Chapter 5

Institutional Resistance to the Use of Rainwater Tanks

> "The rainwater catchment system concept ("catch it when it falls, store it nearby, use it when it's needed") is hardly complex. The cost is generally cheap. The product is desirable. Compatibility with nature is *ipso facto*. One might suppose that rainwater catchment systems implementation would be inherently endorsed. Unfortunately, it appears, simplicity weights against rainwater catchment systems in a world that has grown to venerate bigness, sophistication and hierarchy. Were rainwater catchment systems to incorporate microchips, high-tech materials, laser beams and a strong role for government, perceived legitimacy may be enhanced. Rainwater catchment systems are simply too often ignored or uncritically dismissed. Such disparity is unfortunate for many reasons, but one reason is significant – people need the water." [R.J. Heggen, 2000]

5.0 Introduction

The use of rainwater collected in tanks to supply domestic outdoor, toilet and hot water uses will reduce mains water demand and stormwater discharges (Chapters 2 and 3). This has the potential to reduce the requirement for mains water supply and stormwater pipes, and water supply dams. Reductions in stormwater discharges will also reduce the incidence of erosion, sedimentation and contaminant transport to the environment. The use of rainwater tanks in urban areas may produce substantial benefits to the community.

In Chapters 2 and 3 it was found that rainwater stored in tanks was of acceptable quality for outdoor, toilet uses and hot water uses. Chapter 4 revealed that the incidence of illness caused by ingesting rainwater was rare even though many Australians used rainwater collected from roofs and stored in tanks for drinking purposes. The majority of illnesses caused by drinking rainwater were derived from poor construction and maintenance of rainwater tanks allowing debris and vermin to enter the tanks. However the modern rainwater tank has screens on all inlets and outlets to eliminate access of vermin and debris to the stored water. Use of rainwater from tanks for non-drinking purposes (such as outdoor, toilet and hot water uses) or the use of a rainwater treatment chain will substantially reduce and possibly eliminate health risks believed to be associated with drinking rainwater.

Unfortunately the Figtree Place and Maryville experiments revealed significant institutional resistance to the use of rainwater stored in tanks. This resistance often manifested itself in the guise of health and economic concerns. However Chapters 2, 3 and 4 reveal that these issues may not be as significant as they were made out to be. Indeed experience shows that there are many assumptions and myths about the use of rainwater tanks. To some extent the rainwater tank has been demonised. Why is this so?

In order to understand and evaluate resistance to the use of rainwater tanks this Chapter will examine the history of water supplies, and the development of sewerage, water supply and stormwater paradigms.

5.1 A Brief History of Rainwater Tanks for Water Supply

Capture of rainfall runoff from roofs in tanks (cisterns) for domestic uses is an ancient practice [Pacey and Cullis, 1986 and Heggen, 2000]. The use of rainwater tanks in the early settlement of Newcastle in New South Wales is well documented. In the 1800s rainwater tanks erected above or below ground were used to collect rainwater from roofs for household uses [Lloyd et al., 1992 and Armstrong, 1967]. In the majority of cases square black iron tanks with a capacity of 400 gallons erected above ground were used for water supply. Underground rainwater tanks with a capacity of about 3,000 gallons were constructed of brick and rendered with cement.

The underground rainwater tanks posed a considerable health hazard because they were often poorly constructed allowing sewage from adjacent cesspits, stormwater from roads and seepage from the cemeteries on higher ground to enter the tanks [Lloyd et al., 1992, Armstrong, 1967]. Outbreaks of Typhoid were common. Although it was often suggested roof runoff captured in tanks was contaminated by coal dust and disease, water supply from above ground tanks caused relatively few health problems [Lloyd et al., 1992].

During droughts the household rainwater tanks would empty forcing the residents of Newcastle to draw water from shallow public wells. These wells collected sewage, stormwater runoff and contamination from roads, household yards and coalmines. The shortage of water from household tanks during droughts forced people to drink from the polluted wells resulting in increases in the number of Typhoid and Cholera cases.

Fires in the new settlement were fought with water drawn from tanks, wells or creeks. Invariably the fires burnt uncontrolled because the water supply was insufficient to extinguish the fire. Water shortages that resulted from droughts and insufficient water for fire fighting led to calls for a permanent water supply [Lloyd et al., 1992 and Armstrong, 1967]. Construction of the Walka Water Works began in 1880. Mains water was supplied to Newcastle and Maitland in 1885, and to East Maitland and Morpeth in 1888.

The New South Wales colonial government constructed the Walka water supply scheme at a cost of £350,000 and sold bulk water supplies to local councils at a cost of 1s. 6d. for 1,000 gallons [Lloyd et al., 1992 and Armstrong, 1967]. The local councils sold the water to residents. A sum of £18,000 was needed every year to pay interest and operating expenses but the government was only receiving about £6,000 per year from water sales. The local councils were also in serious debt. Newcastle Council had accumulated a debt of £3,000 by the end of 1888.

The majority of residents would not connect to the mains water supply or pay for water preferring to use household water tanks and when tanks were empty source water from public standpipes or wells [Lloyd et al., 1992 and Armstrong, 1967]. The government realised that it would not be repaid for the Walka water supply scheme until residents were compelled to use and pay for mains water. In 1892 the Hunter District Water Supply and Sewerage Act was ratified by the New South Wales State Parliament requiring that all residents pay for the water supply even if they did not use it to ensure that government debt was repaid [Armstrong, 1967].

Water rates were levied on properties within 60 m of the water mains. This created an inequable situation for many residents. People could not afford to connect to the water supply and were forced to pay for water they could not use. Indeed many of these people had previously incurred considerable expense to construct rainwater tanks and wells, and did not require the mains water supply [Armstrong, 1967].

In 1894 about 75% of residents were not connected to the mains water supply and did not require connection. In accordance with the Hunter District Water Supply and Sewage Act many residents were prosecuted by the court for not paying the water rate even though they were not connected to the mains water supply [Lloyd et al., 1992]. Residents were thus forced to use mains water by the courts. They were also encouraged to remove their rainwater tanks and use mains water by the government [Lloyd et al., 1992 and Armstrong, 1967].

The government and the media played an active role in portraying the mains water supply as superior to household tanks. People who refused to use the mains water were condemned for their “dirty apathy” in print and by the government [Lloyd et al., 1992 and Armstrong, 1967]. Many residents removed their household rainwater tanks and connected to the mains water supply only to find that the water was unacceptably hard. The New South Wales Public Works Department explained to the citizens that hard water from the mains was significantly purer than soft water from roofs [Lloyd et al., 1992].

Ambiguous hygiene requirements in the Hunter Water Supply and Sewerage Act also enabled water authority employees to enforce the removal rainwater tanks from households [Armstrong, 1967]. In the years that followed many residents were told their rainwater tanks were not safe and were forced to remove them [J. Belshaw, personal communication, 1999]. Wade [1999] explains that legislation was often used to stop Australians from retaining their rainwater tanks after the installation of a mains water scheme in their town.

The need for a reliable source of water during droughts and for fire fighting led to the introduction of mains water supplies. To ensure the economic viability of the new centralised water supply paradigm the use of rainwater tanks was discouraged by the levying of water rates, legislation and education. The government also educated the community that mains water was good and rainwater from tanks was bad to ensure that debt was repaid. Lasting normative values were created in the community that rainwater tanks should not be used.

Resistance to the use of rainwater tanks originated from government endeavours to ensure the economic survival of new water authorities. Unfortunately this has resulted in a centralised water supply paradigm that is seen as the panacea for urban water supply to the exclusion of all other solutions. Although resistance to the use of rainwater tanks is manifested as water quality concerns the resistance is still driven by economic factors. The rainwater tank in the modern age does not threaten the viability of water authorities but rather it is perceived to challenge the monopolies and profit margins they maintain [Wood, 2000].

5.2 The Operation of the Pipe Paradigm

Kuhn [1970] determined that the development of science consists of periods of normal activity and times of scientific revolution. During periods of normal activity scientific research concentrates on past discoveries that scientists consider to be fundamental to their work. Scientific revolution occurs when scientists no longer agree that past achievements are fundamental to their work and new theories are presented.

The past discoveries that form the basis of normal scientific endeavour define the problems and methods used in research. A scientific paradigm consists of the laws, applications, theories and instrumentation that are developed from past discoveries [Beder, 1998, pp. 76]. The operation of a scientific paradigm will eventually reveal inconsistencies that the scientific community cannot reasonably ignore, forcing scientists to acknowledge that the paradigm is no longer adequate [Kuhn, 1970].

The engineering community strongly resists the need to change engineering paradigms. Beder [1998, pp. 139] explains that anomalies between theory and reality that are revealed by engineering paradigms (such as the sewage disposal paradigm) are not consistently tested because a good enough result is all that is required from an engineering paradigm. Good enough engineering solutions are defined by legislation that is shaped by engineering paradigms currently in place. There is no mechanism for change in the operation of an engineering paradigm.

Hawken et al. [1999, pp. 214] reveal that water projects are developed without consideration of the best solutions and appropriate scales. Water supply solutions are chosen from a limited selection of ideas that make up the water supply paradigm. Hooker [1995] explained that technocrats are biased against new forms of technology preferring to recommend technologies from existing paradigms because the performance of a new technology is perceived to be uncertain. The introduction of new technology is also resisted by the mechanisms of the economic market [Hooker, 1995]. Institutions that have invested in existing methods and infrastructure that serve a current paradigm have a vested interest to maintain the paradigm.

The urban water cycle consists of three main engineering paradigms: stormwater and wastewater disposal and water supply. All three paradigms are actually based on a centralised control and pipe transport paradigm (the pipe paradigm). Beder [1993] explains that the pipe paradigm is popular with authorities because it ensures that water supply and wastewater disposal is a relatively automatic process and is a public rather than individual responsibility. The centralised nature of pipe paradigm also provides significant control, power and revenue to central authorities such as water authorities, local and state governments. The perception of lost power and revenue is a major source of institutional resistance to the use of decentralised technologies such as rainwater tanks.

Powerful institutional bodies such as the Institution of Engineers, Australia; and the Australian Water Association have perpetuated the pipe paradigm. These institutions perpetuate the pipe paradigm through education and practice that is specified in accordance with the paradigm. Beder [1993] states that this has resulted in the domination of the wastewater disposal and water supply industries by engineers who have discarded the search for better solutions because the consensus is that the pipe paradigm is adequate.

5.3 Summary

Mains water supplies were constructed at considerable expense in the 1880s and 1890s in the Lower Hunter region of NSW to ensure that a reliable source of water was available during droughts and for fire fighting. The NSW Government and water authorities could not recover the debt incurred in the construction and maintenance of mains water supplies because citizens refused to connect to or pay for mains water preferring to source rainwater from household tanks and community wells.

The NSW government enacted legislation in the 1890s that forced citizens to pay for water even if they did not use it to repay government debt. The legislation also allowed water authority staff to enforce the removal of household rainwater tanks. A campaign was conducted by the NSW government in the media to proclaim that citizens that refused to connect to mains water supplies were unclean and that rainwater from tanks was inferior to mains water to encourage the use of the mains water system.

Institutional resistance to the use of rainwater tanks was fostered to ensure the economic viability of the new centralised water supply paradigm. The operation of the water supply paradigm and lasting normative values that rainwater tanks should not be used has served to exclude the use of rainwater tanks in urban areas that have a mains water supply. The evolution of the centralised control and pipe paradigm for water supply, stormwater and sewage disposal has created further resistance to the use of source control measures such as rainwater tanks.

Paradigms change when evidence accumulates to the point where the current paradigm is no longer deemed to be tenable. However the engineering community has accepted that the pipe paradigm is adequate for water supply, stormwater and sewerage management therefore better solutions are not required. The pipe paradigm is considered to "serve us well". Institutions such as water authorities and local governments resist changes to the pipe paradigm because they require centralised control of infrastructure and the revenue that this control generates. However the use of rainwater tanks may provide significant benefits at the subdivision and regional scales that result from reduced stormwater discharges, mains water demand and environmental impacts. Indeed the use of rainwater tanks may complement the existing pipe paradigm to produce significantly improved urban water cycle outcomes for the community.

In Chapter 6 a water balance model is developed that will allow analysis of the long-term impact of the installation of domestic rainwater tanks on mains water use and stormwater discharges. This model will work at time steps that will allow an understanding of the impact of rainwater tanks on water supply and stormwater infrastructure. The water balance model will be used in conjunction with a stormwater drainage model in Chapter 7 to evaluate the impact of rainwater tanks on the provision of stormwater infrastructure.

In Chapter 8 the water balance model will be used with a regional demand model to understand the impact of rainwater tanks on regional water demand. The regional demand model is used in conjunction with a water supply headworks model to evaluate the impact of the use of rainwater tanks on the provision of new dams in the Lower Hunter and Central Coast regions in Chapter 9. The results from Chapters 6 to 9 are combined in an economic model in Chapter 10 to determine the economic impact of the installation of domestic rainwater tanks on the urban water cycle.