more recent settlers. Installers of water saving appliances give greater support (29% more so at New Haven, 20% Mawson Lakes) which is also suggested by those who support household water restrictions. A direct relationship is also found for those who strongly agree with using recycled water for irrigating parks and gardens, industrial and agricultural reuse. An inverse relationship is found for those who find issue with corporatisation and the private outsourcing of water supply services: 27% compared to 67% who do not at New Haven, and at Mawson Lakes, 23% compared to 50%. Eight New Haven residents who are concerned about the ongoing maintenance of the system have less trust in potable reuse (38%) than those who do not specify this (50%).

As noted earlier in Figure 8.4, more people are prepared to trust potable water to the level of showering except at Brevard County (a net of one more at New Haven, five at Mawson Lakes and seven at Altamonte Springs). At this lower level of risk of ingestion the correlations noted for Mawson Lakes and Altamonte Springs are

weaker, stronger, or disappear (see Appendix 8.2). Being a professional or a white collar worker is more strongly associated with acceptance at this level. The salience of water issues, being prepared to take risks in handling the water, strong agreement to water restrictions for businesses, trust in science, trust in the health department and water and sewerage authorities is also more important. Negative associations with the unfairness of price sanctions, drinking filtered water, being female and having children in the household are weaker or non existent. At Altamonte Springs, the 50-64 year age group is stronger in support as are those who have children at home and the correlation with water conservation and privatisation is weaker at Mawson Lakes. Trust in the local council and United Water and strong agreement with agricultural reuse has no association at Mawson Lakes which is also found for water quality concerns and trust in the EPA at Altamonte Springs.

Of the nine supporters at the drinking level at New Haven, four have low trust in SA Water (less than 6) and another is unsure. All five drink tap water and more of this group are stronger in their agreement to water restrictions for businesses and disagreement to price sanctions than others. Three of these participants have previous or current experience that is favourable to their acceptance of potable reuse. Sandy, the farmer, relates stories of extreme water deprivation on the land during drought conditions where, at one time, he transferred water from a cattle trough to top up the household tank for human use. The Murray River is most salient for him and he displays accurate knowledge of the issues involved. Although he has low trust in the local council, the water providers and the corporatisation of the water authority, he rates the CSIRO and university scientists 9, indicating high trust in science. He also finds no problem with his dog lapping the recycled water. The Sydney Water incident was simply a case of "bad luck" (N6) for Sandy and he strongly agrees with both levels of potable reuse.

The unqualified support of Will is also not surprising. He recounts tales of deprivation during the war years in Europe, where everything was recycled and market gardens thrived on the minimum amount of water. Will still practises this strategy to avoid "bringing the salt up" and has even tinkered with the dual-flush toilet to cut down on the flush time to save water. Like Sam, he indicates acute salience and knowledge of the Murray. However, unlike the farmer, he has lower

trust in the CSIRO (5) but highly trusts the local council (8). He is a recent arrival at New Haven who is unaware of the original public health safety rules and has installed a tap for car washing and hand watering. His enthusiasm for agricultural reuse is mirrored in his response to potable reuse and contrasts with his wife's concern:

> Will: Yes … I would sit under the shower, no problem!
>
> Margaret: As long as there is no smell. I don't want a smell thank you. [Agree]
>
> [Asked about cooking and drinking]
>
> Margaret Oh no!
>
> Will: Yeh, it would be good – if you could do it.
>
> Margaret Strongly disagree.
>
> Will: I would go with it. I would spend the money to do that. Anything to save our resources. [Agree] (N7:386-394)

Warren, the teacher who voluntarily creates a newsletter for New Haven, is one of only three at New Haven who have installed water saving devices and is excited about the possibilities of recycled water. High trust in science, the local council and non potable reuse is evident. Warren uses reclaimed water for vegetables, fruit and fowls, and believes the water is safe. He strongly agrees with recycling for showering and laundry, but is less sure about cooking and drinking (agree) because of "people's perceptions of taboos" (N5:363).

Although unsure of SA Water and United Water, Don's enthusiasm for potable reuse emerges from trust in science and technology and his role as the unofficial coordinator with hands-on experience in keeping the system running. This is supplemented by his army experience at Wagga Wagga that first introduced him to the practice of treating sewage for non potable reuse. Handed a glass of treated water, he trusted the operator's claims to purity so much that he drank the product water; "and I'm still alive" (N11:443). His response to drinking is cavalier: "Well, why not?" His wife is less certain. To the concept of showering, Fiona adds: "I agree if they got it to a standard that I was happy with … If it was to such a good standard, yes" (N11:414, 416).

Robyn has no special experience but mediates her low trust in SA Water (5, unsure of United Water) with confidence in tap water, high trust in the EPA (10), university scientists (8) and strong agreement with reuse for parks and gardens, industrial and agricultural reuse. In addition, she marshals the saving of water and is the only respondent to strongly agree with water restrictions on households. Yet, like Warren and Don, she admits to using more water on the garden because it is recycled, unlike the other six residents who support potable reuse. For these three participants, potable reuse may be seen as an acceptable way of freeing up more water resources to ease the burden of the more measured consumption of more costly potable water.

Among eight who disagree to potable reuse for cooking and drinking and three who are unsure, are four respondents who trust SA Water. All have difficulty coming to terms with the corporatisation of the water utility. Kim's opposition also correlates with his preference for filtered water, concerns about non potable water quality, need for more information, distrust of the local council (0), and the reclaimed water quality events at New Haven. To showering and laundry, Kim states:

> Unless they can guarantee the water is 100% OK - and they can't, based on the history here. (N10:64).

Karl and Hilda's opposition is also shaped by experience for, like Kim, they give a high rating to the CSIRO and university scientists (9 each). Originally from Europe, they have lived through the polluting effects of stormwater discharges at West Beach and are alert to a recent problem of soil contamination at West Lakes due to effluent disposal:

> Well, you know there was a lady at West Lakes who died because of the problem there - the ground is poisoned. … Just last week. So I wouldn't trust anything anybody said about the safety of the environment! (N14:158, 160)

They will not support potable reuse because: "It's too risky" (N14:282).

Following agreement to reuse for showering and laundry, Ross and Florence relate privatisation directly to their unsure response for ingestion:

> Ross: It would have to be controlled so strictly and people would be very sceptical of it. … It would be a wonderful thing and it really is the way

> forward, there is no doubt about it. The thing that would worry me would be: would they cut corners for profits to do it because it would be expensive to do it, there's no doubt about it
>
> Florence: They out-source these things as well - because you couldn't really trust the companies that they use. (N17:375-376)

Their "don't know" response is echoed by Belinda who has low trust in the CSIRO and university scientists (5). She is among eight who relate particularly inconvenient or disturbing events in their experience of the residential reuse system.

The adverse experience of the non potable system at New Haven affects Megan's assessment of potable reuse (as with Kim above); she states:

> I think they need to focus first on the other side and improving it with odour and all those type of things. (N15:699).

Two of the four professionals are amongst those who recall events and are either unsure or don't trust the water providers and potable reuse. Bernard's explanation for not trusting potable reuse is the possibility of human error:

> It's like in my engineering field. In the advent of computer controlled machines, that machine will only produce as good as the programmers will let it produce and then you've got the human error factor coming in. (N4:483)

Another professional reports that a bucket is needed when the system is down but does not make a particular complaint. This teacher's opposition to potable reuse accompanies high trust in the CSIRO and the EPA, mediated by a background level of trust (she has seen too many "disasters") and low trust in SA Water and United Water.

At Mawson Lakes, only six households agree with both levels of potable reuse; five changing from agreement to disagreement when drinking the water is proposed. Of the six supporters, four trust SA Water and United Water (7 to 8) and two, who are the only respondents who strongly agree to potable reuse, have little trust in them (2 to 5). Both are males who drink tap water and recognise the salience of the River Murray as an issue of some concern. On the other hand, they are the only supporters to express concerns about the safety of residential reuse and would appreciate more information. Robert agrees to all forms of non potable reuse,

including agricultural reuse and places trust in the local council, CSIRO and the health department (6 each). He volunteers no explanation for his support, but was aware of the sewage source of the water and is the only professional who accepts the potable reuse concept. By contrast, Wayne was previously unaware of the sewage source, has lower trust in the local council (5) and is unsure of agricultural reuse:

> Don't think we're qualified to answer that. … Wouldn't use it for my vege garden. … You never know; certain things come back to bite you. (M18:267, 271, 273)

However, he places high trust in the CSIRO, university scientists (8 each) and his overseas experience reinforces his knowledge of water issues and confidence in water technology:

> I travel overseas quite a bit in my job around the Middle East, where water is just absolutely vital and precious. You realise how precious it is when you go to these countries and also knowing we're in the driest state in the driest nation.
>
> I see how precious water is to people in the Middle East and how money and technology goes into recycling of water there - or desalination. They do it well. … They use if for everything except drinking. They buy their drinking water in. (M18:70, 249, 253)

Among the fourteen respondents who are unsure of or disagree with potable reuse, the majority (8) indicate low trust in SA Water (0 to 5) with only one of these affording more trust in United Water (6). The remaining six do not support potable reuse although they agree with agricultural reuse, place high trust in the CSIRO and they trust both agencies: five highly trusting them (one unsure of United Water), and the other awarding them 7 each. Only one of the six was aware of the sewage source of the water and those that were not indicate they would like more information on the safety aspects of recycled water. All of the five who highly trust water providers, filter their tap water. Other possible background and mediating influences on trust in potable reuse for these six participants are presented below, beginning with four respondents who express dissatisfaction with corporatisation.

Ivan and Donna who were aware of the source of recycled water, have a European background and experience drawing water from a bore. For potable reuse, they

prefer to put their trust in desalination because it is a more palatable concept and is health giving:

> Ivan If you are prepared to use that water, they only get the salt out with some chemical treatment or whatever. You're prepared to use that water. And this other treated water, it should be just as clear, [but] it's just because in the back of your mind it's the sewer where it originated from.
>
> Donna Sea water has always been a healer. If you have sores you go into the ocean and you swim around and the germs disappear. My grandmother taught me that. She was a diabetic and all her sores healed up. But you wouldn't use the recycled water for this. (M5:350-351)

Vince, the orchardist, also cites an alternative. He believes water can be transferred from other regions if necessary for showering and the laundry. For drinking, he just thinks the concept is "stupid" (M20:281) and his wife declares:

> Well, I'll just start buying bottled water. I just couldn't drink it. Just the thought. (M20:282).

Vince later explains why the idea is stupid:

> The cost involved completely outweighs any benefits. We have got more than enough good quality drinking water, we don't have to do that. (M20:337)

Similarly, Nick, a business executive, is not convinced there is a lack of water in the state to warrant such a measure now, or in the future.

Eric, a self employed computer consultant, is intrigued with the possibility of the technology. However, the probable cost of treatment and public aversion to the concept are his main concerns:

> I don't know whether people would want to drink it even though knowing that we've got filtered water. (M16:224)

Tracy, a nurse and mother of small twins, concurs with this view. She is aware of the River Murray problems and demonstrates she is prepared to take risks with recycled water: there is no potable tap in the yard, and although she thought that the recycled water was already on line, felt comfortable about using the water to fill the toddler's wading pool because "having a few sips is not going to really hurt them"

(M14:156). However, Tracy balks at using recycled water for showering and washing clothes: "I don't know about that" (M14:112), but agrees to investment in the technology. Like Eric, she thinks the concept will put people off drinking it:

> I don't know if I'd like the idea of toilet water producing drinking water, even though its clean. … There would be a lot of people that wouldn't like that, I think. Disagree. (M14:116, 118)

Brian is also a professional, although he currently does not work in his engineering field. During the interview he revealed that his immediate concern was for the progress of Mawson Lakes and his views reflected his former role as one of three public relations persons for the residents' association. It is suggested that it was because of this single focus that permeated all his responses that the potable reuse questions were considered somewhat irrelevant to his underlying interests. No explanation was given for his agreement to recycled water for showering and laundry nor his unsure response for cooking and drinking.

At Altamonte Springs, of the nine who accept potable reuse, high trust in the city is evident (8-10 with one awarding 7) and only two do not trust city governance. Both respondents are the engineers who query water restrictions, fines and the weak access point demonstrated by the city commissioner who violates water restrictions. The strength of their support for potable reuse is not as strong as the other engineer in the sample who has complete trust in the city and strongly agrees to both levels.

The extent of trust in the city of Altamonte Springs is such that there is not one correlation between distrust in the city and opposition to potable reuse. Only one respondent is unsure of trusting the city government and this Hispanic woman's response to cooking and drinking is: "No! Bad! You cannot drink this water" (A5), suggesting she did not fully understand that the water would be treated to a higher level than that for non potable reuse. She disagrees to both levels, and another is unsure. This respondent works for the city and is alert to the reactions from the general population; for reluctance, she responds: "people are scared of anything – changes" (A4). To the application of showering and laundry, it is "the thought" that puts her off and her response to the level of cooking and drinking is that its "a good

idea, but!" (A4). Another city white collar worker is unsure about the first level of potable reuse and she disagrees to the highest level, offering no explanation. She rates all agencies 10 except science (6).

The remaining seven of the ten who do not support recycled water for cooking and drinking, previously agreed to the application for showering and laundry. None of these drink water straight from the tap and indicate lower trust in independent scientists than those who support potable reuse. Four earlier indicate concerns about quality of tap water, for example: "What's in it? The taste! the smell!" asks a female assistant administrator who strongly disagrees and filters water "because of the smell and chemicals" (A15). A woman who describes herself as a widow living alone, rates the city 6 although she has "never had any problems" and states that her reason for disagreement to cooking and drinking is that: "I don't trust them enough for that" (A9). The only male who changes from agreement to disagreement thinks it is a good idea but that it "would be reactive" and filters drinking water because of concerns about water quality (A6). An Hispanic "scientists and nurse" with children is concerned about the odour and taste of drinking water and comments:

> If in extreme necessity its going to happen but I wont like to drink it. Dilution of water is much higher. (A18)

A homeowners' association president moves from strongly agreeing to the first application to strongly disagreeing with ingestion, but gives no explanation for this. She has no concerns about recycled water because she has "been through the plant" and handles the water for car washing (A14). A city clerk comments on her agreement to showering and laundry: "A little bit but not all the way" (A3) and consequently disagrees with cooking and drinking. She has the lowest trust in independent scientists (3). A self employed Hispanic is the only respondent of the six for whom the drought is a salient water issue. She explains that "the thought of it" (A11) is behind her opposition to ingestion, similar to others who are put off by the source.

Eight participants agree with both levels of potable reuse, six are professionals and only one woman, also a professional, agrees. This respondent is the musician, aged

50 years, originally from England For her the quality of drinking water has more salience than the drought and although she handles the recycled water she is anxious about it being “dangerous for bare feet” and would like more information on its safety (A6). Only three of all nine supporters of potable reuse for drinking explain the reason for their agreement. The engineer who rates the city low because he is unhappy with fines and restrictions, earlier commented that recycled water for the laundry and shower is “probably drinkable” (A13). A golf course consultant qualifies his agreement: “if they can” (A19) while a consulting engineer describes a “closed loop system”, outlining direct potable reuse (A8).

A relatively high number of respondents agree to both forms of potable reuse in Melbourne, Brevard (13) with two more agreeing to cooking and drinking following an unsure response and disagreement to showering and laundry. Only three of the fifteen who agree with potable reuse have little trust in the County, whereas a lack of trust does not directly correlate with those who oppose. A retired engraver has a flair for chemistry and wonders “what additives are in the [drinking] water” (B11). He places high trust in independent scientists (9) and his low trust in Brevard (5) is linked to his annoyance about receiving mixed messages about the stadium having priority of reclaimed water supply over residents. He qualifies his agreement to potable reuse that signifies the ‘active trust’ nature of his support: “Maybe” (A11).

The low trust in the County by two female respondents, a homeowners’ association president and a retired government worker, who agree with potable reuse arises from a generally low trust disposition. Their individual mean score for trust in five agencies is the lowest of the sample, 3.8 and 4.8 , compared to 7 for this group. Their highest rating is awarded to environmental groups. The homeowners’ association president is concerned about the County’s boil-water alerts and is unsure about water reuse for showering and laundry, saying: “I don’t have the scientific knowledge”, but is prepared to consider reclaimed water for cooking and drinking, although, again, this is provisional:

> They can do the best they can, and then I’d have to be convinced. (B3)

The government worker is more confident, agreeing to both levels. She acknowledges the salience of droughts, and is concerned about ongoing

development and the increasing demands placed on water resources, saying: “I try to be what I call a concerned consumer”. She is alarmed at the idea of using more water on the garden because it is recycled: “No, absolutely not!” (B12). This respondent is one of the few at Brevard who uses recycled water for car washing.

Respondents who invest trust in Brevard County but disagree with potable reuse are women who include a homeowners’ association president, a home manager and a teacher. The drought is not a salient issue for these respondents and all three filter their tap water. Two have the lowest trust in independent scientists (1) and one is unsure. The latter respondent is a 35 year old “house wife” with no children, who has no concerns about water or reclaimed water, other than to filter tap water, and for whom the benefit of reclaimed water is its “consistency and price” (B5). The homeowners’ association president’s only health risk concern in relation to residential reuse is for her dogs (B1). The teacher nominates “chemicals and insecticides” (B16) as her main concern for water, and does not allow her children to play on the wet grass. For others’ reluctance she cites “just the fear of chemicals” (B16), and strongly disagrees with the highest level.

Two other comments made by those who agree with both levels of potable reuse represent views held by others across all sites. A male retired business owner remarks that it is an “exciting technical possibility” (B4), while a professional woman, the 36 year old respondent with a Masters in communication, makes a statement that holds weight for many of those who are hesitant:

> It is going to be a hard sell. The immediate image that comes to mind. People know they have a choice and they won't choose that. They would have to have no other choice to accept it. (B5)

All reasons offered by research participants for their response to the two potable reuse questions are detailed and summarised in Appendix 8.3. Comments are coded into eight categories: technology, source, cost, conservation, trust, environment, supply and alternatives. Because not every participant chose to explain their response, the patterns identified represent most of the responses in the Adelaide sites but only half of the participants who comment on either one or both of the two

questions in the Florida case studies. Trust in the technology initially explains acceptance of both levels at each site.

However, when conditional statements are taken into account, the volatility of trust in potable reuse emerges. Concerns about the technology, such as "if it works" and the sewage source combine to outnumber comments of trust in the showering level at Mawson Lakes and Altamonte Springs, and for drinking at Brevard. Trust in the technology is equalised by this uncertainty at New Haven for showering and at both New Haven and Altamonte Springs for drinking. Therefore, amongst those who support potable reuse, 'active trust' characterises at least fifty percent of the responses in relation to the effectiveness of the technology (Appendix 8.3, p.6).

Turning to reasons why people do not accept potable reuse, no direct explanations are given at Brevard. Concern about the sewage source, followed by distrust in the technology explains most of the response in each of the other case studies. Distrust in the ongoing operation, or providers of potable reuse, is also mentioned at the Adelaide sites as well as some doubt about the need to supplement the water supply and a preference for alternatives. Therefore, as found in open responses analysed in previous surveys (Chapter Four), active trust describes the tentative acceptance of potable reuse. On the other hand, opposition to potable reuse is firmly anchored in the unacceptability of the sewage source and distrust that the technology will clean the water to drinking standard. Health risk concerns are suggested but the jarring notion of ingesting or washing in water sourced from sewage also violates cultural codes. As such, a high level of trust in science and technology is required to overcome these barriers.

These results confirm the gender differences in acceptance of potable reuse earlier identified by Bruvold (1972) and verified in the audit of more recent surveys (Chapter Four). The data suggests possible influences that the previous surveys are unable to report due to limited analysis of the data. The Florida data is more straight forward. Gender is evenly represented in the sample of twenty residents interviewed at Altamonte Springs, where 70% of females are prepared to accept potable reuse at the laundry and showering level, compared to agreement from all males who responded (one missing). At the drinking level, six women withdraw

their support compared to only one male. Professional status may have a bearing on this result. All five male professionals accept potable reuse for drinking compared to one of two professional women. In the Brevard County sample, all four professionals are women and three of these are accepting of potable reuse. However, only one professional male at each of the Adelaide sites and neither of the professional women interviewed alone agree to the drinking use of reclaimed water. While the influence of higher education and professional status on gender differences is inconclusive, it is suggested that cultural capital derived from professional status combined with transparency of management of recycled water, as found in Brevard County, may encourage higher support for potable reuse.

Observations made during the more in-depth interviews with couples at the Adelaide sites conveyed a sense that the final word on acceptance of potable reuse will not rest with the male heads of households. Several women either allowed their partners to make the decision on acceptance of potable reuse and had nothing to add, or they commented that they did not like the idea (Appendix 8.3 summarises the discussions). Responses from the older respondents at New Haven suggest greater volatility. Across the two questions, four women influenced the male response, and at least another four women indicated that the matter would be discussed further if actual implementation of potable reuse was under consideration. At Mawson Lakes, two women influenced the negative decision, and the responses from another two suggest the matter would be under debate.

It is argued that the traditional housekeeping role of women plays a part in this response. A reversal of roles could lead to a different outcome. For example, in one household interviewed at Mawson Lakes, a husband keeps house while his wife pursues her nursing career, and he has "reservations about washing good clothes" in the water (M10). By contrast, his partner thinks the concept of converting reclaimed water to drinking water is fantastic, with qualifications: "if its researched and it can be done … as long as its not going to impact on our health" (M10).

Conclusion

The usefulness of Sztompka's framework for the social becoming of trust emerges through its explanatory power of the process of trust involved in accepting or rejecting risk, or highly significant socio-cultural change. Its logical ordering of the process silhouettes these findings. Results forged from the embedded data of archival records, documentation, fieldwork including site visits, interviews with managers and other stakeholders and interviews with users of the service provide consistency in each case study. The inherited culture of trust is negatively characterised for many in the Adelaide case studies and positively reflected in the background data for the Florida sites. Structural constraints in the Adelaide sites, particularly at New Haven where they reach disabling proportions hamper an unproblematic engagement with residential reuse, which is more readily attainable at both Florida sites.

Combined with a more trusting social mood, enhanced by the enthusiasm of responsible managers at Altamonte Springs and Brevard County, compared to uncertainty at the Adelaide sites, a more viable agency is suggested in the Florida data. Yet, although cultural capital, represented by socio-economic status, is highest in Altamonte Springs, the social capital of social networks, provided by homeowners' associations at the two Florida sites, is found in a more informal guise at the Adelaide sites. The coordination involved in managing system crises at New Haven works to maintain trust in residential reuse and, at the same time, shields management from a measure of distrust. Expectations that the non potable reuse system will function properly at Mawson Lakes are backed by the potentially reflexive role of the residents' association Overall, a more optimistic social mood and collective capital is found at Mawson Lakes compared to New Haven.

The revised culture of trust is examined in two ways. Firstly, through the trust levels awarded to recycled water, water and sewerage providers compared to the historical context. Despite revisions of trust upwards in the Adelaide sites, high trust at Altamonte Springs, followed by Brevard County reflects the positive characteristics of agency. The lower trust in the recycled water providers at New Haven and Mawson Lakes coincides with the weak structural context and lack of knowledge of the system yet, it is argued that this could be lower but for the fact

that many are unaware of who is ultimately responsible for the management of the system. Levels of trust in water and sewerage agencies in Adelaide are lower still, partly reflecting the historical context. Secondly, acceptance of potable reuse provides the opportunity for a review of trust in providers, science and technology. Here again, high trust is confirmed in Florida compared to Adelaide sites.

Trust in technologies for laundry and shower mirrors the level of trust in water and sewerage authorities: highest at Altamonte Springs and lowest at New Haven. However, when people consider drinking the water, support falls dramatically at Altamonte Springs and Mawson Lakes, but there is little disturbance at New Haven and it increases at Brevard County. Analysis of the social and behavioural influences at both levels confirms the importance of associations made with agreement to the highest level of the technology. These include being male, recognising the salience of water issues, trusting tap water, handling recycled water, agreement to water restrictions on business and trust in science, health, water and sewerage agencies. People who cite the unfairness of price sanctions and Adelaide participants who raise the issue of corporatisation of the local water and sewerage utility are less in agreement to potable reuse.

Those who distrust the providers but are willing to trust potable reuse for drinking are more likely to be male, drink tap water, believe in science and technology and have prior or current experience conducive to accepting this level of reuse. However, the review of reasons offered by all participants for acceptance as well as rejection of potable reuse portray a sense of uncertainty in the effectiveness of the technology for removing the sewage factor. The cultural discord that this concept represents is suggested and explains a healthy distrust in this level of potable reuse for at least some of the opposition which is most strongly implied at Altamonte Springs where trust is at its highest.

Gender difference in response to acceptance of reclaimed water for drinking is also clearly seen in the Altamonte Springs data where gender is evenly represented. Although seven women support potable reuse at the laundry and showering level, only one is prepared to accept uses involving direct ingestion. From observations made during the interviews in Adelaide and the detailed responses it is suggested

that although women may concede male opinion publicly, they are likely to have more to say privately about the concept of potable reuse. With women predominantly managing food preparation, the care of children in households, as well as the cleaning of bathrooms and toilets, their wishes concerning the quality of drinking water should carry some weight. Faced with an actual proposal of potable reuse, individual households may give less support after rumination and debate closer to the time of implementation, resulting in waning enthusiasm and finally opposition to the concept as experienced in recent attempts to introduce this advanced water reuse system (Chapter Five).

These three chapters confirm the importance of mapping the historical, background context. In addition, for water reuse or other ecological or natural resource issues, it should include the environmental context. Current ecological issues may also surface in the structural context to provide the enabling and constraining effects that Sztompka identifies in his general theory (1990). The social mood and collective capital are helpful organisers of the characteristics of actors. However, it is stressed that agency also reflects structure and the cumulative product of prior social praxis. It is confirmed that the revised culture of trust can be enhanced or depressed, depending on the complex set of circumstances that draw on the different strengths and weaknesses involved in the social praxis. Sztompka (1999) acknowledges that 'healthy distrust' may ensue and this complements the cultural explanation of the rejection of drinking water sourced from sewage. Conversely, high trust in science and technology accounts for the majority who embrace the concept. These findings will be reviewed in more detail in Chapter Nine in the light of the findings reported in previous chapters and the associated emerging theory.