Chapter 2

Water supply

Introduction

2.1 For many urban dwellers, water is simply a product that comes out of a tap It is assumed that it will be there when needed, and that it will be safe, clean and clear. Yet in reality, the processes required to deliver high quality water to Australia's towns and cities are much more complicated, and face considerable and growing challenges from increasing demand, competing uses, pollution and climate change.

2.2 This chapter examines how these pressures are affecting Australia's water supplies, and some of the alternative sources of supply that have been advanced to solve these problems.

Urban water supplies in context

2.3 A number of issues at the supply end of the water cycle are driving changes to the way we manage urban water, and so provide an important context for much of the discussion that follows.

Global warming & climate change

2.4 There is much uncertainty about the effects that climate change will have on rainfall patterns and water supply. However, possible scenarios include the potential for decreased yields from existing water supply catchments; decreases in rainfall; reductions in average volumes of river flow; decreases in run-off; difficulties in maintaining environmental flows; increases in drought severity; and increases in flooding in urban areas due to more intense rainfall falling on impervious urban surfaces.[1]

2.5 Consequently, urban water planners must factor this uncertainty of the future water supply into their calculations, as it cannot be assumed that catchments will maintain their current levels of water. This uncertainty suggests that as a society, we must build in a larger margin for error, or 'fudge factor', when planning our future water supply to allow for these unpredictable changes.

Competition with other uses

2.6 Cities will also increasingly have to compete with the requirements of both the environment and irrigators for water supplies. There is growing awareness that the current levels of extraction from catchments and rivers are unsustainable and that the

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1 Senate Environment, Communications, Information Technology and the Arts References Committee, *The Heat is On: Australia's Greenhouse Future*, November 2000, pp 28-29.

health of these riverine ecosystems depends on restoring something approximating their natural flows, including both quantities and flow patterns. It is estimated that environmental flows should be about two-thirds of the natural flow, yet one of Australia's greatest rivers, the Murray, has an average flow of only about 27%.[2]

2.7 This can have significant impacts on planning for urban water supplies, as the experience of the ACT shows. In 1993, when undertaking the future water supply strategy for the ACT, it was considered that a new storage facility would not be needed until 2040:

> The impact of the introduction of mandated environmental flows under the ACT Water Resources Act shifted that timing back 20 years – in other words, back to 2018, 2020.[3]

2.8 Equally, irrigators, who are the major users of water in Australia, are coming under increasing pressure to use their water more efficiently. All users of water, both urban and agricultural, will face capping of water extractions.

2.9 A further factor is the increased value being placed on the recreational and environmental values of pristine catchments and waterways, which can be degraded or destroyed by the construction of new dams, or from major water extractions. Mr Wilkinson from the ACT government outlined the wider context of these planning constraints:

> In theory, we could be all right for some time, but as we have said, we are in the Murray-Darling Basin. We might be able to physically catch more water up here but we have to take a broader view of what is happening in the basin as a whole. We also have to take account of the environmental impacts of building another dam. That area where the new dam would go is a valued recreational wilderness area. There would be a lot of public opposition to building the new dam. So, while on one hand we have the physical resource there, we are still subject to the same pressures as everyone else about trying to develop that. We are coming to the realisation that we will probably have to manage within our existing developed resource.[4]

2.10 In this context, supplies of water directed to urban use will need to be justified, and the trade-offs for increasing this supply increasingly apparent and costly.

Water shortages

2.11 Other pressures on the supply are more immediate, with several Australian cities already facing severe pressures on their water supplies. Perth, for example, is:

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2 Dr Blackmore, *Proof Committee Hansard*, Canberra, 23 May 2002, p 565.

3 Mr Dymke, *Proof Committee Hansard*, Canberra, 23 May 2002, p 552.

4 Mr Wilkinson, *Proof Committee Hansard*, Canberra, 23 May 2002, p 551.

> suffering from the worst water shortage in its history. There were possibly equally acute ones in the 1890s, but this is the worst since it has been a large city.[5]

2.12 Melbourne, Adelaide and the Gold Coast have also faced significant shortages within the last two years, and many towns in NSW and Victoria are also under pressure.[6]

2.13 The consequences of these shortages can go beyond domestic inconvenience. In Gladstone in central Queensland, the Awonga Dam is down to 30 per cent of capacity, and:

> Of the water supply for Gladstone 75 per cent is used by industry in Gladstone – Queensland Alumina, the NRG power station and so forth. If it does not rain shortly, there is a real prospect that our exports will be directly affected by the drought, and that is probably the first time that has happened in terms of manufacturing capacity.[7]

2.14 Similarly, capping of the town's water supply threatens to freeze Tamworth's urban and industrial growth prospects to current levels.[8]

Future dilemmas: finding extra supplies

2.15 Many Australian cities are facing considerable challenges over the next twenty or so years, as the competing demands made on the water supply increase. Fundamentally, water managers must consider the options of finding extra water supplies, decreasing water demand, or both.

2.16 The timeframe for this decision varies across Australia. It is estimated that a new water source will be required for Perth between 2005 and 2007;[9] Brisbane by 2015;[10] and Canberra by around 2017. Other cities have more time: Melbourne has enough capacity to maintain the security of supply until 2040 without developing new water sources,[11] and in South Australia, the metropolitan supply is considered to have significant spare capacity, which has reduced the need for increasing future supply.[12]

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5 Dr Humphries, *Proof Committee Hansard*, Perth, 29 April 2002, p 416.

6 Including Broken Hill, Coolabah, Wallan and Broadford. Herald Sun, *Town consumers suffer big thirst*, 14 October 2002, p 24 and Daily Telegraph, *Towns down to 6 months water supply*, 12 October 2002, p 16.

7 Dr Fisher, *Proof Committee Hansard*, Melbourne, 23 April 2002, p 364.

8 Land (NSW), *Watershed politics*, 1 November 2001, p 6.

9 Water Corporation of Western Australia, *Submission 49*, pp 25-26.

10 Ticky Fullerton, *Watershed: Deciding our water future*, ABC Books, 2001, p 39.

11 Melbourne Water, *Submission 46*, p 4.

12 Government of South Australia, *Submission 51*, p 10.

2.17 However, these timeframes are shorter than they may at first seem, given the scale of the investments required to build new dams or significantly change usage patterns. Planning must also be done in the context of uncertainty over regional growth patterns. The Committee saw how Wellington, New Zealand, for example, has not grown at the expected rates, with the result that the water supplies easily meet likely future requirements.[13] Other cities with high growth rates, such as the Gold Coast, Queensland, face the opposite problem.

Threats to water quality

2.18 The issues discussed above are not the only problems facing the water supply. The quality of the water drawn from the environment cannot be taken for granted, and is increasingly being affected by pollution, salinity, and other problems associated with the degradation of many of the catchment areas.

Contaminants in surface water

2.19 Water from rivers and dams inevitably has some degree of contamination, including from natural sources. These have effects ranging from aesthetically undesirable taste, odour or colour, through to harmful organisms capable of causing disease and death. The principle pollutants are organic matter, nutrients, pathogens and trade waste.[14]

2.20 Organic matter refers to faecal, vegetable and animal matter suspended in the water, together with bacteria that feeds on it. Because the bacteria needs oxygen to do this, the amount of oxygen required is a useful measure of the amount of organic matter in the water, and is known as Biochemical Oxygen Demand (BOD). The other main measure of organic matter is the amount of solid matter suspended in the water, known as the Suspended Solid content (SS).

2.21 Nutrients comprise nitrogen and phosphorous, with most nitrogen in the water coming from urine, present as ammonia or urea.

2.22 Pathogens are organisms that are capable of causing disease, and are of four common types. Bacteria, are single celled organisms and dangerous examples include *Salmonella typhi* (typhoid fever) and *Vibrio cholerae* (cholera). Another bacteria *Escherichia coli* (E. coli) is found in the digestive tract of all warm-blooded animals and therefore serves as a useful indicator of the presence of faecal matter in water (although the faecal matter need not originate from humans). Protozoa are also single-celled organisms which form hard-coated cysts that contain their eggs; these pass out of the body in the faeces. The two that are most often associated with human health problems are giardia and cryptosporidium. Helminths are parasitic worms such as

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13 Committee briefing, Wellington Regional Council, Wellington, 15 April 2002.

14 An excellent overview of pollutants is: Simpson and Oliver, *Water Quality: From wastewater to drinking water to even better* and *The Dilemma of Watter Quandary*, 1996, pp 9 – 16, from which this summary is taken.

round worms and tape worms. Their eggs are passed in faeces and if ingested will lead to infection.

2.23 Waterborne diseases are illnesses caused by drinking contaminated water. The contaminants can be bacteria (*Salmonella, Campylobacter, Shigella, Myobacterium, Vibrio, Leptospira, E. coli*), viruses, or small parasites (*Cryptosporidium, Giardia,* and *Toxoplasma*). Most outbreaks of waterborne disease are caused by faecal contamination of water by infected animals or people. Drinking water systems and public swimming pools have both been associated with waterborne disease outbreaks. People who have suppressed immune systems are at greater risk from waterborne disease.

2.24 For many years it has been widely accepted that contaminated water is the major vehicle for transmission of diarrhoeal diseases, and this has led to a predominant emphasis on the microbiological quality of drinking water.[15] However, recent work by the World Health Organization and others has shown that food-borne transmission is more important and probably accounts for 70 per cent of diarrhoeal episodes. Outbreak of waterborne disease in Australia is thought to be rare although it is often difficult to determine the source of such diseases, as they may be food-borne, faecal-oral, or person-to-person as well as waterborne.

2.25 Campylobacteriosis, cholera, cryptosporidiosis, leptospirosis, salmonellosis, shigellosis, tuberculosis, typhoid, and yersiniosis are nationally notifiable diseases in Australia that may be waterborne; giardia may be waterborne but is not nationally notifiable. The National Notifiable Disease Surveillance System annual reports provide little information on the source of the disease associated with the notification. Therefore, it is not possible to provide an indication of the relative importance of waterborne disease compared to food-borne, faecal-oral, or person-to-person transmission. In addition, water is often considered a food and so disease caused by contaminated water is reported as ‘food-borne’.

Salinity

2.26 Although salinity is usually a problem that is associated with causing damage to agricultural lands, awareness is growing of the threat that salinity poses to drinking water supplies. The CSIRO comments that:

> If biological contamination of Australia’s drinking water is rare, salinity is a much more pervasive problem, especially for selected cities and towns that draw water from inland rivers and groundwater aquifers (for example Dubbo, NSW; and Katanning, WA). For Adelaide in particular it represents a real challenge. …
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> The recent Salinity Audit for the River Murray System (MDBMC 1999) reports that by 2020, water supplied to Adelaide will exceed the World

15 CSIRO, *Submission 47*, p 29.

> Health Organisation threshold (upper limit 800 EC) for drinking water 20 percent of the time and by 2050, 50 percent of the time.[16]

2.27 Currently, around 1,100 tonnes of salt are extracted from the Murray river every day just to maintain the status quo, and this is due to be increased by an additional 900 tonnes per day, at a cost of $60m per annum.[17] Similarly, removing the salt from town water supplies in NSW's central west costs $5.1m a year.[18]

2.28 Salinity in catchment areas is threatening urban water quality in some Queensland towns including Kingaroy in the South Burnett and Warwick in the Darling Downs, while it is estimated that salt flowing into river systems in the Condamine-Balonne catchment will rise from 5.02 tonnes a year in 1997 to 16.021 tonnes a year in 2050.[19] Water supplies in Yass, NSW, have salt levels of around 700 parts per million,[20] and CSIRO notes that Katanning, in Western Australia, is another example of a town experiencing problems with the salinity of its water supply.[21]

Catchment quality

2.29 A critical consideration for the health of both surface and groundwater supplies is the catchment in which they are located, and changes to landuse or ecosystems in a catchment can have profound effects on resulting water quality. As discussed above, the quality of the catchments supplying Australia's major cities varies considerably. There are four principle threats to catchment quality.

2.30 Agricultural activities may result in run-off of pesticides, herbicides, fertilisers, and animal effluent into the waterways. As Dr Fisher told the Committee, on a farm, either urine or excrement:

> is straight out the back of the animal to the paddock. Some research is showing that the antibiotics that they have been giving to cattle as fatteners or growth promoters are producing mutations in dung flies – and that is only the start. A lot of stuff is going onto the farm: a lot of hormonal chemicals are used to bring cows into heat at the same time, to synchronise cows; other chemicals are used to bring on birthing cows; and antiseptics are used on cow teats. Also, topicals are painted on the spines of the cattle for ticks, worms and so forth.[22]

2.31 Urban developments within catchments may also cause contamination (through stormwater and septic systems, discussed in chapters 4 and 5), however, even

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16 CSIRO, *Submission 47*, pp 30-31.

17 Dr Blackmore, *Proof Committee Hansard*, Canberra, 23 May 2002, p 562.

18 Daily Telegraph, *Salt of the earth is a $51m problem*, 7 February 2002, p 22.

19 Courier Mail, *Town water supplies facing salinity threat*, 17 April 2002, p 7.

20 Dr Blackmore, *Proof Committee Hansard*, Canberra, 23 May 2002, p 560.

21 CSIRO, *Submission 47*, p 30.

22 Dr Fisher, *Proof Committee Hansard*, Melbourne, 23 April 2002, p 366.

protected catchments are vulnerable to contamination caused by illegal activities such as camping, and rubbish dumping. Professor Bursill reflected on the experience of a Water Corporation of Western Australia staff member and how hard it was to keep people doing the right thing:

> There are big signs saying, 'This is a water protection zone. It is your water supply catchment area. Please stay out. Please observe the rules,' and all of this sort of detail. There were bullet holes shot through the thing, piles of disposable nappies and other rubbish piled up underneath the signpost, fences cut through and four-wheel drive tracks going through the place. The guy even showed one picture of a series of they must have been at least fifteen or twenty 44-gallon drums of industrial organic waste piled up not far from one of their bores … .[23]

2.32 There is also emerging awareness of the effects of logging operations on the effectiveness of catchments. The Doctors for Native Forests point out that:

> Logging has a significant impact both on water quality and quantity. Clearfell logging causes a 50% reduction in water yield that takes over 130 years to return to pre-logging levels. This is because the regrowth forest consumes large amounts of water. Logging has an impact on water quality. The muddy run-off from clearfelled sites carries with it mud, salt and nutrients. Many of the catchments that have had clearfelling have had severe problems with algal blooms. Rivers in the Otways, Daylesford, Bacchus Marsh and Blackwood, amongst many other areas in Victoria, have had algal blooms in the recent past. The forests that supply these areas have had a severe impact from logging. For example, Daylesford has had three years of permanent boiled water notices. …
>
> A recent report into the impact of logging on the water supply to Geelong and the Otways concluded that the cessation of logging the Otways would lead to an increase in water yield of the region of 10%, which is enough to supply a town the size of Colac.[24]

2.33 Even from a purely financial point of view, there are powerful incentives to ensure that catchments are as protected as possible. As is shown below, the technology exists to purify water of almost any quality, however, these treatments are expensive, and often it will be cheaper to take steps to protect the catchment in preference to meeting the costs of water treatment.

2.34 Several examples demonstrate this point. One of the first big cities to discover this was New York in 1997, where they found that proper management and

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23 Prof Bursill, *Proof Committee Hansard*, Adelaide, 30 April 2002, p 538.

24 Doctors for Native Forests, *Submission 15*, p 2; see also Australian Conservation Foundation, *Submission 68*, p 12.

protection of the city's catchment was a lot cheaper than building the improved treatment facilities.[25]

2.35 Another (award winning) example occurred in Melbourne, where the Tarago Reservoir, 85km out of Melbourne, suffered blue-green algae outbreaks. The overall catchment area is 11,400 hectares of which around 2,800 is in agricultural use. Faced with taking the reservoir out of use, and in the longer term building an expensive water treatment plant, Melbourne Water embarked on a community partnership which involved funding catchment repair activities. These remediation efforts proved very successful and resulted in significant reductions to the projected costs of future water treatments.[26]

Costs of water treatment

2.36 Customer and regulator expectations are driving water suppliers to ensure that water provided for urban purposes meets health and aesthetic standards. Although water treatment in Australia is for the most part effective, the costs are high. The minimum immediate cost to Sydney Water of the *Cryptosporidium* incident was $33 million. Improving the quality of raw water from surface water and groundwater storages provides an efficient and potentially more effective path to protect public health, than continued investment in treatment infrastructure. The requirement for better catchment management to maintain water quality is evidenced by the formation of a new Catchment Management Authority in Sydney.

2.37 Considerable effort has been directed to improving, or at least managing, land uses and conditions such that runoff from the land to storages and to groundwater is not degraded. However, increasingly it is evident that a holistic understanding is required, incorporating land use and management and the management of stored waters, including their ecology. To date there appears to have been relatively little effort spent on quantifying the economic and environmental benefits that result from maintaining or improving water quality in surface water storages.

Dams and reservoirs

2.38 The construction of dams to 'drought proof' the country has long been a feature of Australian water management and public investment. The number of dams is a reflection of both Australia's aridity and the large variability of our rainfall, resulting in storage levels that are 12 to 15 times greater than other areas in the world.[27] Australia has 443 large dams with a total storage capacity of 10.45km^2 with

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25 Dr Steven Cork, Presentation to the 2001 Annual Conference of Parliamentary Environment Committees, Hansard, 11 July 01, p 37.

26 CRC Association, *Triumphs of Technology Transfer*, p 6. The project won an award for excellence in technology transfer.

27 Mr Daniell, *Proof Committee Hansard*, Adelaide, 30 April 2002, p 506

around a million ‘small’ dams.[28] These large dams alone, if full, have the capacity to store five times Australia’s annual water consumption.[29]

2.39 As is now becoming more widely understood, construction of dams brings with it significant environmental problems that compromise the benefits of water storage, as the Great Barrier Reef Marine Park Authority explains:

> Local river impacts include impediment of the movement of fauna along waterways, alteration of water temperature and flow regimes, loss of habitat and degraded water quality … loss of breeding habitat for fish and altered hydrological regimes in estuarine areas.[30]

2.40 Dams interrupt the natural life cycles of fish, macro-invertebrates and other species, with consequent impacts on their breeding and colonising up and down the rivers.[31] According to the Australian Conservation Foundation:

> The capture of flows during wet seasons delays natural high flow periods and suppresses flow peaks at the expense of floodplains, wetlands and lakes. Invariably, rivers are used to deliver high volumes of water during naturally low flow periods, again disrupting river ecology.[32]

2.41 A second issue is cold water pollution. Cold dense water settles at the bottom of reservoirs and is released downstream from low-level valves, with releases commonly 10-12 degrees colder than ambient water temperatures and in some rivers temperatures do not return to normal for hundreds of kilometres downstream. Estimates suggest that about 2,500km of rivers are affected by coldwater pollution in the Murray Darling Basin alone, which can affect breeding, reproduction, migration and survival which are all temperature dependent.[33]

2.42 Thirdly, CSIRO explains that additional problems occur through stratification of water in storages, which causes anoxic (no oxygen) conditions with a resulting high concentration of dissolved metals (particularly iron and manganese), the release of nutrient rich sediments, and associated high levels of organic carbon. These support the development of algal blooms and more rapid growth of biofilms in the reticulation network.

28 That is, those with a wall height of less than 15 metres.

29 *The Australian Water Directory 2002*, Australian Water Association, p 16.

30 Great Barrier Reef Marine Park Authority, *Submission 60*.

31 *Dams and Diversity – Disturbing the balance*, Dr Richard Marchant, Watershed, Mar 2001, p 5.

32 Australian Conservation Foundation, *Submission 68*, p 3.

33 *Cold Water Pollution: Barren, wintry rivers in Mid-Summer*, Dr John Harris, WaterShed, Sep 2001, p 3.

2.43 For water treatment plants, the implications of this are increased treatment costs, and larger doses of chlorine which in turn produce more disinfection by-products such as trihalomethanes, which are suspected carcinogens.[34]

Groundwater supplies

2.44 As evidenced above, many Australian cities are heavily dependent on groundwater for their urban water supplies. This is due not only to the scarcity of surface water in some parts of the continent, but also that Australia has one of the largest aquifer systems in the world – the Great Artesian Basin which covers 1.7 million square kilometres. The national sustainable yield from groundwater sources is estimated at 25,789 gigalitres per year with actual extractions amounting to 4,962 gigalitres per year or 19 per cent of sustainable yield and 21 per cent of national water use.[35]

2.45 In maintaining the quality and sustainability of groundwater supplies, the two central management issues are over-extraction and contamination.

Over-extraction of groundwater

2.46 Essential as groundwater is as a supply of water, overuse of this resource poses several threats caused by the altering of the levels of the watertable. First, in relation to coastal aquifers such as those in Perth or Wellington, depletion of aquifers may lower the watertable allowing salt water from the nearby sea to enter the aquifer and contaminate it (known as saline intrusion).[36] This may render the water unfit for human use for decades, which could be catastrophic for an urban centre that relies on the groundwater.

2.47 Second, the loss of water from the aquifers and resulting changes to the water table may affect the health of wetlands and ecosystems on the surface.[37] This is explained by the Australian Conservation Foundation:

> The first comprehensive attempt at documenting groundwater dependent ecosystems in Australia was undertaken by Hatton and Evans (1998). Despite an overwhelming lack of data and research, Hatton and Evans described a number of ecosystem types that are wholly, or partially, dependent on groundwater for their continued survival. These include:
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> *River base flows* – where they exist – are by and large wholly dependent on groundwater discharge.

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34 CSIRO, *Submission 47*, p 33.

35 *The Australian Water Directory 2002*, Australian Water Association, p 18.

36 Discussed in *Urban water crisis in Perth*, Catalyst, 14 Mar 02, ABC TV. This also poses a problem in Wellington, New Zealand, where the Committee was briefed on issues relating to the aquifer recharged by the Hutt River which supplies 50% of Wellington's water.

37 Dr Leybourne, *Proof Committee Hansard*, Perth, 29 April 2002, p 399.

> *Terrestrial vegetation* – wholly or partially dependent on groundwater availability. These include some tropical paperbark forests, jarrah forests, swamp sclerophyll forests, some coastal banksia and casuarina woodlands, coastal heathland communities, saline discharge samphire shrublands, and a unique inland stand of coastal mangroves at Mandora Soak, south of Broome, WA.
>
> *Wetland communities*, including numerous coastal wetland, mangrove and saltmarsh communities, arid-region waterholes, and some swamp sedgelands and grasslands.
>
> *Karstic cave* and sinkhole ecosystems, including their 'troglodyte' fauna
>
> *Aquifer ecosystems* – poorly-known communities of bacteria and primitive invertebrates living between wetted subsoil particles in aquifers.[38]

2.48 This issue became cause for recent comments by the Western Australian Department of Conservation and Land Management, which reports that thirty or more species faced extinction from the drying out of the Yanchep caves which are fed from the Gnangara mound aquifer.[39]

Contamination of groundwater

2.49 Contamination of groundwater poses a major threat to both the continued safety of drinking water supplies, and eventually to the health of waterways generally, once the water re-enters surface water streams. Of particular concern though is that once contaminated, it is extremely difficult, expensive and often impossible to remediate the damage.

2.50 Common sources of groundwater contamination are leaky septic tanks (discussed in detail in Chapter 5), wastedumps and industrial facilities, and recent examples include:

- toxic chemicals from the former Bellevue recycling plant have leaked into a Perth tap water source;[40]
- pollutants (especially ammonia) from landfills in Tasmania;[41]
- the Friends of Malabar Headland in Sydney drew the Committee's attention to leachate from landfill contamination;[42]

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38 Australian Conservation Foundation, *Submission 68*, p 4.

39 West Australian, *Bores pose threat to WA fauna*, 11 June 2002, p 3.

40 West Australian, *Toxic waste linked to water*, 11 February 2002, p 7.

41 Mercury, *Water contamination fear from tips*, 31 June 2001, p 15; The Examiner, *Project to examine effects of disposal*, 31 May 2001, p 10.

42 Friends of the Mallabar Headland, *Submission 26*.

- groundwater pollution by septic tanks has caused closure of Sisters beach in Tasmania, with an associated drop in business;[43]
- the Claisebrook Catchment in Perth has a 200 year legacy of soil and groundwater pollution from urban and commercial use;[44]
- groundwater pollution presents a significant threat to the water supply of the key regional centre of Mount Gambier;[45] and
- according to a CSIRO study, one fifth of Perth's 500 service stations had leaking underground tanks. One station had leaked 15 litres a day into the system for two years, producing pollution 1,000 times higher than NHMRC guidelines.[46]

Other sources of water

2.51 Four other sources of urban water supplies are briefly considered: desalinated water; major transfer schemes, rainwater tanks and reused water.

Desalination

2.52 Australia is surrounded by water, and despite its salt content, it often seems tempting to use sea water to solve Australia's water supply problems. But implementing large-scale desalination has significant practical problems, as Dr Fisher explains:

> Desalinated water costs about three times the price of reservoir supplied water at the moment. It also has a very significant brine output. If that brine is delivered into waters like estuaries and bays then it leads to high salinity contamination of the waters. So I do not think that desalination is the panacea it is made out to be. It is also, at the moment, very energy guzzling. We have to look at the impact of that in terms of greenhouse gas emissions and so forth.[47]

2.53 Nevertheless, the option remains attractive, particularly if the energy needs can be met using sustainable power from solar or wind sources. A desalination plant has already been installed at Penneshaw on Kangaroo Island, and the towns of Coober Pedy and Roxby Downs source their water from desalinated groundwater.[48] A desalination plant is also currently under consideration for Perth, which will cost over $200 million, with an $850 000 feasibility study currently under way.

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43 Mercury, *Popular holiday centre hit by sewage problem*, 8 January 2002, p 11.

44 Swan Catchment Council, *Submission 23*, pp 1-2.

45 Dr Nicholas Fleming, *Submission 8*, p 4.

46 Sunday Herald Sun, *Five cities and their different supply problems*, 15 July 2001, p 80, quoting John Archer, *Australia's Drinking Water*.

47 Dr Fisher, *Proof Committee Hansard*, Melbourne, 23 April 2002, p 364.

48 Government of South Australia, *Submission 51*, p 26.

2.54 However, as Professor Jennings from the WA Conservation Council noted, fresh water from the plant is likely to cost about $1.80 a kilolitre compared to 55c a kilolitre that is currently charged,[49] and the WA Water and Rivers Commission confirm that this is not likely to prove an attractive option.[50]

2.55 Notwithstanding these problems, several commentators consider that the desalination technologies are becoming much more cost effective and will be used much more widely in the next 20 years as alternate water sources increase in price, and as groundwater and rivers face increasing pressures from salinity.[51]

Major transfer schemes

2.56 A perennial solution that is put forward to solve Australia's water problems is the large scale transfer of water from the major rivers of Northern Australia to the drier inland regions and southern states. Mr Stroud gave this explanation:

> [T]here needs to be a solving of the imbalance between the high-rainfall regions of northern Australia, and the rain-deficient population concentrations of south-western and southern areas.
>
> … the excess seasonal rainwater harvested in the Ord River Scheme in the Kimberley in northern Australia now needs to be also directed, by pipeline or open canal/channel, directly overland down south to the water-restricted population centres of Perth and Adelaide.[52]

2.57 Mr Stroud adds that there is the added advantage of:

> [at] the same time mitigating some of the regular flooding problems of the [Northern] river pathways.[53]

2.58 There are significant adverse environmental problems with this approach. First, it would cause a major disruption to the natural flow patterns of the northern rivers, whose natural ecosystems rely on the flood cycle. Second, as Dr Fisher argues:

> You are transferring water from one watershed to another that is maybe 2,000 or 3,000 kilometres away. We are thinking about these schemes to transfer water from Far North Queensland into the Murray-Darling Basin, where we are transferring into those all sorts of micro-organisms of which we have no information about how they are going to interact in the new

49 West Australian, *Desalination plant closer*, 1 Februrary 2002, p 11.

50 Dr Leybourne, *Proof Committee Hansard*, Perth, 29 April 2002, p 399.

51 Dr Nicholas Fleming, *Submission 8*, p 9. See also Government of South Australia, *Submission 51,* p 26.

52 Mr Stroud, *Submission 38*, p 2.

53 Mr Stroud, *Submission 38*, p 4.

> environment. This is a great concern and it should be researched more adequately before anything like that is entertained.[54]

2.59 Overall, given the complexity of the relationships within floodplain ecosystems and our lack of knowledge in this area, coupled with the massive problems in rectifying the damage caused by water diversions and dams in the southern states, it would seem irresponsible to multiply the problems in the north.

Reclaimed water and rainwater tanks

2.60 The two other alternate water sources for urban use are reclaimed water and rainwater collected in tanks. Both issues are examined in detail in following chapters.

Water treatment

2.61 Before water is delivered to homes through a tap, it is subject to a process of treatment and testing to ensure it meets public health standards. Modern treatment processes are capable of turning heavily contaminated water into safe drinking water through a number of processes which are briefly described below.

Treatment processes

2.62 Treatment processes vary depending principally on the quality of the catchment areas: protected catchments such as those enjoyed by Melbourne and Canberra require little treatment, whereas water from unprotected catchments, such as Adelaide's Mount Lofty Ranges will need much higher levels of treatment. Water coming into a treatment plant will go through several phases.[55]

2.63 The first step is known as flocculation, which involves the adding of chemicals such as alum (aluminium sulphate) to the water which acts as a coagulant to make suspended matter aggregate into larger, heavier particles that settle into the sludge at the bottom of settlement tanks. Often water also has to be treated to remove iron and manganese which are common in Australian water (Perth groundwater, for example, is naturally very high in iron which causes discolouration[56]). Lime, sulphuric acid or sodium bicarbonate may also be added to alter the pH (acidity or alkalinity of the water). Then, in the second phase of treatment, water is moved through filtration beds of sand, fine gravel, anthracite (finely divided high carbon coal) or zeolite (a fine clay).

2.64 The treated water is then disinfected with chlorine to protect it from infection within the water supply system, and also dosed with flouride. Sometimes ammonia is

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54 Dr Fisher, *Proof Committee Hansard*, Melbourne, 23 April 2002, p 364. *See also* Dr Fisher, *Submission 2*, p 2.

55 The following outline of the treatment process is based on Simpson and Oliver, *Water Quality: From wastewater to drinking water to even better* and *The Dilemma of Watter Quandary*, 1996,pp. 30-31

56 Dr Humphries, *Proof Committee Hansard*, Perth, 29 April 2002, p 417.

added with the chlorine to produce chloramines which have a longer lasting residual effect.[57]

Concerns with chlorine dosing

2.65 Chlorine disinfection continues to attract some controversy. Dr Fisher explains that:

> Chlorine is a pernicious element. ... It is also capable of forming quite serious disinfection by-products if there is any organic matter in the water when the water is chlorinated. This is a concern because disinfection by-products are carcinogenic.
>
> It has been shown, in California for instance, that drinking 10 glasses of chlorinated tap water per day can produce miscarriages in women. It is like cigarette smoking: we do not have definitive proof but there is an indication – and I emphasise that point. I am concerned about the continuing usage of chlorinated water with respect to the drinking water supply, because half of that water is going onto gardens and it has disinfection by-products in it. It is going into the ecosystem in some way or other.[58]

2.66 On the strength of these concerns, some towns actively oppose chlorine treatments. Elmhurst in Victoria has successfully opposed plans by Grampian Water to treat its water supply with chlorine, while in Myrtleford in 2000, the town rejected chlorine and argued for the use of ultraviolet treatment instead.[59]

2.67 However, according to the Australian Water Association, the health risks of drinking unchlorinated water far outweigh those of drinking chlorinated water.[60]

Visits to water treatment plants

2.68 The Committee visited a number of Water Treatment Plants during the course of the inquiry, including:

- Mount Stromlo WTP (ACT);
- Sandhurst Water Treatment Plant, Bendigo; and
- Te Marua Water Treatment Plants in the Hutt Valley, New Zealand.

2.69 Additionally, it received a briefing on the Mt Pleasant WTP (SA).

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57 Australian Water Association, *We all use water … A users' guide to water and wastewater management*, p 78.

58 Dr Fisher, *Proof Committee Hansard*, Melbourne, 23 April 2002, pp 364-5.

59 Herald Sun, *Here's cheers*, 31 May 2001, p 24.

60 Australian Water Association, *We all use water … A users' guide to water and wastewater management*, p 78.

2.70 A more detailed description of these visits is included in Appendix 5. However, several examples of innovative best practice deserve mention here.

2.71 The first of these is the use of membrane microfiltration at the Sandhurst Water Treatment Plant in Bendigo, Victoria. This plant was constructed for Coliban Water by Vivendi, under a $50m Build Own Operate and Transfer (BOOT) contract, and uses submerged membranes which filter down to 0.2 microns[61] – small enough to remove cryptosporidium and giardia as well as protozoan cysts. This process produces high quality water without the need for as much chemical dosing as is required in traditional treatment and disinfection processes.

2.72 The Mount Stromlo Water Treatment Plant in the ACT, uses a standard water treatment process, but is interesting for its introduction of a mini hydro-electricity generator turbine that is coupled onto the gravity fed water supply pipes connecting the Bendora Dam to Mount Stromlo. The generator saves over 3,600 tonnes of greenhouse gas emissions each year, by supplying electricity that would otherwise come from fossil-fuel power stations.

Future dilemmas: finding extra supplies

2.73 As is evident from the above discussion, many Australian cities are facing considerable challenges over the next twenty or so years, as the competing demands made on the water supply increase. Fundamentally, water managers must consider the options of finding extra water supplies, decreasing water demand, or both.

2.74 The timeframe for this decision varies across Australia. It is estimated that a new water source will be required for Perth between 2005 and 2007;[62] Brisbane by 2015;[63] and Canberra by around 2017. Other cities have more time: Melbourne has enough capacity to maintain the security of supply until 2040 without developing new water sources,[64] and in South Australia, the metropolitan supply is considered to have significant spare capacity, which has reduced the need for increasing future supply.[65]

2.75 However, these timeframes are shorter than they may at first seem, given the scale of the investments required to build new dams or significantly change usage patterns. Planning must also be done in the context of uncertainty over regional growth patterns. The Committee saw how Wellington, New Zealand, for example, has not grown at the expected rates, with the result that the water supplies easily meet likely future requirements.[66] Other cities with high growth rates, such as the Gold Coast, Queensland, face the opposite problem.

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61 A micron is one millionth of a metre.

62 Water Corporation of Western Australia, *Submission 49*, pp 25-26.

63 Ticky Fullerton, *Watershed: Deciding our water future*, ABC Books, 2001, p 39.

64 Melbourne Water, *Submission 46*, p 4.

65 Government of South Australia, *Submission 51*, p 10.

66 Committee briefing, Wellington Regional Council, Wellington, 15 April 2002.

Conclusions

2.76 From the discussion in this chapter, it is evident that the sources of water for Australian cities are under growing pressures from pollution and competing uses, such as irrigation and environmental flows. Added to this is the uncertainty of changes to climate and rainfall patterns caused by human induced global warming.

2.77 Several things stand out in this discussion. The first is the importance of high catchment quality in ensuring high water quality, and in minimising the costs of treatment. To a large extent, this relationship is still not adequately understood by the public, which creates extra difficulties for policy makers in gaining public acceptance for some of the hard decisions on land use in these catchment areas.

2.78 Catchment protection is a matter in which the Commonwealth has only a limited role, however, the Committee urges state and territory governments to take decisive action to increase the level of protection for threatened catchments. The security of some of the catchments supplying Canberra and Melbourne stand as powerful examples in this regard.

2.79 The second issue concerns the search for new sources of water supply. The chapter discussed several possibilities that are currently under consideration, but the Committee cautions against pursuit of many of these ‘silver bullet’ solutions. These options should, in most cases, not be allowed to take priority over the more urgent business of using existing water supplies more efficiently. Increasing supply without addressing these underlying inefficiencies will only delay the inevitable point where demand again outstrips supply.

2.80 However, where these alternative sources of supply are sought, the focus of effort should be on options that solve other problems in our water use patterns, such as the use of rainwater tanks, or expanding the use of recycled water. These issues are explored in the following chapter.