How Can Everyone Have Sufficient Clean Water Without Conflict?

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Abstract

This article provides a statistical update of Australia's water situation including data on usage, consumption, and volume supplied, and some recent developments in water policy, science and technology that might assist in managing the nation's future water supply challenges. The prevailing 20th century water paradigm is then contrasted with some emerging perspectives that might herald a shift in Australian thinking about water, a shift that could influence behavioural change and begin to answer some of the water demand challenges the nation faces in the 21st century. Causal Layered Analysis (CLA)[1], is used to briefly examine the way water has been valued and measured, and the systems and worldviews that have influenced the past Australian human-water relationship. The same framework is then used to explore emerging perspectives on water, providing contrast between 20th century and emergent thought and debate. I conclude that these more recent perspectives, some with old foundations, are signs of a shift in water values and ethics and that Australia is crafting new stories, forming new worldviews, creating new systems and technologies, and developing new measures of success for its water futures.

Keywords: Water usage, demand, supply, human-water relationship, water values and ethics, systems, worldviews, CLA, scenarios, stories.

Introduction

One of 15 global challenges identified by the Millennium Project is the provision of sufficient clean water for all without conflict. The project's 2009 State of the Future report notes 'about 700 million people face water scarcity today which could grow to 3 billion by 2025 due to climate change, population growth and increasing demand per capita… water stress could affect half the world's population by 2050' (Glenn et al., 2009, p.14). Planet Earth seen from space could well be renamed 'planet water' yet for all the water visible from space only 1% is fresh water available

for human sustenance and the competing needs for this 1% are growing along with the world's population[2] and economic growth. One estimate suggests that a safe global boundary for consumptive blue water use is approximately 4,000 cubic kilometres per year and that current annual extraction is already 3,000 cubic kilometres (Pearce, 2010). As water withdrawals are projected to increase by 50 percent by 2025 in developing countries, and 18 percent in industrialised countries, one plausible future scenario is that of water resource depletion (Diamond, 2006; SIWI, 2009).

Whilst the water challenge is global in its reach it nonetheless affects different nations, and different communities within those nations, in many different ways. For example, in addition to its central role in maintaining human life, health and wellbeing, water also plays a pivotal role in socio-economic development and production of food particularly in developing nations where agriculture remains central to livelihoods, determining levels of poverty and food insecurity (Craswell, 2005; Falkenmark, 2007; WHO2003, p.19). One future hot-spot for food trade gaps is West Asia. 'Sufficient' for people living in extreme poverty in this region is enough water to survive. In contrast, city and town dwellers in wealthier nations like Australia have become accustomed to plentiful and cheap supplies of clean, potable water 'on tap'. We have increasingly used potable water for a wide range of agricultural, industrial, domestic and recreational purposes. 'Sufficient' in this context then becomes difficult to define - who decides how much clean water is 'sufficient' and for what purposes it may be used? During extended periods of drought and severe water restrictions, however, it is apparent that Australia's 20th century relationship with water cannot continue.

As the nation's water pendulum swings from a decade of severe drought to a period of extreme floods in some parts of the country the subject of water is never far from the centre of public debate. Climate change, future population growth, competing needs of industry and agriculture, ageing infrastructure, greater public involvement in water-related decisions, and growing ethical considerations, including the rights of other life forms and concerns for future generations, all point to the fact that water remains one of the nation's key challenges for the future. And paraphrasing Einstein, we cannot solve key challenges using the same thinking that was used to create them.

The use of futures research methodology CLA opens our thinking to other ways of looking at challenges, broadening the range of options we might consider in addressing them. CLA helps us look below the surface 'noise' of information overload to explore the deeper levels of thinking and practice that influence a given topic or issue. CLA is structured vertically in four levels: level one, the Litany, represents the official public description of the issue, including statistics, measurements, and government policy; at level two, Systems, we ask 'what are the systems that uphold the way we value and measure water?' These might be economic, political, social, technological or natural systems, or a combination of systems. Level three, Worldviews, explores our deeply held views of a topic or issue, often culturally or ideologically formed over time, seeking to answer the question 'which worldviews are driving the prevailing systems?'; and level four, Metaphor/Myth, aims to reveal the deep collective stories and archetypes, operating at an almost subconscious level, that could be blocking our path to a better water future for all.

Shifts in thinking take place at each level. The most resilient transformation in organisations and communities occurs when the deepest levels are accessed and a new narrative is created along with new, robust measures to assist with implementation (Inayatullah 2004, 2011). In this article CLA is used to contrast the prevailing 20th

century Australian water paradigm with what might be an embryonic human-water relationship based on emergent thought and behaviour. The following table summarises the CLA framework and the structure of the Australian water discussion in this article:

Table 1. *CLA summary of Australia's water situation*

Headings	**Prevailing 20th century paradigm**	**New story for the 21st century?**
Litany	Water measures: availability, supply and consumption. Water resources. Water challenges.	Virtual water measures and water footprints. Portfolio of water sources. Social pricing; tiered pricing.
Systems	Economic-industrial. Major centralised infrastructure.	Ecological-social. Multiple supply options.
Worldviews	Water as a cheap commodity, an industrial good. Supply–based focus. Technology fix.	Water as a social-cultural good, a human right. Supply and demand-based. Behavioural change.
Metaphor/myth	'The tap that never turns off'	'Water is life'.

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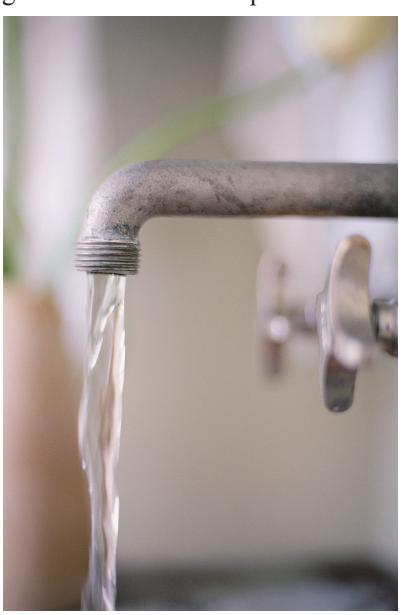

The Prevailing 20th Century Paradigm

The litany

Australia is a land of contrasts and nowhere is this more evident than its hydrology. Annual rainfall variability is greater for Australia than any other continent.[3] The recent ending of a decade-long drought with extreme floods in some parts of Australia

is characteristic of this variability of weather condition, a variability that generates concerns as to future water security. These are, however, only the most visible components of the water challenge. Underneath is an equally worrying trend of declining runoff which is expected to worsen as the climate warms over the next few decades (WSAA, 2010).

Climate change, according to the Water Services Association of Australia (WSAA), is one of the two dominant factors influencing the sustainability and reliability of water supplies for urban Australia. The other is population growth.[4] The Australian Bureau of Statistics (ABS) series 'B' projections suggest a total population of 35.5 million in 2056, an increase of 69% on 2009 figures. Australians being highly urbanised, it is anticipated that most people will be living in cities and major towns. As for climate change, those measurements are still a work in progress. However emergency services agencies are anticipating an increased frequency and severity of extreme weather events into the future, over and above what might be expected for a continent with a long track record of capricious weather patterns.[5] What we can expect, with some confidence, is increasing unreliability in rainfall.

Measuring water, then, becomes an important part of ensuring water for all without conflict in the future. Water is measured in Australia primarily by availability, volumes supplied and consumed, and by expenditure on services.[6]

Water measures: Availability, supply, consumption

Availability: Water availability is estimated using three common measures: the difference between rainfall and runoff into rivers or recharge into groundwater acquifers; water stored in dams; and groundwater resources (NWC, 2011).

In 2010 rainfall was 703mm, significantly higher than the annual average[7]. Much of this in concentrations in southeastern Australia that resulted in major flooding.[8] However, on average, only 10% of rainfall becomes runoff and is available for use. Based on 2004-05 data, the total inflows to Australia's surface and groundwater resources were made up of 83% runoff and 17% groundwater recharge (NWC, 2011). Of the current surface and groundwater management areas, 26% of surface and 34% of groundwater areas have been assessed as 'overdeveloped'.[9]

Water storage data is maintained by the Bureau of Meteorology (BoM). As of April 2011, there were 261 storages with a capacity of 78,449,195ml currently running at 50.6% capacity. This is unevenly spread with Darwin and Hobart at 100% capacity, for example, and Perth at 17.6%.[10] BoM is also developing a National Water Account service to provide a standardised national data source for water availability, use, rights and trading with the first report to be published mid 2011.

Groundwater availability, according to the National Water Commission, is difficult to measure as little is known about these natural systems and their connections to surface water resources.

Supply and consumption: Supply is much easier to measure and as the following tables show, totals extracted and consumed have been decreasing steadily despite population growth. Yet Australians remain amongst the world's highest water consumers per capita.

Table 2. *Total Australian water supply and consumption from 1996 to 2009 in GL.*

Water source/use	2008-09 GL	2004-05 GL	2000-01 GL	1996-97 GL
Extracted	59,839	79,784	76,668	68,703
Consumed	14,101	18,765	21,703	22,185
Agriculture	6,996	12,191	14,989	15,503
Forestry and fishing	101	47	40	19
Mining	508	413	321	570
Manufacturing	677	589	549	728
Electricity and gas	328	271	255	1,308
Water supply	2,396	2,083	2,165	1,707
Other industries	1,327	1,059	1,102	523
Households	1,768	2,108	2,278	1,829

Source: ABS Water Accounts1997-2009 www.abs.gov.au

In 2008-09, total water consumption in the Australian economy was 14,101 GL, down 25% from 2004-05. Australian household consumption was 1,768 GL, a decrease of 16% from 2004-05.[11] Agricultural activity used half (6996 GL) of total water consumption in 2008-09, a significant reduction from 2004-05. The mining industry consumed 508 GL, 23% more than in 2004-05, a rise that is associated with increased mining activity. Manufacturing industry consumption also increased by 15% increase from 2004-05.

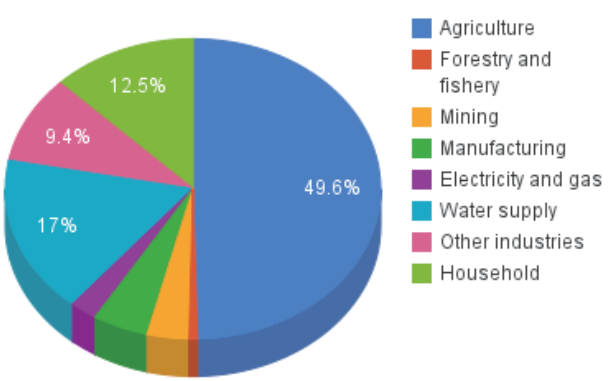

Figure 1. Australian water consumption by sector 2008-09[12]

In most major cities the volume of water supplied has reduced and within this volume the consumption per capita of residential water is also following a downward trend. Despite these reductions in usage the average price of water nearly doubled from $0.40/kL in 2004-05 to $0.78/kL in 2008-09. As well there was large variation

in the average price paid for water in 2008-09 with households paying $1.93/kL and agriculture $0.12/kL.

Table 3. Total urban water supplied (GL)

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Adelaide	166	166	151	156	139	138
Canberra	49	48	52	48	41	42
Melbourne	433	431	438	402	370	360
Perth	228	225	231	240	240	250
SE Queensland*					215	223
Sydney	563	526	528	510	482	492
Total					1,486	1,505

*total data not available for South East Queensland, Source: WSAA Occasional Paper 25

Table 4. Consumption per capita: residential water (kl)

	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09
Adelaide	105	101	101	102	84	83
Brisbane	102	104	73	60	51	53
Canberra	97	94	104	95	76	79
Melbourne	77	74	75	68	60	57
Perth	111	107	105	110	104	106
Sydney	83	78	75	74	68	74

Source: WSAA Occasional Paper 25

What these measurements tell us is that the amounts supplied to most major urban centres are gradually reducing, that the bulk of water supplied goes to agriculture and industry, and that residential water consumption per capita has also reduced considerably in recent years. The WSAA suggests per capita consumption is likely to remain stable from 2009 out to 2026. However despite this stability the total urban water demand is expected to increase by an estimated 42% by 2026 and 76% by 2056 along with population growth (table 5. series B WSAA, 25, p.14). This equates to an increase of 600 billion litres per year by 2026 and 1147 billion litres a year by 2056 (WSAA, 2010).

Table 5. Projected total urban water consumption (GL) 2026 and 2056

	Actual 2009	2026 Series % change B GL from 2009	2056 Series % change B GL from 2009
Sydney	492	613 25%	709 44%
Melbourne	360	511 42%	647 80%
SE Queensland	223	494 122%	693 211%
Adelaide	138	174 26%	174 26%
Perth	250	284 14%	368 47%
Canberra	42	59 41%	61 45%
TOTAL	1,505	2,136 42%	2,652 76%

Source: WSAA Occasional Paper 25:15

Expenditure on Services: The OECD estimates Australia's future expenditure on water and wastewater services to be USD billions 9.95 by 2025 (OECD, 2007, p.289).

Water resources: During the past century Australia was almost completely dependent on surface runoff into dams as the sole source of water (Binney et al., 2010). Many of the traditional water sources have been over-allocated. Based on the projected population growth, and the unpredictability of rainfall and climate change impacts on an already arid continent, it is clear that other sources of supply are needed and climate independent sources such as desalinated sea water will play a key role in Australia's water futures (WSAA, 2010). Perth was the first city to invest in desalination in November 2006 prompted by strong climate change signals. By 2012 there will be five more desalination plants in Adelaide, Brisbane, Melbourne, Perth and Sydney with a potential capacity of 674GL per annum (WSAA, 2010, p.16). Whilst the WSAA is optimistic that this capacity will meet demand at 2026 they also caution the need to be adaptable to changing circumstances. Other sources of supply such as recycled water, stormwater, groundwater and rural to urban water trading schemes have also been developed (WSAA, 2010).

Water challenges. As Australian towns and cities expand to cope with the growing population to 2056, demands for water are expected to rise along with the energy needed to move that water around. The following water challenges have been identified:[13]

- Maintaining water security in a changing climate for a growing population
- Managing diverse sources of supply
- Achieving water efficiencies – more crop per drop, reducing carbon footprint and recovering energy and nutrients from wastewater
- Maintaining healthy waterways in increasingly urbanised environments
- Aging infrastructure
- Pricing policy and structures ensuring affordability of drinking water

- Water sharing
- Water allocations for the environment and for future generations
- Demand management through non-punitive means ie behavioural change
- Providing safe drinking water
- Communities adjusting to a life with less water
- Providing consistent national data to meet a range of decision-making needs.

20th century water paradigm: Systems, worldviews and myth

There is a growing appreciation in Australia that 20th century approaches to the planning and provision of future water services may not provide for a range of unmet and newly identified needs, and that combining centralised infrastructure with new approaches for water supply, demand management, and community engagement may be more successful and less costly (OECD, 2007; SIWI, 2009; Water Corporation, 2009). 20th century water systems were created to a great degree for public health outcomes and security (Binney et al., 2010).

In the prevailing 20th century water paradigm the dominant systems affecting water issues in Australia have been economic and industrial, generated by a worldview of water as a commodity to be priced and traded and supplied to Australian cities and towns primarily via major, centralised infrastructure systems with large supply, distribution and treatment facilities. In this worldview, water is a commodity to be used as required, provided it is paid for. Underpinning this paradigm is a myth that has driven water views and behaviours over the past half century based on a belief of endless water supply – the myth of the tap that never turns off. In the writer's view it is time to write a new Australian water story for the 21st century. This task is beyond the scope of this paper but some of the possible themes for the narrative are highlighted here.

A New Story for the 21st Century?

Using the CLA framework to map the Australian water discourses, in comparison with earlier ways of valuing and measuring water, we can see subtle shifts in thinking and behaving towards water.

Table 6. CLA map of emerging water story

CLA	
Litany (measures)	Virtual water and footprint measures; portfolio of water sources; social and tiered pricing; triple bottom line decisions.
Systems (supporting)	Interconnected, eco-social, multiple supply options.
Worldview (stance)	Human rights and ethics, demand management, spiritual discourse.
Metaphor/Myth (underlying story)	Water is life.

The litany: New measures, new sources

Virtual water and water footprint measures.

Whereas water has been measured by volumes of supply and usage as discussed earlier, we are now seeing new measures being developed such as 'virtual water' and 'water footprints'. Virtual water measures estimate the amount of embedded water in products. For example, 1kg of steak requires 15,500 litres of water to produce whereas 1kg of wheat contains 1,300 litres of virtual water (Chapagain & Hoekstra, 2004) both products being popular in the Australian diet. Water footprints, which have an agreed global standard since 2009, are more comprehensive measures that look at the total direct and indirect water use of an individual, community or business. Comparisons between nations reveal not only the national water footprint but how much countries are externalising their footprint by importing water-intensive goods from other nations.

A few comparisons between nations in the Asia/Oceania region with that of the largest footprint from the U.S and the global average footprint of 1243 m3/cap/yr (table 7) assists countries in the region to manage their footprint in the context of their economies:

Table 7. Comparisons of national water footprints

Nation	Water Footprint in cubic meters/year/capita	% Externalised
USA	2483	19%
Australia	1393	18%
Indonesia	1317	10%
Japan	1150	65%
India	980	2%
China	700	7%

Source: www.waterfootprint.org (Hoekstra and Chapagain 2008)

In Australia, the Western Australian Water Corporation have set an aspirational goal and an organisational value of 'Zero Footprint' for their operations (Water Corporation, 2010). The state water plan also includes reference to the need for the provision of water services that is congruent with our cultural and spiritual values of water (Kelleher, 2008).

Portfolio of water sources

In the water as commodity paradigm water comes from rain fed sources and is supplied via major infrastructure. But where do we find water when there is no rain, often for months at a time? For Australia with its decade-long droughts and bursts of severe flooding, rain water cannot be taken for granted; rather we need to think about a portfolio of water sources: a climate independent water regime.

What might this look like? A combination of recycled wastewater and desalinated

water to supplement existing groundwater and surface water sources, and local means of optimising rainfall, storm and floodwaters whenever and wherever available (WSAA, 2010). One way this is being achieved in some parts of Australia is rainwater harvesting.

Rainwater harvesting is growing in popularity in Australia for domestic and commercial building water uses where untreated rainwater is used for washing, cleaning, flushing toilets and gardening, and treated water is used for drinking and cooking. ARID estimates that 50% of Australian domestic water use is for toilet flushing and garden watering and that rainwater or other fit-for-purpose water could be used instead[14]. March 2010 figures from the Australian Bureau of Statistics (ABS) indicate that 26% of Australian households use rainwater as a source of water. In South Australia the figure is 49%. Of the capital cities Brisbane recorded the highest increase in rainwater tank installation from 18% of households in 2007 to 43% in 2010.[15]

New building designs are focusing on rainwater harvesting as a means of reducing water consumption. In new housing developments in 2010 rainwater tanks have been installed in 57% of homes under one year old compared with 26% in 2007.[16] An emerging trend in urban development is the design and installation of water systems that include multiple water sources in an integrated water cycle management framework. One example is the Pimpama Coomera Water Futures project in Queensland that uses domestic rainwater tanks, wastewater reuse through 'smart sewers' and water efficient appliances to alleviate increasing deficits in water availability from catchments. Its target is an 85% reduction in water use and a sustainable water supply for a future population of 150,000.[17] A recent commercial development includes the use of Siphonic Roof Drainage technology at Sydney and Adelaide airports which improves access to water from high-intensity rainfall events, virtually eliminates underground pipework, and provides greater opportunities for stormwater reuse options (Lucke et al., 2007).

Social pricing and tiered pricing

Water pricing models for the future are under consideration as prospective increases in water and energy prices engender concerns of affordability. Social pricing and tiered pricing models feature in the discussions in some states.

The systems: Interconnected

Ecological-social

The OECD writes of the potential to leverage the principal drivers of change and opportunities, "which include financing, demand management, the scale of water systems, climate change, and public involvement and equity" to transform the water sector (OECD, 2007, p.287). This advice has been heeded in Australia and governments are increasingly adapting policy and water security planning methods to incorporate public consultation, futures research, and behavioural and educational approaches to demand management to supplement restrictions and punitive measures. Whilst economic and industrial drivers remain important, environmental and social issues, including cultural and spiritual concerns, are attaining greater prominence in Australian

public debate as well as a growing recognition of the interconnectedness of natural and human-made systems involving water. Biomimicry, human innovation by copying other forms of nature, is one example of this and an area worth exploring. Native plants and animals live with very little water. How might creative humans emulate them?

Equally Australia's First Nations have over 60,000 years experience of water and land stewardship. This experience is increasingly being valued in programs such as the Caring for Country Initiative, the Working on Country Program and Cape York Park management. However decades of European-style water management has disrupted the natural flows of water which many communities rely on to maintain the health of waterways and ecosystems – the foundation of their social, cultural, spiritual and economic lives termed 'cultural water' by First Nations in the Murray-Darling Basin area.[18]

Multiple supply options

Whilst major infrastructure is expected to deliver the bulk of Australian water needs in the foreseeable future, there is a growing interest in using a portfolio of supply options for sourcing and delivery of water. Depending on location, options can include locally managed cooperatives such as Gascoyne Water in Western Australia[19] and Coleambally Irrigation Cooperative in New South Wales.

The Western Australian Water Corporation 'Water Forever' program is a fifty-year outlook informing water policy and planning based on formal futures research and an extensive community engagement program. A range of supply and demand management options were evaluated in consultation with the public, including innovative proposals such as cloud seeding20 and a community-initiated project based on the work of Japanese scientist Emoto in 'Messages from Water' using local creative talents to paint messages on a community water tank to encourage positive thoughts into the local water supply (Kelleher 2008). The Corporation's view is that future water security is best assured through supply diversity and in partnership with its diverse communities. One outcome of this program is a considerable increase in public confidence in the Water Corporation's ability to plan for the longer-term future and ensure climate-independent water supply for the state's growing population in a hotter, drier climate.

An expanded worldview: Including water as a social good

Human rights and ethical discourses

The United Nations and the World Health Organisation (2003) have enshrined the rights of all members of the human family to food, work and water[21]and encourage us to think of water as a social and cultural, as well as economic, good. For Shiva (2006), one of India's preeminent writers on water issues, the right to water is predicated on and bounded by the duty to conserve water, keep it pure and provide it to those who need it, thus the right is accompanied by responsibilities.

Rights-based discourse and ethical debate is now further complicated by the inclusion of the rights of future generations and of other life-forms (Shiva, 2009). From the perspectives of intergenerational equity and neohumanism some are asking how

much water is needed for the rest of the planet and what must be conserved for future generations (Marks, 2007)?[22] Table 8 maps these three perspectives of water rights and ethics:

Table 8. CLA applied to water rights and ethics discourse

Deconstructed by ideology.	Human rights	Future generations	Neohumanism
Litany	Volume per capita for human survival.	Volume needed for growing population.	Volume needed for all life forms.
Systems	Social. Cultural water.	Interconnected systems, stewardship.	Ecological. Biomimicry.
Worldviews	Human rights.	Rights of future Australians.	Rights of all life forms.
Deep stories	Listen to First Nations.	Listen to our great-great grandchildren.	Listen to water.

In Australia the Commonwealth government has embarked on an Environmental Watering program aimed at avoiding the loss of threatened species and maintaining key refuges in drought conditions to allow recolonisation when conditions improve[23]. Early results indicate the program is achieving its goals.

Demand management

Demand management is about reducing the demands for water, particularly potable quality water. It is customarily achieved through a combination of water policies, including restrictions, and education and awareness raising that lead to changes in behaviour over time. According to the OECD, a greater focus on managing demand for water, rather than relying on continual searches for new supplies, changes the industrial dynamics, increases the time scale of planning efforts (long term vs. short term), focuses on the end-goal instead of the path to reach it, involves fewer technical risks and uses less money (OECD, 2007, p.271). Some writers are promoting a more holistic approach to education to improve demand management (Rogers, 2006 in Cosgrove 2010). Wildman presents one Australian approach to holistic community action learning later in this report. In addition to Emoto's contested findings in Japan, researchers in Germany have been experimenting in communications with water, whilst others are promoting Biomimicry[24] as a means to harmonise human-water interaction. In this approach humans would learn from water, adopting the nature and characteristics of water in stewardship education and emulating water's abilities to adapt its form without losing its integral components (Marks, 2007).

Consumerism also has a role to play in the current water situation. A 'cultural pattern that leads people to find meaning, contentment, and acceptance primarily through the consumption of goods and services', consumerism takes different forms in different cultures yet consistently leads people to associate high consumption levels with well-being and success (State of the World, 2010). Easing overconsumption and underconsumption are the two equally important sides of the global water challenge

in the Asia-Oceania region and both will require the transformation of this cultural patterning to one that helps people find meaning, contentment and acceptance primarily through 'enoughness'.

Spiritual discourses

According to Wong (2008) religion and spiritual feelings are collective experiences with implications for (water) resource management for common purposes. Religions and spiritual beliefs are creations of their socially constituted contexts and generate different cultural patterns including symbols, language and stories (Eisler, 1995; Inglehart & Norris, 2008, p.396; Vaneechoutte & Skoyles, 1998). Water features strongly in these. In Australia 'the human spirit child is believed to jump up from the ancestral forces within the water to enliven the foetus in the woman's womb' (Strang, 2006, p.73). In Nyungar cosmology the Waakal (rainbow serpent) is both the creator of humans and of rivers (Collard, 2006).

Water is encoded with immensely powerful meanings for humans. Religious and spiritual beliefs that highlight humanity as steward, rather than dominator of the environment 'can be a powerful influence in developing and sustaining the awareness of societies and communities of their roles in using and conserving natural resources, including water' (WWAP2009, p.38). The meanings encoded in water that are believed to be common to all:

- 'Water as a source of human spiritual regeneration and well-being
- Water as a metaphor of a cycle of life time
- Water as a source of 'enlightenment' and knowledge
- Water as the substance of social identity
- Water as the literal and metaphorical substance of social connection linking individuals to groups or congregations
- Water as the substance linking people to particular environments
- Water as an image of human health, wealth and agency
- Water as a series of images for imagining the self, social systems, economic systems, and environmental systems' (Strang, 2006, p.80).

Metaphor: 'Water is life'

At the fundamental levels the human family recognises water as the origin of life through a variety of creation myths and through scientific knowledge and education. Humans know that water comprises a large part of the physical body and that water is a vital element for the continuation of human life. Outside of the wealthier, industrialised nations, humans know, in many different ways of knowing, that water connects the individual human body with its immediate social and physical environment. As such it is integral to social identity, uniting person with place and with other people who ingest, use and share the common element (Marks, 2007; Strang, 2006).

In Australia our language will need to shift from the commodity-based water worldview of the 20th century to reflect the precious life-giving element that water is and to engender protective feelings enacted as stewardship of water. In Iran, for example, the language around wetlands has changed significantly from 'mourdab', meaning dead land, to 'talaab', land for life and water (Marks, 2007, p.35). Iranian

worldviews, shaped through culture and language, are influencing and being influenced by their natural environment. In Samoa the language of peace is based on water (Marks, 2007, p.100).

In Australia there are a number of myths about water from the educational stories of Australia's First Nations, Tiddelik the Frog for example, and the Rainbow Serpent or Waakal. These two myths teach young people how to survive in the desert and about the human-water relationship of spirituality and mutual need. While the dominant concepts of water relate very much to its cyclical nature as well as its use and abundance, those emerging from the stories of Australia's First Nations are complex, multi-dimensional and extend into spiritual realms. The depiction of relationships involving water reveals a body of knowledge in First Nations communities that is different from the prevailing concepts - one that is gradually being understood, respected, and harnessed in land and water management programs. This blend of knowledges is helping Australia transition from the mythical 'tap that never turns off' to the metaphor 'Water is life'.

Scenario Sketches

The content of this article can be summarised in four simple scenario stories providing a quick visualisation of possible futures:

Business As Usual: the same players, relationships and attitudes towards water continue. Water is valued as a cheap commodity to be bought and sold to the highest bidders creating further rich/poor divides as those who can afford to do so buy their water actually and virtually and those who can't afford it have their access further restricted. Major infrastructure dominates supply and demand management combines restrictions and punitive measures with education for gradual behavioural change.

Collapse: Australian society fails to respond to the severity of imminent challenges. Lulled into a false sense of water security by recent floods, restrictions are eased, desalination budgets cut and water withdrawals begin to exceed long-term sustainable supply capability. As floodwaters recede competition for water between agricultural, industrial and domestic human needs ramps up. Conflicts arise in the form of increasing water thefts and divisions between and within communities over allocations. The natural water system is depleted in the next drought period.

Discipline: Australian water rights, responsibilities and ethics are introduced as accepted cultural norms following extensive public consultation around the theme 'Water is life' and the Australian value of 'a fair go'. The needs of other life forms, cultural water needs and water conservation for future generations are included in the ethical considerations as equally deserving of water allocations alongside the present needs of agriculture, industry and domestic users. Desalination technology provides the bulk of human supply needs with natural sources such as streams, rivers and lakes being preserved for other life forms, cultural uses and future generations. First Nations communities create cultural economies around stewardship of the continent's natural water systems.

Transformation: a fundamental reorganisation of the human-water relationship signals a complete break from the past. In this scenario Australians transition from water overconsumers to innovative water misers within a decade. Building on the combined strengths of many ways of knowing that stimulate creativity and innovation, Biomimicry leads water research and technological innovation as humans listen to water and use its principles as the platform for a system of interconnected relationships

– social, ecological, spiritual, economic, political. 'Fit for purpose' water is supplied to all homes, public parks and amenities and used for everything except drinking and cooking. It is also the only water accessible for agricultural and industrial purposes. This reduces potable water consumption by over 80%.

Conclusions

Traditionally, valuing, measuring and planning for water provision has been largely about ensuring the supply of a plentiful commodity through adequate infrastructure. However at the nexus of population growth, climate change, and Australia's 'water pendulum', lies the realisation that the human-water relationship cannot continue this way. Planning needs to account for a range of future possibilities, particularly with respect to the two dominant factors of climate change and population growth.

Whilst the writer has alluded to scenarios in this paper, and provided a few simple archetypal storylines, recent changes in climate suggest that planning could be better served by the formal research and development of alternative scenarios to generate plausible options for the nation's water futures and guide the decisions we need to take today. Examples of this are to be found in the Central Highlands Water and the WA Water Corporation planning processes. Scenarios for future water systems planning need to go beyond supply-based modelling and technology solutions to incorporate a wider range of social and environmental water needs and relationships, employing a more systemic approach to scenario research and development.

In this article we provided an update of Australia's water situation and suggest that the nation is in transition from being over-consumers to water stewards. We included data and some recent developments in water policy, science and technology that might assist in managing the nation's future water supply challenges. We then contrasted the 20th century water paradigm with a few emerging perspectives that we believe signal a shift in the nation's thinking about water, a shift that could influence behavioural change answering some of the water demand challenges we face in the near future. We conclude that these more recent perspectives, some with old foundations, are signs of a shift in water values and ethics and that Australia is crafting new stories for its water futures.

In response to the Millennium Project challenge of providing clean water for all without conflict, this challenge will be met when Australians are confident that they, and their children's children, will have reliable water services. Governments and water sector entities are addressing the challenge with multiple responses:

- National Water Initiative water sharing policies and water rights
- Bureau of Meteorology water forecasting service
- Desalination plants
- Broadening the traditional technology/supply focus to include social, cultural, spiritual, and ecological aspects
- Extending demand-based programs through greater community engagement
- Learning from the traditional custodians of land and water
- Using formal futures research to explore options and plan water futures

Whilst Australia would not claim to have all the answers to the water challenge, there are clear signs of new thinking and innovative approaches in various parts of the country.

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Notes

1 See Inayatullah, S. ed 2004. The Causal Layered Analysis Reader, Tamkang University Press, Taipei.
2 See http://www.eoearth.org/article/Freshwater
3 See www.abs.gov.au 4610.0 water account
4 WSAA Occasional Paper 25 – Implications of population growth in Australia on urban water resources
5 See FESA 2023 for example
6 See http://www.environment.gov.au/water/publications/action/securing-water-future.html
7 C Racic Bureau of Meteorology 29/04/2011 personal conversation, See: www.bom.gov.au/announcements/media_releases/climate/change/20110105
8 See www.australiancollaboration.com.au
9 See http://water.bom.gov.au/waterstorage/awris/index.html
10 See ABS 4610.0 water account 2008-09
11 See Urban Water Factsheet ABS Water Account 2008-09
12 See www.csiro.au; www.ccsa.asn.au; www.environment.gov.au www.bom.gov.au
13 See www.arid.asn.au
14 See www.abs.gov.au/ausstats 4602.0.55.003 Environmental Issues: Water Use and Conservation Mar 2010
15 See www.abs.gov.au/ausstats 4602.0.55.003 Environmental Issues: Water Use and Conservation Mar 2010
16 See www.allconnex.com.au
17 See www.hreoc.gov.au/social_justice/nt_report/ntreport08/pdf/Climate_Change_Community_Guide.pdf
18 See www.goscoynewater.com.au
19See www.watercorporation.com.au/_files/PublicationsRegister/22/Water_Forever_Options_Report.pdf
20 Declaration of Human Rights; The Right to Water; Convention on the Rights of the Child (1989).
21 See www.prout.org
22 See www.environment.gov.au/water/publications/action/cewh-outcomes-report-2009-10.html
23 See http://www.biomimicryinstitute.org.

References

Binney, P, A Donald, V Elmer, J Ewert, O Phillis, R Skinner, & R Young. (2010). Spatial Planning and Institutional Reform Working Group Report. In IWA Cities of the Future Program: Spatial Planning and Institutional Reform Conclusions from the World Water Congress. Australia.

Chapagain, A. K., & A. Y. Hoekstra. (2004). "Water footprints of nations." In *Value of Water Research Report Series*. UNESCO-IHE.

Collard, Len. (2006). "The Cosmology: The creator of the trilogy Waakal or Nyungar Rainbow Serpent." In *Water: Histories, Cultures, Ecologies*, Marnie Leybourne & Andrea Gaynor (Eds). Perth: University of Western Australia Press.

Cosgrove, William J. (2010). *Public Participation to Promote Water Ethics and Transparency*. In work in draft: unpublished.

Craswell, Eric T. (2005). *Water and Poverty in Southeast Asia: The Research Agenda from a Global Perspective*, In SEARCA Regional Conference on Water Governance and Poverty,. Manila: Global Water System Project, Center for Development Research, Germany.

Diamond, Jared. (2006). *Collapse: How Societies Choose to Fail or Survive*. London: Penguin Group.

Eisler, Riane. (1995). *The Chalice and The Blade*. New York: Harper Collins.

Falkenmark, Malin. (2007). *On the Verge of a New Water Scarcity: A Call for Governance and Human Ingenuity*. Stockholm, Sweden: Stockholm International Water Institute.

Glenn, Jerome C, Theodore J. Gordon, & Elizabeth Florescu. (2009). *2009 State of the Future.* Washington: The Millennium Project.

Hoekstra, A. Y., & A. K. Chapagain. (2008). *Globalization of Water: Sharing the Planet's Freshwater Resources.* Oxford: Blackwell Publishing.

Inayatullah, S. (ed) (2004). *The Causal Layered Analysis Reader*. Taipei: Tamkang University Press.

Inayatullah, S. (2011). *CLA Presentation and Examples: Personal Communication*, Anita Kelleher (ed). Queensland: University of the Sunshine Coast.

Inglehart, R., & P Norris. (2008). "Why didn't religion disappear? Re-examining the secularization thesis." In *Conflicts and Tensions*, H. K., Isar Anheier, & Y. R. (Eds). London: Sage.

Kelleher, A. (2008). *Water Forever: Exploring Futures*. Perth: Water Corporation (unpublished).

Lucke, T., S. Beecham, & G. Zillante. (2007). *Rainwater Harvesting Options for Commercial Buildings Using Siphonic Roof Drainage Systems: Lessons for Building Surveyors*. In 4th International Conference of the Australian Institute of Building Surveyors. Adelaide Australian Institute of Building Surveyors.

Marks, Williams E (ed) (2007). *Water Voices from around the World*. 1st Edition. Edgartown, MA: William E Marks Inc.

NWC. (2011). *Water Availability*. Australia: National Water Commission.

OECD. (2007). *Infrastructure to 2030: Mapping Policy for Electricity, Water and Transport*. Paris: Organisation for Economic Cooperation and Development

Pearce, Fred. (2010). "Earth's nine life-support systems: Fresh water." *New Scientist* (2749).

Shiva, Vandana. (2009). "Soil not oil*." Alternatives Journal Waterloo, 35*(3), 19-21.

SIWI. (2009). *Water: At the Tipping Point*? Stockholm, Sweden: Stockholm International Water Institute (SIWI).

State of the World. (2010). *State of the World: Transforming Cultures from Consumerism to Sustainability*. In Worldwatch Institute Reports on Progress Toward a Sustainable Society, L. Starke & L. Mastny (Eds). London: Worldwatch Institute.

Strang, Veronica. (2006). "Aqua culture: The flow of cultural meanings in water." In *Water: Histories, Cultures, Ecologies*, Marnie Leybourne & Andrea Gaynor (Eds) Perth, Australia: University of Western Australia Press.

Vaneechoutte, M., & J. R. Skoyles. (1998). "The memetic origin of language: Modern humans as musical primates." *Journal of Memetics - Evolutionary Models of Information Transmission* 2.

Water Corporation. (2009). *Towards Climate Resilience*. In Water Forever. Perth, Australia: Water Corporation.

Water Corporation. (2010). *Statement of Corporate Intent*. Perth, Australia: Water Corporation Western Australia.

Wong, Sam. (2008). "Humanising the world bank's sustainable water framework with 'pro-poor' principles of governance*." Social Alternatives, 27*(3), 15-20.

World Health Organisation. (2003). *The Right to Water*. Geneva: World Health Organisation.

World Water Assessment Programme. (2009). *The United Nations World Water Development Report 3: Water in a Changing World*. Paris: UNESCO Publishing, and London: Earthscan.

WSAA. (2010). "Occasional paper no. 25: Implications of population growth in Australia on urban water resources." In *Submission to the Australian Sustainable Population Strategy Taskforce*. Melbourne and Sydney: Water Services Association of Australia.