

THE AUSTRALIAN
WATER ASSOCIATION'S

50

*50 years of
water in australia*

1962 - 2012



*Leading Australia's
water industry*
50
years

foreword from the President and CEO

Fifty years is a milestone worth celebrating and reflecting on, particularly in a sector where there have been so many challenges and developments. And so, as AWA approached this significant birthday, we considered it only fitting that we commemorate it with a permanent record of the people and events over that time. Hence this book is about the achievements of both the Australian water sector and the Australian Water Association (AWA) over the years 1962 to 2012.

In reviewing these past 50 years, this book also demonstrates why Australia is recognised globally for its skills, expertise and knowledge in all things water. It showcases the people, organisations, projects and programs that make our sector a world leader.

We would like to thank the past Chief Executive Officer of AWA, Chris Davis, for his outstanding work in researching and writing this book. Chris was very generous with his time, going through old AWA records, speaking with long-time members and scouring through public records. We know it is a book that will be treasured by AWA members – past and present – and will be read by members for years to come.

We thank all the members that contributed to the book throughout its many iterations, in particular Frank Bishop, Rod Lehmann, Richard Marks, John Parker and Barry Sanders. Branch committees were also involved in ensuring no key moments were missed and we appreciate their efforts as well and hope that it reflects all pivotal events as accurately as possible.

As Chris concludes in the book "The only certain prediction must be that the next 50 years will be at least as dynamic as the last. AWA will continue to maintain its relevance and play a key role in shaping the future for the Australian water sector." We believe this indeed true and we both look forward to the years to come.

We hope that this book will not only be enjoyable reading as a historical record, but will also inspire future water professionals to great outcomes in the years to come.

Tom Mollenkopf

Chief Executive
AWA

Lucia Cade

National President
AWA

preface

This booklet is a narrative which weaves together, as coherently as I can, story lines about the water industry in Australia and the establishment and evolution of the Australian Water Association. The timeline covers 50 years, from 1962 when AWWA (as it was then known) was founded, until 2012. It is not a scholarly work, although I hope expert readers will not find too many errors. I also hope some of the trends and influences will resonate with older readers, while younger people might appreciate learning about the origins and contextual flavor of water, mostly leaning towards urban, but picking up on some key rural issues too.

Many thanks to people who contributed and/or commented, mainly: Frank Bishop, Rod Lehmann, Richard Marks, John Parker and Barry Sanders, as well as others who made collective suggestions through AWA branches.

Chris Davis

Editor

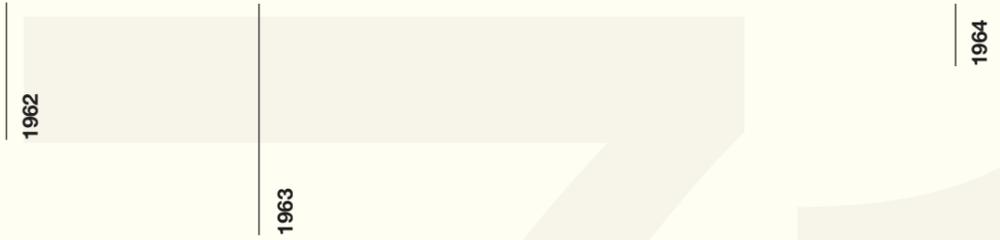
historical context

Water has been at the heart of Australia's affairs from the beginning of European settlement. Governor Phillip chose Sydney Cove in 1788 as the landing place for the First Fleet because it was the only site which appeared to have a reliable stream of fresh water. The 'Tank Stream', established there, was to be Sydney's only public water supply for about 40 years.

The Common Law of England provided a foundation for the management of the colonies' water resources. Problems with water management emerged early for the new colonies, especially in view of Euro-centric expectations and the vagaries of Australia's climate.

By the time of Federation in 1901, water was vested in the Crown, but the Constitution devolved most aspects of water management to the states and territories. That disposition set the tone for water management thereafter and, by the second half of the 20th Century, governments and their agencies were wrestling with many challenges.

post-war backlog
1962 - 1971



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Although World War II had ended in 1945, Australia was still dealing with the aftermath in the 1960s. By 1962, infrastructure that was vital for water supply and sanitation was being built rapidly in most Australian cities to catch up with an accumulated backlog. Australians were beginning a long-term love affair with home ownership – the housing style of choice was the quarter-acre (about 1000 m²) block, necessitating mains water supplies and water-borne sewerage. A shortage of building materials had slowed the rate of housing construction, but the pace had increased by the early sixties and utilities had difficulty keeping up with the demands on infrastructure.

Irrigated agriculture was also growing and dams were needed to even out the natural variation in rainfall. This decade was the first of three during which half of all Australia's large dams were built. Work was well under way on the massive Snowy Mountains Scheme, which had been conceived in the 40s and Sydney's Warragamba Dam had been completed in 1960 and was filling.

It became clear to all the stakeholders that information about water resources was lacking, so, in 1963, the first

comprehensive appraisal of Australian water resources was carried out.

Australia has always had a strong reliance on groundwater as a source, not as critical as some other countries' but important, especially in specific locations. The Great Artesian Basin (GAB) underlies a large proportion of New South Wales and Queensland and has numerous natural mound-springs, which build up like oases in the parched region; as well as numerous drilled bores. Many of those drilled bores had fallen into disrepair and were losing water which was effectively being wasted. By the sixties, there were about 1,100 bores operating in the GAB, delivering 3,000 ML/d, but only 50 bores had been rehabilitated.

A surge of interest in groundwater led to widespread exploration and monitoring and was the main impetus behind the growth of the fledgling profession of hydrogeology. Expanding mining activity was also a driver for training in geology; the two professions having close ties. In addition to the mainly surface water consultancies in operation in the 60s there was the emergence of groundwater specialists.

The Murray-Darling Basin, straddling five jurisdictions (Queensland, New South Wales, Australian Capital Territory,



Victoria and South Australia), had been the food bowl of Australia for years after the rivers had initially served mainly for navigation. The advent of irrigated agriculture in the 1880s had turned the Basin into a highly productive region. Contentious aspects of water allocation between the Basin states had been managed by the Murray Commission since 1918.

By the end of the 1962/1963 season, a diversion dam on the Ord River had been completed at what is now Kununurra in the far north of Western Australia; it was opened by the then Prime Minister, Sir Robert Menzies, in 1963. Motivation for this project was the potential to irrigate in what was otherwise an arid area and funding from the West Australian government was made available in 1967. The diversion dam was the first of two stages in the Ord project.

Managing water allocation was beginning to become problematic, although full realisation really only came later. Licences for irrigation water were being handed out freely with little regard to the wide variability of annual flows. Water rights were attached to land title and licences were generally expressed in terms of volume per unit of land area. Water trading, on a formal basis, was unknown, although during a drought in 1966/67 the New South Wales government allowed informal trades between neighbouring farmers.

After both world wars, returned soldiers had been resettled on small irrigation blocks underwritten by Commonwealth funds. However, blocks tended to be too small to be viable, so consolidation began to occur. In the 60s a cotton industry began to grow, as did mining, both placing demands on surface water and groundwater. The rice industry, which had been initiated in the 1920s, was well established and the areal extent of plantings, mostly in NSW, was 16,000 hectares by 1960.

The urban water utility landscape in the 60s varied across the six states and two main territories that make up Australia. New South Wales, the most populous state, had a mix of institutions. Sydney's metropolitan area was served by the venerable Metropolitan Water Sewerage and Drainage Board

(MWS&DB) which had been established in the late 19th Century following a Royal Commission into the very severe drought of the 1850s. By 1961, the population served was around 2 million. The MWS&DB was a large empire, run by engineers who were by nature very conservative. Much of its construction work was carried out by day labour, so the total staff complement was around 14,000. Almost as old, and equally conservative, was the Hunter District Water Board, serving communities centred on Newcastle, some 160 km north of Sydney. The total population of the Newcastle-Manning region was just a quarter of a million, so it was much smaller than Sydney. Broken Hill, in the far west of NSW, was also serviced by a state-owned water board. The rest of the state's communities received their water supply and sewerage services from local councils, over 125 in all. Technical support, capital subsidies, training and monitoring of the many council systems was provided by the Public Works Department.

Victoria, the state with the second largest population, had a similar institutional landscape, with a notable difference in that there were more than 400 small towns and villages across the state, each having its own water supply business, affiliated to the local authority and to a sewerage authority. The Melbourne metropolitan area (the 1961 population was about 1.9 million) was managed by the Melbourne and Metropolitan Board of Works (MMBW) which, unlike MWS&DB in Sydney, included waterways in its purview.

Queensland had each local authority in charge of water supply, sewerage, drainage and stormwater within its boundaries, and there were some 134 councils across the state, including Brisbane City Council, which serviced about 625,000 people in the greater Brisbane area in 1962.

South Australia had a different arrangement, involving one, central agency, the Engineering and Water Supply Department (EWS) which managed urban water for the whole state and sewerage for the metropolitan area and larger towns, while local councils provided sewerage for smaller towns. The Adelaide metropolitan region's population

in 1961 was 480,000; by comparison, the 2011 figure was around one million.

In Western Australia, there was a Metropolitan Perth Water Board and country water and sewerage branches of Public Works Department which gave way to a statewide Water Authority from 1985. Metropolitan Perth went from a population of around 500,000 in 1961 to 1.7 million in 2011. Tasmania had a council-based model, very similar to Queensland's, under which nearly 30 local authorities provided water services to their communities. Hobart was the largest, but the metropolitan area had several other councils in close proximity; then there were many very small, rural towns. As the population of the whole state was only 350,347, none of the utilities was very substantial. Hobart's water supply was split between a bulk water agency of the State Government and the distribution and retail functions performed by Hobart City Council.

The Australian Capital Territory had its water supply and sewerage managed by the National Capital Development Commission, with technical assistance from the Australian Department of Housing and Construction. The total population, according to the 1961 census, was 58,828.

The vast, but thinly populated (27,095 in 1961, not including 'full blood aborigines'), Northern Territory, had a single agency, the Power and Water Authority, to look after both electricity and water services.

Across the country, these arrangements had been quite stable for decades. The diversity of approach reflected the constitutional devolution of authority to the jurisdictions to manage their own water systems. The water utilities wielded enormous power by comparison to today's, particularly in Melbourne, where a larger-than-life character, Alan Croxford, was in charge from 1966 until the early 1980s, and Sydney, where Ted Walder was the mandarin. An article in the Sydney Morning Herald of 25 June 1967 was highly critical of a Board which failed to deliver mains sewerage services to 600,000 of its residents. The average Sydney water consumption then was 500 GL/y, more than in 2011, but

restrictions were in force and the Board rejected suggestions that water should be charged for on consumption.

The major water and sewerage utilities were very large, vertically integrated businesses; they evolved their own standards for hardware and design, and had large design departments, substantial construction workforces, as well as support workshops and, in some cases, foundries. From 1925, an informal 'club' existed among the major utilities, known as MUWAA, Major Urban Water Agencies of Australia. Senior officers met in different cities, biennially, in rotation, to discuss matters of common interest, including technology exchange and administration advances.

In the early 60s, a small band of consulting firms serviced the water industry. These included Gutteridge Haskins & Davey, Scott and Furphy, Garlic and Stewart, C W Candy & Associates, C D Parker Pty Ltd and the recently established Sinclair Knight. In Western Australia, the local firm was G B Hill. Compared to 21st Century consulting businesses, these were very small practices. Fees were based on the scope of work, the estimated cost of construction and the complexity; a typical figure being six per cent for design and supervision of construction. Rates were laid out in a publication from the Association of Consulting Engineers. Clients selected firms on their perceived merits and there was no question of fees-based competition.

Prescient leaders in Sydney, Melbourne and Perth had ensured that the surface runoff catchments for their water supplies were protected or even completely quarantined and, as a result, the quality of the runoff was so good that treatment was not needed, beyond basic chlorination. In Melbourne, at least, chlorination was not employed at all until much later.

Most Australian cities had a combination of gravity sewers (typically vitrified clay pipes at the local street scale), septic tanks and night carts. Many suburbs had been laid out with back lanes down which night carts could travel to collect buckets of 'sullage' from backyard dunnies (toilets). The typical pattern of development was to construct gravity sewers where the topography was favourable, leaving more challenging

locations to night carts or septic tanks. In situations where it was impractical to dispose of septic tank effluent by soakaways, the tanks were effectively just sullage holding tanks, to be emptied by a 'honeysucker' once filled. By 1965 Adelaide was near to 100 per cent served by mains sewerage, ahead of all the other capitals. Australia's first large activated sludge sewage treatment was built at Glenelg in the 1930s and was considered a world leader of its day, given that the activated sludge process was only deployed at large scale in the 1920s in England. Australia's second large activated sludge plant was built at St Mary's in Sydney in the 1960s.

Where sewers were in use, most inland towns deployed trickling filters (biofilters) for sewage treatment. In Western Australia, most communities had oxidation ponds, which were cheap to build and operate, but which required large land areas; not a constraint in WA. An early experiment in Subiaco, WA, however, had been to install an activated sludge plant, with very crude, coarse bubble aeration, simply pumping air through pipe nozzles. The plant was problematic and had to be upgraded over the years.

In the 19th Century Melbourne had established a massive sewage treatment system at Werribee, to the west of the city. The installation, now known as the Western Treatment Plant, made use of lagoons, grass filtration and land treatment before discharging the effluent into Port Phillip Bay. The grassland was used for grazing cattle and sheep and the plant was the largest of its type in the world. One of Australia's largest livestock farmers was, in fact, the Melbourne and Metropolitan Board of Works.

For most coastal communities, ocean outfalls were the norm, sometimes just with sewage screened before discharge and otherwise with primary settling tanks to scalp some of the suspended material before discharge. The relatively new, activated sludge process (invented in 1914) was gradually being established across Australia, requiring a higher level of skill in the sanitary engineering profession.

After an initial meeting in 1961, at which a World Health Organisation official emphasised the need for holistic water

organisations, a multi-disciplinary group of concerned practitioners in urban water set up the Australian Water and Wastewater Association (AWWA) in June 1962. Up to that time, the Institution of Engineers, Australia and the Royal Australian Chemical Institute had both been professional homes for people with an interest in water, but neither had allowed professionals outside their own discipline to belong and AWWA met the need for all relevant disciplines to be represented. The association also had the aim of improving professional skills in the urban water industry in particular, to cope with new water and wastewater treatment processes.

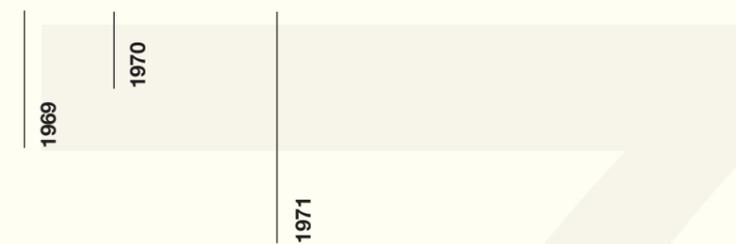
The choice of a name for the new organisation was not any easy one and, in the end, AWWA was a compromise. Its initials were the same as those of the American Water Works Association, which led to confusion for years. Luckily, relations between the two AWWAs were good, so the name clash did not affect interaction.

To become a full member of AWWA, a candidate had to be nominated by two existing Members, hold a relevant tertiary qualification, and have experience in the industry. Associate membership was available to non-professionals, while organisations could join as Sustaining Members. The carrot for full members was being able to use the post-nominals, MAWWA, although the title never quite achieved the gravitas associated with the long established, professional societies.

The new organisation had a federal structure, with branches, initially, in Victoria, New South Wales, Queensland and South Australia. The inaugural Federal President was Jim McIntosh and the Hon Secretary Treasurer was Guy Parker. By 1963 membership totaled 364. In 1964, the first Federal Convention for AWWA was held in Canberra, attended by 64 delegates and incurring a loss of £340. Despite the loss, the event was judged to have been a success and the Federal Council resolved to run the Convention biennially, which it did, for several decades, growing in size and stature. By 1969, there was an AWWA branch in the Australian Capital Territory.

It is interesting to note that the AWWA was not formally incorporated for its first ten years of existence – a risk no

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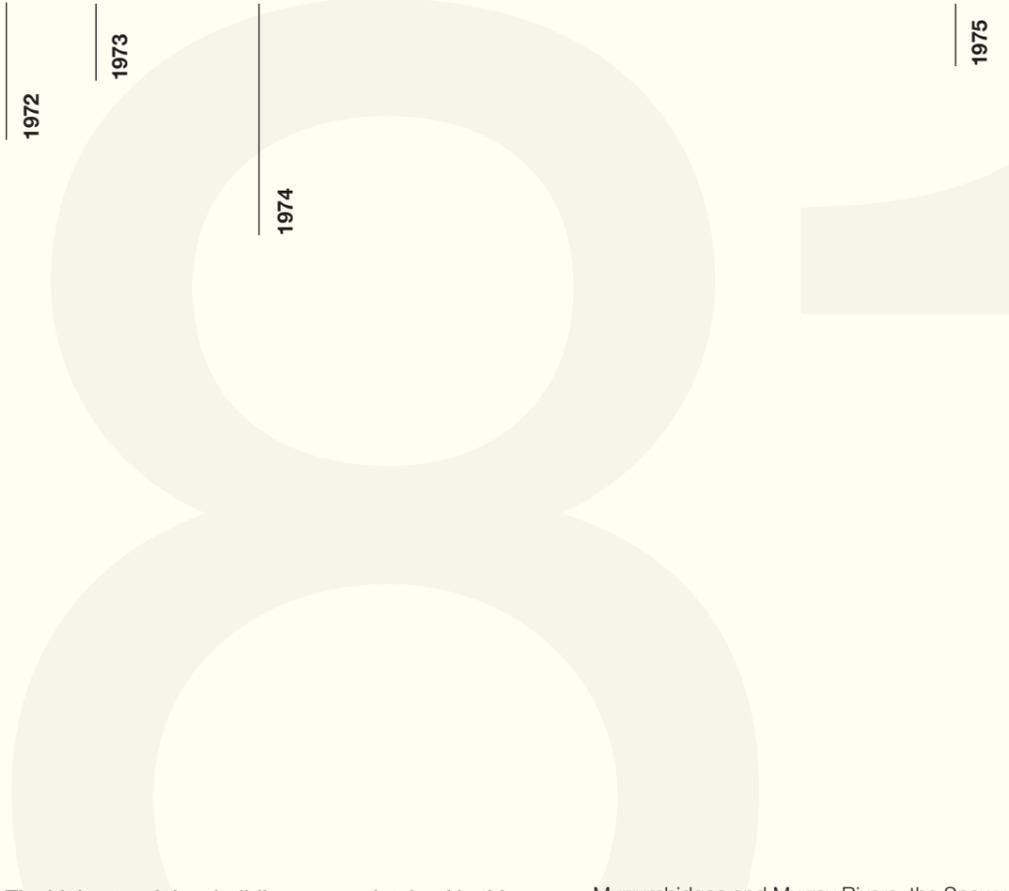
prudent body would take in today's litigious world. The Association's first logo was an amateur rendition including images of a city, factory and pipes, reflecting the association's urban and technical roots, not to mention an absence of graphic designers.

From its earliest days, AWWA established cordial relationships with the Water Pollution Control Federation (WPCF), the American Water Works Association (AWWA), and the International Association for Water Pollution Research (IAWPR).

By the end of the decade, the pace of dam building was unabated and the next ten years saw that momentum maintained.

more dams
1972 - 1981

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ASSOCIATION'S 50 YEARS



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The high rate of dam building was maintained in this decade. From 1972 to 1981 more than 75 large dams were completed. There are various drivers for dam construction: bolstering urban water supplies, serving irrigation districts, hydroelectricity (including pumped storage), flood protection and recreation, not to mention the political kudos of being the proponent or presiding dignitary at the opening of a large civil engineering structure. Dam design and construction featured prominently in contemporary engineering education and exemplified the civil engineering credo of 'harnessing the forces of nature for the benefit of mankind'.

Australia's largest water storage, Lake Argyle, was created by the main Ord River Dam; completed in 1971 and filled by 1974, covering a massive 980 square kilometres. Development of irrigation in the Ord scheme proceeded more slowly than had been expected: water was plentiful, but markets were far away and finding labour in this remote area was problematic.

The Snowy Mountains Scheme came to fruition in 1974 after 25 years of planning and construction. Aside from storing water (mostly snowmelt) and delivering it into the

Murrumbidgee and Murray Rivers, the Snowy Scheme brought the flexibility and responsiveness of pumped storage hydroelectricity which has ever since helped stabilise the eastern Australian electricity market and deliver up to ten per cent of the electricity demand of New South Wales. Engineers who worked on the Snowy Mountains Scheme were held in high esteem by their colleagues.

At a capital cost of \$820m, it was the largest ever Australian infrastructure project up to that time. The magnitude of the Snowy Scheme was such that many post World War II migrants from Europe were employed in its construction, bringing a degree of multiculturalism that Australia had not experienced before. Of the total workforce of 100,000, 70 per cent were migrants. The Scheme includes sixteen major dams, seven power stations, a pumping station, and 225 kilometres of tunnels, pipelines and aqueducts. This makes it one of the most complex hydroelectric schemes in the world. The entire scheme covers a mountainous area of approximately 5,124 square kilometres in southern New South Wales.

On the negative side of the ledger, water was diverted from the iconic Snowy River in NSW, reducing the once substantial

1976

1977

1978

1979

river to a trickle in its upper reaches – the cause of ongoing community concerns and the problem was to persist for decades.

Brisbane suffered major flooding in 1974, which accelerated long-standing plans to build the Wivenhoe Dam upstream. Wivenhoe was conceived, however, as a multi-purpose dam, to deliver flood protection, water supply and pumped-storage hydro-electricity, as well as recreation. It was not to be officially opened until 1985.

On the other side of the rainfall coin, although its import was not immediately apparent, Perth in Western Australia began to suffer what appears to have been a step change in its climate, with runoff from its surface catchments falling from the mid-70s.

Burgeoning irrigation farming enterprises, mainly fodder, cotton and rice, were thirsty and governments strove to support them by building dams across the country. Dam designs were predicated on yield estimates based on the existing hydrological record, which dated, at best, back to the late 1800s. Australia has naturally variable rainfall, equaled only by South Africa for its erratic nature, in time and location. What was not apparent to hydrologists at the time was that the period from 1950s to 1960s had been unusually wet, which inflated the estimated yields, from rivers and the dams across them. Governments, particularly in New South Wales, responded by issuing many substantial, free water licences to farmers. It was only later that realisation dawned – nominal entitlements from all issued licences exceeded reliable yields by what was, in New South Wales at least, a substantial margin.

Major dams were completed in all jurisdictions, the largest being:

Gordon (Tasmania) 12,359 GL

Argyle (Western Australia) 10,760 GL

Dartmouth (Victoria) 4,000 GL

Although the focus of water resource management in the decade seemed to be on the volume of water, there was

a growing emphasis on water quality in the urban context. The Metropolitan Water Agencies of Australia (MUWAA) published the 1972 Australian Drinking Water Guidelines (ADWG), with the imprimatur of the National Health and Medical Research Council (NHMRC). The Guidelines were updated again in 1981 and, although not mandated, they acted as a de facto standard and most water utilities strove to comply with the water quality nominated in ADWG.

In this era sewage treatment was dominated by American technology, hardware and firms. Several major, iconic treatment plants were commissioned in the decade:

- Melbourne's South-eastern Purification Plant was commissioned at Carrum in 1974/5 - a fine-bubble, diffused air aeration activated sludge plant, designed by a consortium of John Connell and Brown & Caldwell (from California).
- Canberra's Lower Molonglo Water Quality Control Plant was commissioned in 1976 – a very elaborate activated sludge plant, with denitrification (using methanol as an external carbon source), sludge incineration and other features, including fine bubble diffused air aeration, similar to Carrum's. It was the most expensive plant in Australia, but also produced the highest quality of effluent. The consultant for the project was Caldwell Connell, the merged firms of John Connell and Brown & Caldwell.

At the other end of the size spectrum, technical evolution occurred across New South Wales, where the Public Works Department led the way in small sewage treatment plants. First, the Pasveer ditch was adapted from European practice, then the homegrown, eponymous Bathurst Box was developed. The concept was an evolution of sequencing batch reactors but, instead of batching the feed, a continuous inflow was allowed, with intermittent decanting over a weir flap.

The consulting landscape became very fluid, with allegiances and ownership changing and involving various combinations of local, US and UK firms.

AWWA was formally incorporated as an association in the Australian Capital Territory in 1972 and membership grew,

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1980

1981

reaching 758 by June 1972. Branches were established in Western Australia (1972), Tasmania (1973) and the Northern Territory (1974). Also in 1974, the journal 'Water' began publication and has been in print ever since. Never intended as a purely scholarly publication, 'Water' was (and remains) a useful bridge between water research and practice, as well as being a magazine for the urban water industry. The starting frequency was four times per year and early editions were relatively slim, 24 - 32 pages each.

As the Association became more sophisticated, its logo was revamped, becoming a shield with two wavy lines to symbolise water.

The AWWA Biennial Federal Convention was held in Adelaide in 1972 (220 delegates) and Melbourne in 1974, but the conference of the International Association for Water Pollution Research took place in collaboration with AWWA in Sydney in 1976. This led to abandoning of the initial, even-year pattern, so subsequent Conventions were held in odd years, commencing with Canberra in 1977.

An innovation for AWWA was a summer school, aimed at new graduates and held in Brisbane during 1973. This filled the program gap in off years between Federal Biennial Conventions, as well as rounding out the content of most bachelors' degrees on offer in Australian universities.

As membership of AWWA had grown to nearly 1,000, the administrative burden increased to the point where a part-time administrator, Judith Sears, was engaged; but financial management proved to be difficult and a crisis meeting was held in 1976 to address the money problem. The outcome was a commitment by the Melbourne and Metropolitan Board of Works to provide a 'volunteer' Treasurer (Jim Greer) while the Sydney Metropolitan Water, Sewerage & Drainage Board offered a Secretary (Peter Hughes, then Assistant General Manager and previously with the Snowy Mountains project). Sydney's Water Board (MWS&DB) also generously offered free accommodation, so AWWA's office was set up on the 23rd floor of the headquarters building on the corner of Pitt and Bathurst Streets in the city. The basic

membership fee for AWWA had increased, to all of \$12 per annum.

In 1980 Dr John Paterson, an economist, was appointed as Managing Director of the medium-sized, traditional water utility that serviced the NSW city of Newcastle and surrounds, the Hunter District Water Board. Paterson's tenure in the Hunter was short, less than two years, but the reverberations of his reforms still echo in the industry. Up until then, water utilities had been managed by engineers, who naturally brought a technical bias to their work – all of that was beginning to change.

A national thrust towards micro-economic reform impacted the water industry, following the lead of Dr John Paterson, who had controversially introduced the user-pays concept to Hunter District Water Board. Until then, water businesses had charged for services through what were effectively property rates; at a percentage of the property value.

In terms of timing, the Metropolitan Water Board in Perth had commissioned a study in 1979 by UK consultants, Binnies, into aspects of financing the business. Among the recommendations by Binnies was one which urged the introduction of a two-part tariff. This was implemented for Perth in 1980, just ahead of the well-known Hunter initiative.

reform begins
1982 - 1991

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A national thrust towards micro-economic reform spilled over and into the water industry.

Although many properties were metered, customers were only charged on a volumetric basis if they used 'excess' water. The threshold was so high that only the most profligate of consumers incurred the excess fee. Dr John Paterson's user pays tariffs were introduced in 1982 and led to a sustained drop of about 20 to 29 per cent in Hunter Water's consumption. Not content with only tariff reforms, Paterson had also begun splitting off services which could be contestable and establishing business units which could compete on the open market, or even become privately owned commercial entities.

Among the ranks of the long-established and intrinsically conservative water industry, the emerging reforms were seen to be threatening and caused great disquiet, but they were consistent with national microeconomic reform policy and were unstoppable. The range of services open to contestation in major water businesses was increased and the amount of work done under day labour diminished.

The Sydney Metropolitan Water, Sewerage and Drainage Board separated the role of chief executive and chairman

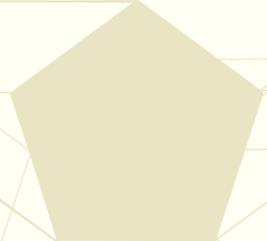
and appointed its first female Chairman, Dr Rhonda McIver, an economist. In 1987, the old MWS&DB title was dropped in favour of Sydney Water Board.

Dam building increased marginally; the decade of 1982-1991 saw a total of about 83 new large dams added to the national stock. This included the Thomson Dam, a 166 metre high earth-fill and rock-fill dam, which was completed in 1983 and is Australia's second highest dam; providing water to Melbourne.

In 1985 the Wivenhoe Dam was officially opened. The dam's capacity was divided between the needs of water storage, flood mitigation and pumped storage hydroelectricity.

A national drought in 1982/3 focused attention on reliability of water supplies with agricultural production falling by a total of 40 per cent.

One of the key water challenges nationally was salinity, induced through a combination of natural phenomena (mainly ancient ocean deposits and millennia of salt-laden rainfall), deforestation, and over-irrigation in vulnerable areas. Complicated salt management and interception schemes were developed for the Murray-Darling Basin, but the future looked bleak, as it did in the West Australian wheat belt.



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By the early 1980s, community opposition to the old cliff-face sewage outfalls in Sydney grew, to the point of public demonstrations and marches in 1989. A giant turd featured prominently in the marches. Fortunately, the Water Board had begun work in earnest on the design and construction of deep ocean outfalls off Manly, Malabar and Bondi. These were commissioned in 1990. The immediate and dramatic improvement in water quality in the area successfully defused the situation, although the then Opposition in New South Wales made noises about 'devoluming' and ultimately decommissioning the outfalls. Ongoing monitoring of ocean condition has demonstrated that there have been no detectable negative impacts on ecosystems as a result. Attention to the outfalls gradually diminished, especially as Sydney Water made improvements to the sewage treatment plants at Manly, Malabar and Bondi, further reducing impacts on the ocean.

In the mid-80s, a small technology company, Memtec, began promoting membrane filtration technology which had been initially developed in the medical industry. The plate-and-frame microfiltration membranes were effective in excluding pathogens, but the costs were too high to be practical. After a few years, the firm developed a hollow fibre membrane which, if frequently backwashed (including an air bump), was more cost effective and began to carve a niche for itself. Early modules bundled one square metre of membrane fibres in a small pressure vessel, but much larger modules were to follow and the technology began to make inroads globally. Peter Hughes, who had been the honorary Federal Secretary

of AWWA since 1976, was engaged as the first, part-time Executive Director in 1986, having retired early as Engineer-in-Chief of the 'Water Board' in Sydney, when he was in the early stages of Parkinson's disease. By 1988 it became apparent that AWWA needed more staff resources to cope with growing membership and increased activity. Margaret Bates was hired as part-time Office Manager. She introduced the first Services Directory, which continued to become the Association's annual Handbook, then the Water Directory. AWWA moved to Sydney Water's offices in Chatswood, but soon after it moved, for the first time, to its own premises in a small, first floor office at 76 Hampden Road, Artarmon. AWWA's highest accolade, the George Goffin Award, was initiated and, in 1987, given to George Goffin, who had been Federal President for two terms (1971-1973) and had served as Editor of 'Water' from 1979 to 1988. The second recipient of the award was Peter Hughes, for his services as Federal Secretary, then Executive Director.

According to AWWA's 1992 Handbook, capital expenditure for the water industry across Australia was \$635 billion in 1989/1990 and turnover was \$855m.

After a period of frosty, antagonistic relationships, the urban water establishment and the environmental movement discovered they had interests in common and regulation of water quality became much more rigorous, as well as being more scientifically based. In general terms, the gap between environmental goals and those of the mainstream water profession narrowed and continued to do so.

8. Victoria's Lauriston Reservoir under construction in the 1940s. (VIC)



6. Gordon Dam in Tasmania is a double arch concrete dam. It escalates 140m and supports the States largest hydropower scheme, approved by Parliament in 1967. (TAS)



7. The Gordon Dam was constructed by from 1972-1974, consuming 154,000 cubic metres of concrete. In 2001, it was still the highest arch dam. (TAS)



3. Construction of Bolivar Wastewater Treatment Plant.

Constructed between 1962-66. (SA)
4. Built in 1956-58, this woodstave pipe is 4.1m diameter and still today - under low pressure - carries up to 51 tonnes to the Wayatinah Power Station. (TAS)
5. Boyne River prior to the first weir being constructed in 1966. (QLD)



1. Men collecting water from the pipes after Cyclone Tracy. (NT)



2. Pikes Crossing Pumpwell. (QLD)



3. Proposed development of Tasmania's Gordon below Franklin scheme initiated much opposition. Water security became heavily political, with the High Court ruling in favour of the Federal Government in 1983. (TAS)

1. Lake Pedder began as a glacial lake of 9 sq km. Developed in 1970-73 as part of the Gordon Power Scheme in Tasmania, it now covers an area of 242 sq km and holds some 3000GJ in storage. (TAS)
2. Darwin River Dam under construction September 2009. (NT)
3. Darwin River Dam overflowing 19 February 2011. (NT)

4. Proposed development of Tasmania's Gordon below Franklin scheme initiated much opposition. Water security became heavily political, with the High Court ruling in favour of the Federal Government in 1983. (TAS)
5. Bolivar laboratory. Water sample analysis. Circa 1970. (SA)



6. Gordon Dam is a jewel for Hydro Tasmania, demonstrating the power of natural thinking. The Double arch design significantly reduced the cost of construction in the early 1970s. (TAS)
7. Centennial Park Reservoir repair, 1988. (NSW)
8. Warragamba Dam in 1988. (NSW)



9. YWP Tunnel Tour at Fremantle Prison, 2006. (WA)
10. Perth Seawater Desalination tour, 2007. (WA)



water quality
1992 - 2001



1992

1993

1994

page 23

After decades of an emphasis on the provision of basic sewage treatment facilities, on one hand, and hydrologically driven stormwater infrastructure on the other, attention began to turn to achieving much higher effluent qualities, and also addressing diffuse pollution from stormwater runoff. Management of stormwater became very technical, focusing on gross pollutant traps, retention pits and sophisticated water quality improvement processes, which ultimately proved expensive to service and maintain.

In keeping with a growing emphasis on water quality, and in the hope of creating better national consistency between regulations, work began on the National Water Quality Management Strategy (NWQMS); a suite of guideline documents and reports about diverse aspects of water quality. The centerpiece was the National Guidelines for Fresh and Marine Water Quality, referred to as the ANZECC Guidelines, approved by the Australia New Zealand Environment Conservation Council. These guidelines established a systematic framework which matched water quality to its intended use. Progress of the NWQMS overall was slow and part of the problem was a lack of the necessary human resources to deliver the documents.

Although most of the guidelines were completed by 1998, a few were wrapped up in 2006.

A major guideline launched in 1996 was a new version of the Australian Drinking Water Guidelines (ADWG) which, for the first time, introduced a risk-based approach and fact sheets, explaining the rationale behind each guideline value and providing examples of typical source water quality in Australia.

A driver of increasing attention to water quality was the occurrence of a 1,000 km long cyanobacterial ('blue-green algal') bloom along the Darling River in late 1991, which was triggered by elevated nutrient levels, sunshine and long retention times. Images of the vivid green scum still reverberate, as do concerns over the toxic potential associated with such blooms.

A major study of Melbourne's Port Phillip Bay, the Port Phillip Bay Environmental Study, was led by Dr Graham Harris of CSIRO and conducted for the Victorian government from 1992 to 1996. Even today it is regarded as the most ambitious research project of its type. The \$12m study came to the unexpected conclusion that the large, shallow bay was coping with a massive nitrogen load, from diverse sources

but, thanks to the activity of sediment organisms, nitrogen was being cycled without causing catastrophic water quality failure. The management implication was that all sources of nitrogen had to be assiduously managed to keep the ecosystem below a crucial tipping point. This understanding enabled the Victorian government to prioritise pollution control efforts for the Yarra River and the very large Werribee (now known as Western) sewage treatment plant.

A few years later, a Queensland estuarine study began, funded jointly by Natural Heritage Trust money, the Queensland Government and a range of local authorities in the Brisbane River and Moreton Bay catchments. 'The Brisbane River and Moreton Bay Wastewater Management Study' showed just how vulnerable key parts of Moreton Bay were to nutrients and contamination, as well as identifying and prioritising the sources. In addition to identifying necessary actions, monitoring of waterway health and water quality was rationalised between the various partners and a system of 'report cards' was initiated, first for estuarine waters and Moreton Bay, in 1998, then for freshwaters from 2001. The success of the approach could be attributed to the separation of the monitoring and reporting from the political realm, thus ensuring that news, good and bad, was regularly communicated to all stakeholders. By July 2001, the various entities involved all merged their efforts to create the Brisbane River and Moreton Bay Healthy Waterways Partnership.

Although there was a strong water quality focus during this decade, action on the reform front maintained its momentum. The Council of Australian Governments (COAG) issued a communiqué from Hobart in February 1994, setting out basic principles for some major reforms to the way water would be managed nationally. Compared to later documents, it was short and to the point, calling for, *inter alia*, full cost recovery of the cost of managing and delivering water: two-part tariffs for urban water (i.e. an access fee and a usage charge); and removal of cross subsidies or at least making them transparent. Those principles set the tone for water governance for decades to come.

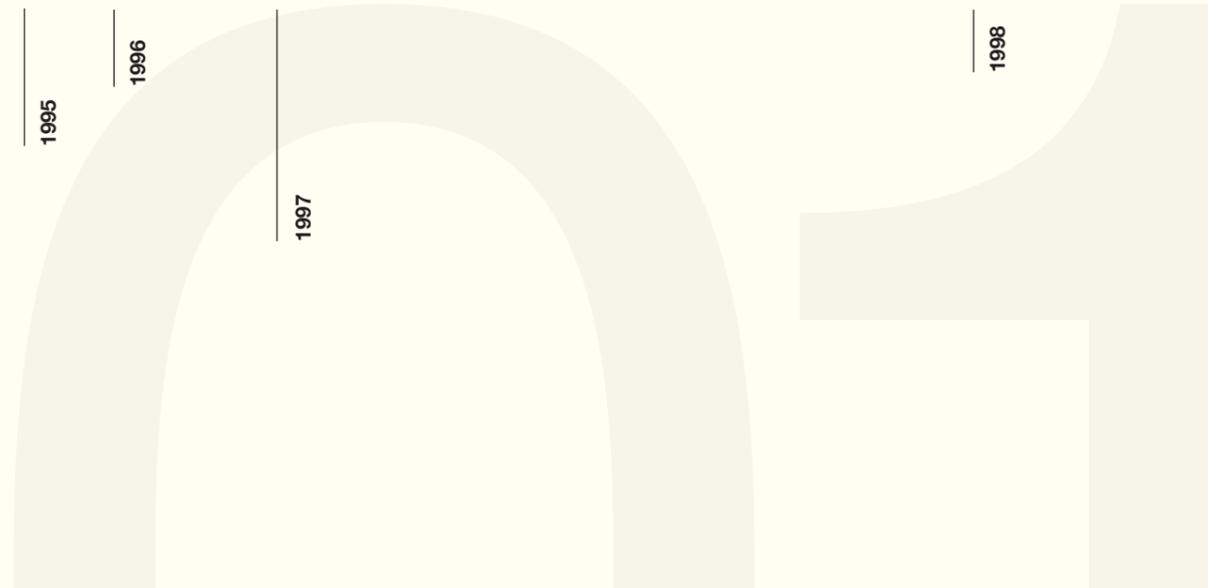
New South Wales led the way in regulatory reform in 1992, by establishing the Independent Pricing and Regulatory Tribunal (IPART) which oversaw water operations statewide, barring the non-metropolitan towns which provided water and sewerage services.

A national thrust for industrially relevant research saw the creation of CRCs - cooperative research centres - in a fiercely competitive process. Each bidder had to bring to the table a combination of industry partners and research organisations, to provide a combination of cash and in-kind support. The Federal CRC program was launched in 1991 and, in the water sphere, three CRCs were in operation by 2001: Freshwater Ecology, led by Dr Peter Cullen, in Canberra (est. 1999); Water Quality and Treatment, led by Professor Don Bursill, in Adelaide (est. 2001); and Coastal Zone Estuary and Waterway Management (1999-2006).

The CRC process was never an easy one and it involved an almost continuous series of progress reports, reviews and rebids; so federal dollars were hard-won. Moreover, once a given set of CRC goals were confirmed, they were immutable, making it extremely difficult to pursue emerging interests.

Recycling of purified wastewater, long practised for irrigation, became more purposeful and more topical within the community. Hunter Water began supplying treated effluent to Eraring Power Station, where it was further purified using microfiltration and reverse osmosis, for use as boiler feed. On the domestic front, Sydney Water established a local recycling system for the new Rouse Hill development, located in the city's northwest. Highly treated water is delivered through a second pipe network, coloured lilac to alert potential cross connectors. Although the local residents responded well to the new 'dual pipe' system, there were nonetheless some unintended consequences. Firstly, the recycled water was initially provided at a fairly nominal cost of 27 c/kL, which encouraged some householders to use much more water than they might otherwise have done. Also, drinking water had initially been delivered in the lilac pipes,

THE AUSTRALIAN WATER ASSOCIATION'S 50 YEARS



while the treatment plant was not yet operating fully; so some opportunistic customers deliberately connected up the lilac pipes to gain access to drinking water at a lower cost.

South Australia took a major step in 1995 when the government decided to phase out all sewage effluent discharges to the marine environment where economically and environmentally sustainable. This gave impetus to the construction in 1999 of the 60 ML/d first stage of the 120 ML/d Bolivar 660,000 population wastewater reclamation plant using the dissolved air flotation and filtration process. Some 30 years in the planning, it was Australia's largest high quality reclaimed water reuse scheme for horticultural irrigation in the Virginia area, including salad crops eaten raw. Mawson Lakes, a 10,000 population residential suburb on degraded land 12 km north of the CBD, originally selected for the futuristic Multi Function Polis, was the first major development in Adelaide to include a second pipe recycled water connection to all lots. The advanced water conservation measures proposed that the recycled water be a mix of purified wastewater and harvested stormwater from the development. However, not long after the first houses were constructed in 1999 it was realised that stormwater harvested from the site often had high salt levels due to the drains penetrating the high salinity shallow watertable, rendering the stormwater unsuitable for use. Sewers were deeper and, although new, infiltrated saline groundwater to the extent that the wastewater salinities were also too high for reuse.

Serendipity was at play in two ways. Firstly, in 2002 the City of Salisbury was developing the 1,600 ha catchment 1.1 GL/a Parafield Stormwater Harvesting Facility using aquifer storage and recovery (ASR) on the busy Parafield Airport immediately to the north of Mawson Lakes and its surplus capacity matched the development's stormwater reuse demand. Secondly, there was surplus capacity in the Bolivar Reclaimed Wastewater Virginia Pipeline Scheme and a pipeline was constructed to Mawson Lakes. This combination gave effect to the originally planned mixed

stormwater-effluent purple pipe recycled water supply.

As Sydney had promised to deliver the 'Green Games' at Homebush Bay, on the shores of the Parramatta River for the 2000 Olympics, a dual pipe system was installed there as well. Although somewhat ironically the recycled water was not delivered through the system until after the Olympics as health authorities feared highly-strung athletes might be more vulnerable than ordinary citizens to any potential health risks.

A hydroelectric station was completed in 1996 at the main Ord River Dam and the dam wall was raised, increasing the storage capacity to a massive 10,700GL. Apart from challenges of distance and labour, farming in the tropics has to cope with very boggy wet seasons, during which it is not feasible to use mechanised equipment on the land.

In April 1992 AWWA took the plunge on staffing and, on the (full) retirement of Peter Hughes as a part-time Executive Director, engaged Chris Davis as its first full-time chief of staff. In the following year, the office moved a few metres down Hampden Road, Artarmon, into much larger, relatively elegant, new premises at Number 44. Membership of AWWA was now 3,047 and initial constraints on classes of member were removed, enabling anyone with an interest in water to join. Since inception, a total of 34 AWWA members had been awarded honorary Life Membership, in recognition of long and distinguished service.

AWWA was alternating its biennial convention with a shared hazardous and solid waste conference in the intervening years and in 1992 the associated trade exhibition was dubbed Ozwater for the first time.

AWWA created the eponymous Peter Hughes Water Award and the first recipient, in 1993, was CSIRO's Division of Water Resources, for work on salinity and community engagement. In 1995, Prof Jorg Imberger won the Peter Hughes Water Award and then went on to win the Stockholm Water Prize.

Hunter Water became a state owned Corporation in 1992 – the first water business to be set up in that framework; to be followed by Sydney and Perth. Brisbane, in 1997, recreated its water and sewerage businesses by creating Brisbane



1999

2000

2001

Water, a business unit with a nominal board of 'directors' to advise on its operation. Brisbane Water was servicing some 1.4 million people by 1994. Later on, Brisbane City Council created a purchaser-provider model for Brisbane Water, which put the utility business more at arms length from Council.

In 1995, a National Competition Policy was introduced and, under the Kennett Liberal government in Victoria, Melbourne's institutional landscape was dramatically revised. The number of regional water businesses was cut down to 100 with the old Melbourne Water Corporation set up as a wholesaler or bulk service provider, delivering water supplies and the service of its two major sewage treatment plants, Werribee (now known as the Western Plant) and Carrum (now the Eastern Plant). This occurred through three retail businesses: City West Water, Yarra Valley Water and South East Water. The rationale behind the split was that the three geographically defined retail businesses would compete by comparison, but it was widely believed in the industry that this was a precursor to selling off one or more of the businesses to the private sector. Competition by comparison was certainly a success, but as the national fervour for microeconomic reform and privatisation passed its peak, the sale of a water business did not occur.

In South Australia, the venerable Engineering and Water Supply Department (EWS) became SA Water in 1995 and, in the same year, operations of the State Water Laboratory and the Australian Centre for Water Quality were merged, to create the Australian Water Quality Centre (AWQC). As noted earlier, the AWQC became the home of the CRC for Water Quality and Treatment.

To keep abreast of an increasingly challenging and complex urban environment, in 1995 the long-established MUWAA was wound up and replaced by a new, incorporated body, the Water Services Association of Australia (WSAA), with Dr John Langford as inaugural Executive Director. The move enhanced the profile and influence of urban water utilities and WSAA took over the research agenda of MUWAA as well.

The first major Australian build-own-operate-transfer (BOOT) contract was for the Yan Yean Water Treatment Plant in Melbourne, in 1994. The contract was won by North West Water for a 25-year period. Yan Yean was the only plant required in Melbourne's system, since the protected, forested catchments, from which 20 per cent of the city's supply was derived, yielded water of such high quality that no treatment beyond fluoridation and chlorination was needed.

In a reflection of increasing focus on water quality, as well as private sector participation, Sydney Water Corporation (now serving 3.6 million people) let contracts for four water treatment plants in the mid-90s. These were Woronora and Illawarra (to CSG), Macarthur (to North West Water) and, the largest, Prospect (to Degremont). All these projects were high-rate, direct filtration plants, on a 25-year BOOT (build, own, operate, transfer) basis. Although the contract process was generally acknowledged to have been effective, the fact that no essentially Australian bids were granted was a source of dismay to the local market.

In 1996, operation and maintenance of the water and sewerage system for metropolitan Adelaide was contracted out for a period of 15 years. The process was challenging, owing to the SA Government imposing a very tight, politically inspired, deadline. After some contention about protocols, the contract was finally let to United Water, a joint venture between Thames Water and Compagnie Generale Des Eaux (later to become Veolia Water), including Kinhill Engineers as a minor partner. An outcome of the hasty contract drafting was the notorious 'Big Pong' which enveloped the city, from ponds on the Bolivar sewage treatment plant. A lack of clarity around the difference between capital and maintenance responsibilities led to a standoff over some necessary upgrades, which in turn caused organic overloading of the ponds; they finally turned anaerobic, and hence malodorous. Difficulties were ironed out, though, and the contract then unfolded without much difficulty thereafter. Administering the contract was, however, a major commitment, occupying a substantial proportion of the SA Water workforce.

A second large contract, the ambitious Riverland BOOT Project to deliver 10 water treatment plants along the Murray River, supplying 100 towns, was awarded in 1996 to North West Water. Through these two contracts, South Australia became a hub of water activity and know-how, and the AWWA Branch grew very quickly.

Sydney Water's main storage, behind Warragamba Dam, experienced a major rainfall event in 1998, filling the large dam in a matter of days. As that event had been preceded by a long, dry spell, the runoff from the catchment contained a lot of contamination. Routine monitoring of the water quality going into supply, using a relatively new analytical method, suggested that the levels of *Cryptosporidium* oocysts (hard capsules containing the pathogenic protozoan) were unacceptably high. A dramatic increase in sample numbers placed even more pressure on laboratory analysts and more positive results were obtained. In response to the inferred contamination, Sydney Water issued boil water notices and there were various accusations leveled about treatment, dead animals in a supply canal and overall incident management. Although some community members claimed to have fallen ill, subsequent investigations showed that levels of cryptosporidiosis in the community were, if anything, lower than normal.

What seemed to have happened was that the new analytical method, for measuring *Cryptosporidium* was rather subjective and sensitive to operator interpretations, so the water may not have had potentially infective concentrations

of the pathogen at all. As a result of the mishandling of the crisis, both Sydney Water's Chairman and Managing Director resigned; the corporation developed much more sophisticated incident management processes and the whole affair cost Sydney Water some \$75m.

The New South Wales Government set up an independent inquiry under senior barrister Peter McLellan. His comprehensive report included a recommendation that the operation of the catchments serving Sydney should be handed over to a new, independent Sydney Catchment Authority (SCA). In retrospect, it was probably fortuitous that such a large, resilient organisation was involved, able to weather the experience and to share the learnings with peers worldwide.

By 1999, AWWA decided, after intense discussion, to drop wastewater from its name and to become just the Australian Water Association (AWA). This acknowledged the interconnectedness of water in all its guises. Some older members rued the loss of the initial identity, perhaps having forgotten that the original name had itself been controversial in 1962. In 2001, AWA converted itself to a Company Limited by Guarantee, having been an incorporated association since 1972. Overall governance was revised, with branch councillors being replaced by a Board of Directors, elected by a Strategic Advisory Council, made up of branch representatives.

Towards the end of the decade, drought conditions began to emerge across the continent.

drought and flooding rains

2002 - 2011

THE AUSTRALIAN WATER
ASSOCIATION'S 50 YEARS

2002

2003

page 29

Early in the 2000s, serious drought began to impact much of Australia. Many water supply businesses had been lulled into a false sense of security, assuming that the yields they had enjoyed, mainly from surface runoff collected in dams, would be reliable. Quite suddenly, storage levels began to fall and alarm bells rang. A generation of consumers who had never experienced water restrictions was somewhat shocked to find itself subjected to increasingly stringent water restrictions. In addition to mandatory restrictions, the communities in Brisbane and Melbourne were both challenged by voluntary consumption targets: for Brisbane the target was to bring domestic consumption down to 140 L per day and, for Melbourne, 155 L per day – Brisbane's consumers were able to achieve below their target and Melburnians were successful in achieving theirs. It is noteworthy that neither community bounced back to pre-target consumptions when the drought ended.

One of the responses to drought across most of Australia was a huge surge of activity in seawater desalination. Up until then only a handful of very small desalination plants existed, mostly in remote locations. Perth was the first cab off the rank, reacting to disastrously low runoff volumes and hotly contested groundwater resources.

Perth was notorious for union-led disruption of major construction projects, so then Managing Director Dr Jim Gill ensured that the whole desalination plant project was carried out in a very low-key manner, enabling it to fly under the radar. The new reverse osmosis (RO) plant came on line in 2006, having successfully evaded any union action.

For South East Queensland, the desalination initiative was taken by Gold Coast City Council, which located an RO plant at Tugun, close to the New South Wales border.

In Sydney, the New South Wales Labor government announced its decision to build a desalination plant. This decision was triggered by water storage levels falling to 34 per cent. As the 2006 Sydney Metro Water Plan had a trigger level of 30 per cent, the decision to go 'early' sparked a great deal of debate. What critics failed to acknowledge was that the dam levels had only been maintained above 30 per cent by pumping from Tallowa Dam, so it would have been a simple matter to cease pumping and send the levels down to the 'official' trigger level.

The South Australian Government elected to build an RO plant on an old industrial site at Port Stanvac, while the Victorian Government selected a site at Wonthaggi, on the Bass Strait coast to the South-East of Melbourne.



The state of play in seawater desalination by the end of 2011 is shown in the table below, based on Spies and Dandy, ATSE, in publication.

Location	Initial capacity (GL/yr)	Maximum expandable capacity (GL/yr)	Maximum expandable capacity (GL/yr) Initial (and expandable) capacity as a % of annual consumption in 2009-10	Initial capital cost		Year of completion
				(\$m)	(\$m/ ML/day)	
Sydney (Kurnell)	90	180	18 (36)	1,890	7.7	2010
Melbourne (Wonthaggi)	150	200	43 (57)	3,500	8.5	2012
South-East Queensland (Tugun)	49		25	1,200	8.9	2009
Perth (Kwinana)	45		18	387	3.1	2006
Perth (Binninyup)	100		40	1,400	5.1	2012
Adelaide (Port Stanvac)	100		80	1,830	6.7	2012
Adelaide (BHP- Port Lowly)	23	92	N/A	N/A	N/A	2017-21

While desalination captured the headlines, there was a general and growing push towards the development of diversified portfolios of water sources, to improve resilience and the ability to shift between sources, along familiar principles to those of financial investment diversity.

A practice which had been implemented in many jurisdictions over decades was the reuse of partly purified sewage (effluent) for use in irrigation or industry. By the mid-nineties, the city of Toowoomba, west of Brisbane in Queensland was in dire straits for water, so the City Council developed a long-range plan to collect recycled water and to blend it with other sources to resolve the critical shortage. A request for federal funding to implement the planned reuse was approved, but only if a referendum revealed that a majority of citizens was in favour of the idea. Sadly, the proposal evoked visceral opposition from a well-funded and vocal opposition, Citizens Against Drinking Sewage, or CADS. After a vitriolic and personal campaign, the final vote was 62 per cent against and 32 per cent for, so the scheme did not proceed and the city's mayor, Di Thorley, ultimately moved interstate.

In South East Queensland, a visionary scheme, the Western Corridor Project was conceived to link the main sewage treatment plants in the region to advanced water treatment plants which would produce up to 232 ML/d of PRW, or 'purified recycled water', to be pumped northwards to supply two power stations and to top up Wivenhoe Dam's storage levels. This \$2.5 billion project, includes a network of 200 km of large diameter underground pipes and three advanced water treatment plants. Recycled water was first supplied to power stations in August 2007. As the project neared completion, drought breaking rains filled dams, enabling the government to backtrack from the original intention of supplying recycled water into Wivenhoe Dam. By early 2012, the policy was that purified recycled water would be delivered into Wivenhoe Dam should the total storage in key water storages fall below 40 per cent. Concurrent with the construction of the Western Corridor project was the construction of the 'Water Grid'. This is a network of treatment facilities, water storages, two-way pipes and water

sources that enable the transfer of water between centres of demand. To support the establishment of the Water Grid, water industry reform in South East Queensland saw 22 separate entities amalgamated into three specialist state-owned bodies and three council-owned retail and distribution businesses.

One familiar but recently disparaged urban water source was the humble rainwater tank, long a familiar sight in rural Australia, but then eschewed by local councils and water utilities, largely on health grounds. The pendulum swung relatively quickly from rainwater tanks being prohibited, to a situation where tanks were actually subsidised. The net result was a national population of around 1.6 million rainwater tanks by 2011. The performance of a rainwater tank was found to be very dependent on location, connected roof area, tank size, and, vitally, how the collected water was deployed. Recent research has shown that tanks often do not deliver to their optimum potential, owing to mismanagement and/or neglect.

Still on alternative water sources, the decade saw a dramatic focus on stormwater as a potential source of useful water. Typically, the annual runoff for an eastern Australian city is greater than the demand for drinking water. The counter argument was that finding storage sites is difficult in an urban environment and that the erratic nature of our rainfall means major storms could never be effectively harvested. While arguments surged back and forth, a passionate group of advocates conducted research and installed pilot projects to harvest stormwater.

Monash University, led by Dr Tony Wong, embarked on a major research and demonstration project, Cities as Water Supply Catchments, but, by the end of 2011, was awarded a CRC for Water Sensitive Cities, scheduled to commence in 2012.

At a practical level, the City of Orange, in New South Wales, installed a stormwater harvesting system to supplement its vulnerable water supply, based on a batch system: treating collected water in a storage lagoon, dosing it with alum, then

2008

delivering the water to the drinking water treatment plant only after its quality had been approved.

In light of mixed success from the 1994 water reforms, COAG (Council of Australian Governments) revisited the basic reform agenda, this time in much more detail and with firm timelines. The National Water Initiative (NWI) was heralded by an intergovernmental agreement (except for Western Australia and Tasmania, which signed up later) in 2004. In 2005 the National Water Commission (NWC) was set up to promote, assess and report on the progress of reform. Under the leadership of inaugural CEO and Chairman, Ken Matthews, the NWC embarked on a learning journey and was soon a knowledgeable commentator and thought leader in water matters.

One of the first documents published by the NWI was a baseline assessment of water resources; the first to have been carried out since the Land & Water Resources Audit which had been published in 1992.

According to the new study, which covered the year 2004-5, national rainfall averaged just 364 mm, a major drop compared to the 105-year average up to then, of 457 mm. Of the total rainfall across Australia, equivalent to 2.79 million gigalitres, 90 per cent was lost to evapotranspiration; eight per cent became runoff and two per cent recharged aquifers.

Of water used nationally, 65 per cent went to agriculture; 11 per cent to households; and the balance to all other uses. At the start of the year, the nation's large dams were 53 per cent full (of a total capacity of 83,853 gigalitres) and, by the end of the year, 48 per cent full. Water trades over the year amounted to 1,301 gigalitres, almost all for temporary trades (i.e. farmers retained ownership of title to the water, but sold whatever allocation they had for the year).

To ensure a continuous appraisal of the resource, the Water Act 2007 (Cth) was designed to give the Commonwealth new powers in relation to the Murray-Darling Basin plus new water data gathering powers and broader water information responsibilities to the Bureau of Meteorology (BOM). Timelines for implementation of a new Murray-Darling Basin

Plan were modest, but gaming by various interests has ensured that not even those targets had been met by 2011.

The BOM took on an enormous challenge in establishing a single, national water database, aiming to make water data freely accessible and, in some instances, available in real time. Hundreds of hydrologists had to be recruited and a very sophisticated data acquisition, management and maintenance system developed.

Interest in water quality had not weakened in this decade and, after a long, arduous gestation, the next version of Australian Drinking Water Guidelines (ADWG) was published in 2004, after being held up for the best part of two years by the then New South Wales Government, for no apparent reason. A massive tome, the new ADWG 2004 developed better guidance for the risk-based approach. The inspiration behind ADWG 2004 was a working party of committed scientists, effectively volunteering their input under the leadership of Don Bursill, then Director of the Cooperative Research Centre for Water Quality and Treatment and head of the South Australian Water Quality Research Centre.

In view of the fact that ADWG 2004 really dealt with reasonably good quality water, new working groups were set up to deal with reused water and stormwater. Thus, Phase 1 of the Australian Water Recycling Guidelines (2006) addressed the production of water for purposes other than drinking, while Phase 2 (2009) covered the use of recycled water or stormwater to augment drinking water supplies. In keeping with the risk-based approach, the documents are substantial and do not simply rely on a single set of numerical targets for water quality.

One of the commitments made in the NWI was to improve water trading and that proved to be successful. Fortuitously, farmers' understanding of trading practices matured at about the same time that drought bit – so astute trades enabled many horticulturalists to buy water from other farmers who could be flexible about what to plant and when to irrigate. Irrigation in general took a roller coaster ride; collapsing in some areas as drought took hold. Rice crops, for example,

2009

had peaked at 1.7 million tonnes in 2001, but fell to a minimum of 19,200 tonnes in 2008, thanks to drought. Cotton shared a similar fate. Both of these crops are flexible, so many farmers simply reverted to dryland operations and sold their seasonal water allocations to horticulturalists who had to sustain their trees and vines.

The Ord River Project, by 2009, had expanded to a relatively modest 12,500 hectares, mostly dedicated to Australia's first major sandalwood plantings; the attraction being accelerated depreciation for tax purposes. A second stage for the Ord Project was launched, aiming for an ultimate irrigated area of 45,000 hectares and including a second irrigation channel. Work on the new channel experienced the same wet season waterlogging problems as farming.

The passage of the Water Act of 2007 set a new agenda, including the creation of a new, Federal Murray-Darling Basin Authority; and a timetable for that Authority to develop and implement a Murray-Darling Basin Plan, by mid-2011.

The 2002-2011 decade saw more water-related Cooperative Research Centres created: Catchment Hydrology; Irrigation Futures (2003-2010); Waste Management and Pollution Control which became Environmental Biotechnology in 2010; eWater CRC (2005-2011) which was formed by the merging of Catchment Hydrology and Freshwater Ecology; and, announced in the closing weeks of 2011, the new CRC for Water Sensitive Cities.

A unique development on the research front was the formation and incorporation in 2007 of membership based research broker, Water Quality Research Australia (WQRA). It was designed to take over the role of facilitating water quality research, with a focus on public health protection, for the Australian water sector when the CRC for Water Quality and Treatment ended its life. Although one of the goals of Federal government when introducing the CRC program had been to create institutes which would be self-supporting after federal funds had stopped flowing; WQRA is the only example of that ideal being achieved. It is a testament to the players in the water industry – utilities, private sector, leading

research organisations and health regulators – and of their investment and commitment to ongoing research.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO), long active in water research, launched a bold initiative in 2005 – the Water for a Healthy Country Flagship. This brought together teams from many disparate Divisions in CSIRO, to focus on potentially critical areas of water research. The national drought added urgency to the Flagship's work and, apart from pursuing its own activities, the Flagship team collaborated in other research efforts, including the Urban Water Security Research Alliance in South East Queensland and the Goyder Institute in Adelaide.

The national drought broke late in the decade, taking water out of the headlines and, to the consternation of many in the industry, off the political priority list. The flow in the Murray River reached an all-time maximum in 2011, filling the Menindi Lakes in New South Wales and reaching down to the Murray mouth for the first time in years (continuous dredging had been a feature).

In January 2011, massive floods hit Queensland, killing at least 35 people and destroying the homes of many more. Brisbane's CBD suffered inundation the likes of which had not been experienced since 1974 and, on television, dramatic scenes were shown, including a 500m long chunk of walkway floating down the river and being nudged to safety by an alert and proactive tugboat captain. The small town of Grantham was hit very suddenly by floodwaters, as was a catchment in Toowoomba – sadly ironic for a town on the top of a mountain. The flooding sparked an inquiry into the management of Wivenhoe Dam, amidst recriminations and amnesia about the original purposes of the dam, which were to balance flood mitigation with storage and a modicum of hydroelectricity.

Floods occurred in Victoria too, but not as severely as in Queensland.

The water industry at large boomed during this decade, as infrastructure and appropriately skilled people were needed to deliver on service and quality targets.

2010

The AWA became more engaged with industry and policy issues and was consulted more often in policy and industry developments. With staff numbers increasing, the Hampden Road office became too small, so part of the floor above was taken over.

AWA was evolving culturally too; with the successful launching of a Young Water Professionals network. This helped to make the Association less daunting for younger members, as well as giving a new generation a leg up in professional networking.

In 2004/5, under Rod Lehmann's Presidency, AWA governance was restructured by the creation of a Strategic Advisory Council (mainly branch representatives) which appointed the Board of Directors. This allowed for a smaller Board (9 instead of 16), the members of which did not feel beholden to any particular Branch.

Chris Davis, who had become CEO of AWWA in 1992, was diagnosed with Parkinson's Disease (the same affliction which struck Peter Hughes) and stepped down from his role in June 2007, to be replaced by Tom Mollenkopf, who came from a diverse water background in Australia and internationally.

The Association moved office in 2008 to St Leonards, Sydney, in a strategic location above the railway station, with all staff on the same floor. The AWA logo was refreshed again, including a stylised river.

From 2010, Ozwater became an annual event, long mooted, but finally realised. By the end of AWA's 50th year, it looked as though this move was positive, with high attendances and quality presentations. The exhibition has gone from strength to strength. In 2011, AWA appointed its first female President, Lucia Cade.

2011

A key industry appointment had been that of Dr Kerry Schott as Managing Director of Sydney Water in 2006; a position she was to hold for five years. At one point in the mid-decade, there were women CEOs in place in four of the major metropolitan water utilities: Kerry Schott in Sydney; Anne Howe in Adelaide; Sue Murphy in Perth and Anne Barker in City West Water.

By the end of 2011, water in Australia was on the cusp of potential major change. With the uncertainty of climate change, the end of a long drought, potentially allowing policy makers to neglect water, global economic uncertainty, and an energetic, national conversation about the future of water management.

Two major issues were looming, both stemming from the concept of Water Sensitive Cities, alluded to in the National Water Initiative. Firstly, the need to positively address the potential for potable reuse of water and, secondly, the multi-disciplinary challenge of creating liveable cities. The next decade should involve serious consultation and positive action on both fronts.

The only certain prediction must be that the next 50 years will be at least as dynamic as the last. AWA will continue to maintain its relevance and play a key role in shaping the future for the Australian water sector. ◆

AWA past presidents

<i>Jim McIntosh</i>	<i>1962-63</i>
<i>Michael Flynn</i>	<i>1963-64</i>
<i>Henry Hodgson</i>	<i>1964-65</i>
<i>R King-Scott</i>	<i>1965-66</i>
<i>Guy Parker</i>	<i>1966-67</i>
<i>Michael Flynn</i>	<i>1967-68</i>
<i>Jack Dwyer</i>	<i>1968-69</i>
<i>W C Andrews</i>	<i>1969-70</i>
<i>R King-Scott</i>	<i>1970-71</i>
<i>George Goffin</i>	<i>1971-73</i>
<i>Trevor Judell</i>	<i>1973-75</i>
<i>Henry McFie</i>	<i>1975-76</i>
<i>Clive Price</i>	<i>1976-77</i>
<i>Don Montgomery</i>	<i>1977-78</i>
<i>Alan Pettigrew</i>	<i>1978-80</i>
<i>Doug Lane</i>	<i>1980-82</i>
<i>Frank Bishop</i>	<i>1982-84</i>
<i>Bob Lloyd</i>	<i>1984-86</i>
<i>Mike Dureau</i>	<i>1986-88</i>
<i>Tim Smyth</i>	<i>1988-89</i>
<i>Peter Norman</i>	<i>1989-91</i>
<i>Barry Sanders</i>	<i>1991-93</i>
<i>Richard Marks</i>	<i>1993-95</i>
<i>Mark Pascoe</i>	<i>1995-97</i>
<i>Greg Cawston</i>	<i>1997-99</i>
<i>Allen Gale</i>	<i>1999-01</i>
<i>Barry Norman</i>	<i>2001-03</i>
<i>Roderick Lehmann</i>	<i>2003-05</i>
<i>Darryl Day</i>	<i>2005-07</i>
<i>David Barne</i>	<i>2007-09</i>
<i>Peter Robinson</i>	<i>2009-11</i>



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