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Aqua Australis

Newsletter of the Hydrological Society of South Australia Inc.

CAN COMMUNITY ACTION MAKE A DIFFERENCE TO HYDROGEOLOGY? THE COORONG LOCAL ACTION PLAN EXAMPLE

Faith Cook, EcoProTem

The Coorong District is 8800 km^2 of mainly low coastal plain. Most of the District is broad acre farming, with 19% remnant vegetation and 1.8% irrigated agriculture. Land clearance and water consumption have created a range of natural resource challenges, including erosion, water quality decline, loss of biodiversity, degradation of wetlands, impacts to cultural sites and management issues.

Groundwater beneath the coastal plain is part of the regional groundwater system of the Murray Basin. Natural discharge from the system occurs via evaporation from low-lying saline lands or discharge into the Murray River and Lower Lakes.

Approximately 80% of the native perennial vegetation has been cleared and replaced with shallow rooted crops and pastures, leading to a greater portion of rainfall recharging the unconfined aquifer, causing a rising groundwater table. As the water table rises, dissolved salts are carried with it. Once the water table is less than two metres below the soil surface, groundwater starts to evaporate, leaving the salt behind and causing land salinisation.

Recharge under annual cropping can be a hundred times that which occurs under native vegetation. Barnett (1992) suggested that a 5-10cm rise across lower-lying areas could be expected in years with average rainfall, as a result of increased recharge. Modelling using data from Barnett suggested that approximately 570 km^2 of agricultural land in Coorong District was currently salt affected and that 700 km^2 could be affected by 2015-2020.

Results of a three year study between Coomandook and Cooke Plains suggested that a recharge reduction of 50% or more would be needed to re-establish cropping in already saline areas. A period of 5-10 years would be needed after implementation to see the effects of recharge reduction (Pavelic et al 1994).

In 1995, a committee of landholders formed to prepare a Local Action Plan (LAP), to address dryland salinity concerns. Over the next two years, this committee worked with a range of technical specialists, including Barnett, Pavelic and Butler, to identify the scale of potential dryland salinity impacts.

Lateral flows and the deeper confined aquifer were considered to be of reasonably minor consequence to the spread of dryland salinity at this location. Accordingly, committee members were advised that local action to in-

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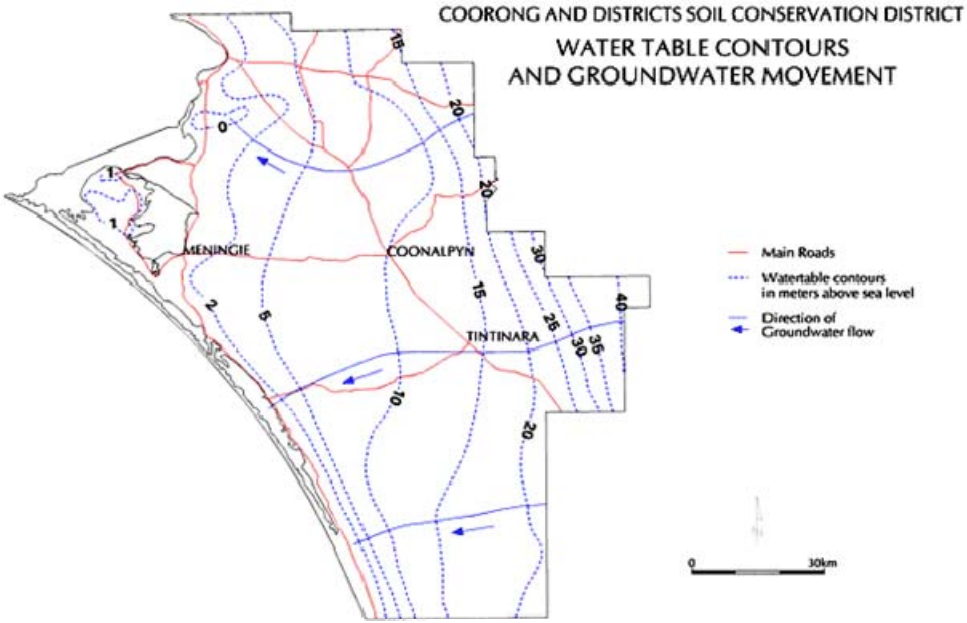

Figure 1: Water table contours, as presented in the revised Coorong LAP

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crease water use could be beneficial.

Using results from the Coomandook study site, Butler assessed a range of ways to mitigate the impact. All potential mitigation methods required landscape scale land management change, reducing the amount of recharge that entered the shallow, unconfined aquifer. To ensure a reasonable uptake across the district, the mitigation methods needed to be cost effective, with the potential to increase agricultural productivity.

Butler's recommendations are summarised in the table below. The critical points being that a) land management needs to be improved across the entire low-lying landscape to achieve the degree of recharge reduction required, and b) recharge reduction on lower-lying areas of land is of higher priority than areas with a higher elevation.

In 1997, the LAP committee released the ambitious Coorong District LAP. The plan aimed to:

- reduce recharge by 20% before 2003 by planting perennial vegetation
- put management practices in place within 10 years that would reduce recharge across the district by 50% of 1994 levels
- increase biodiversity on 290 km^2 of land through better management or revegetation by 2003
- remediate or stabilise 37 km^2 of bare, eroded or salt-affected lands by 2003
- reduce areas of non-wetting sands, and
- match land capability to land use.

In 1999 the issues covered by the Coorong District LAP were estimated to potentially cost the district $77M over 20 years, justifying the expenditure of approximately $1M per year in incentives and other actions outlined within the plan.
Incentives are provided to landholders based on a private versus public benefit cost-sharing agreement, with landholders providing the majority of the funding. The ratio of investment in the LAP on-ground works program is approximately 40-90% landholder contribution, 6-9% Coorong District Council support and 4-45% state or commonwealth grants, depending on the nature of the works.

The long-term nature of the LAP means that exceptionally high levels of community engagement have been achieved and maintained, with approximately 75% of landholders having participated in the program at some stage.

Although the actual impact of the LAP will not be distinguishable from natural variation for some years yet, estimates suggest that LAP on-ground works program could account for a 10-20% reduction in recharge across the district.

This has been achieved by a wide range of on-ground works, including:

- 1073 km^2 of perennial pastures established.
- 50 km^2 of salt-tolerant pastures planted.
- 12 km^2 of fodder shrubs planted.
- 310 km^2 of remnant vegetation protected.
- 47 km^2 of revegetation.
- 21 km^2 of sand hills and blow-outs stabilised.
- 1.5 km^2 of farm forestry.
- Decommissioning 110 leaking confined aquifer bores, and
- Trial of leak detection systems for mains water supplies.

A range of natural and anthropogenic aspects complicate measurement of LAP groundwater impacts. These include tripling of irrigation area across the district (mainly from groundwater sources), uneven distribution of on-ground works (as different landholders volunteer), changes in the area covered by the LAP and changes in the seasonal distribution and volume of annual rainfall (Figures 2 & 3),

Management Option	Recharge Reduction (%)
Alley farming with fodder shrubs to achieve 368 km^2 of total recharge control	7
Additional 561 km^2 of Lucerne and 248 km^2 of veldt/primrose	14
Reduce recharge by 12mm on all remaining croplands (316 km^2) by increasing crop water use efficiency and production	2
1,101 km^2 of phase cropping, therefore an additional 550 km^2 under Lucerne at any one time	15
Stabilise 30 km^2 of bare degraded land and establish a permanent cover of woody vegetation	2
245 km^2 of alley farming using conventional annual crop pastures in alleys	2
TOTAL (Treated area 2,869 km^2)	42

Summary of predicted recharge reduction rates under various management options/ combinations assuming full implementation (Butler, 1995)

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The Coorong LAP is currently a highly successful community-driven local action plan, focussed on improving natural resource management within the Coorong District. To maintain this success, the plan is currently being reviewed. If you are interested in providing comment, electronic copies of the existing plan, discussion document and consultation summary can be found at http://www.coorong.sa.gov.au/site/page.cfm?u=370.

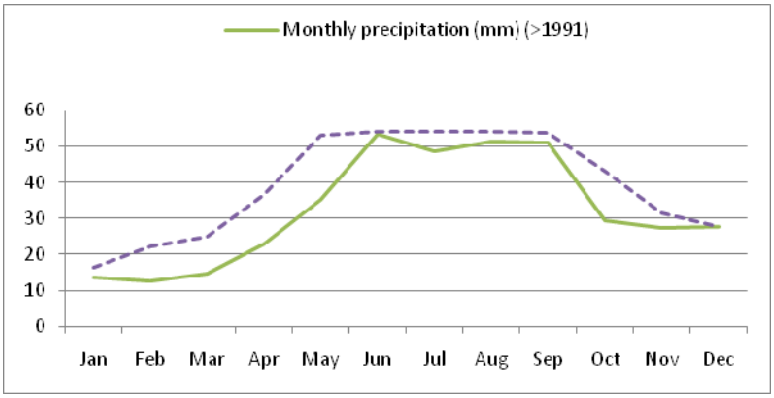

Figure 2: Average monthly rainfall at Tintinara

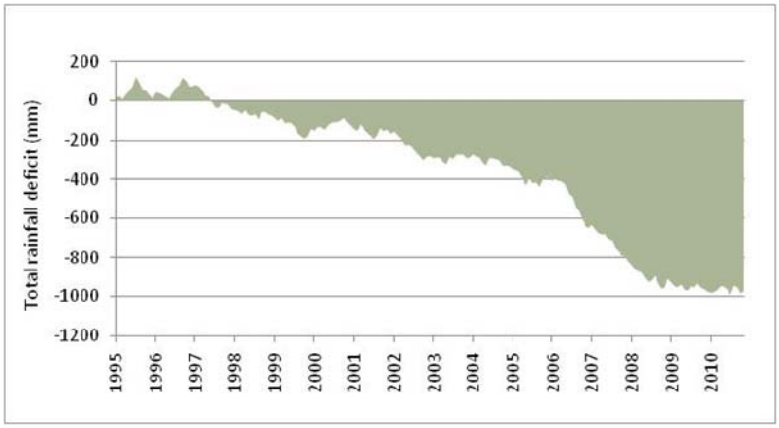

Figure 3: Cumulative monthly rainfall deviation at Tintinara.

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Barnett, S. (1989) *The effect of land clearance in the Mallee region on River Murray salinity and land salinisation in BMR* Journal of Australian Geology and Geophysics.

Barnett, S. (1992) *Regional Hydrogeology of the Cooke Plains –Coomandook Area, Murray Basin* in Report Book 92/14 Dept of Mines and Energy SA

Butler, P. (1995) *Reducing Groundwater Recharge and the Impact of Dryland Salinity in the Coorong & Districts*. Background Paper No. 1. Coorong District Local Action Planning Committee (2000) *Coorong District Local Action Plan*. Meningie, South Australia.

Pavelic, P. Narayan K.A. and Dillon P.J. (1994) *Groundwater flow modelling to assist land management in the Cooke Plains area of South Australia*. Centre for Groundwater Studies No. 58.

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SUSTAINABLE DIVERSION LIMITS: A PLAN FOR THE MURRAY-DARLING BASIN

Mike Young & Jim McColl, University of Adelaide

The Murray Darling Basin Authority is about to release a Draft Plan for the management of the Murray Darling Basin's water resources. As with all plans, there will be devil in the detail especially in the way the Authority chooses to specify Sustainable Diversion Limits (SDLs).

The final version of the Basin Plan is due to be gazetted in 2012 and, once gazetted, the SDLs specified in it will be very difficult to change. Yes, there is a transition period between 2012 and 2019 to allow closure of the gap between existing arrangements and the SDLs set by the Authority but, once 2019 arrives, the SDLs set in 2012 become binding.

When it comes to setting SDLs, section 23 (2) of the Water Act gives the Authority three choices. The Authority can:

a) set a number as is proposed in the Guide to the Basin Plan;
b) use a formula; or
c) specify sustainable diversion limits in any other way that the Authority determines to be appropriate.

When option a) or b) is used, the Act requires any reduction in an SDL to be implemented via a torturous Basin-wide review process involving full consultation with MDB states, approval by the Commonwealth Minister and scrutiny by Parliament. If the resultant review results in a reduction in an SDL then the Act requires that a compensating cheque be sent to each entitlement holder adversely affected by the reduction. Option (c) allows the Murray Darling Basin Authority to be as innovative as it wants to be.

Of these three choices, which is the best option?

A good Basin Plan needs to plan for droughts and flooding rains. And given the likelihood of changes in technology and climate, a fixed number based on averages does not seem like a good idea.

Conceptually, a formula sounds better than a number as it can allow for change. But, all the variables in the formula and all the coefficients in the formula would need to be right from day one. Difficult!

Given these limitations, we believe that option (c) is worthy of serious consideration. The Authority could specify SDLs so that continuous improvement in the management of the Basin's resources becomes possible.

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SUSTAINABLE DIVERSION LIMITS: A PLAN FOR THE MURRAY-DARLING BASIN

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If option (c) is chosen, SDLs could be published in the Basin Plan in 2012 but specified as the starting point in a continuous search for better ways to manage and use the Basin's water resources.

To open up this opportunity and set up an adaptive SDL framework, the Basin Plan would need to establish an SDL register and allow this register to be changed as innovation occurs and knowledge improves. Local community representatives could request an amendment of their SDL to account for any initiative they have taken. Initiatives they might consider include investment in 'environmental works and measures' and policy changes that enable the more efficient delivery of environmental outcomes.

Opportunities to adjust an SDL as adaptive improvements are made
SDLt =SDL2012+ Effects of changes to the portfolio of environmental entitlements held after 2019+ Effects of investments in environmental works and measures made after 2012+ Effects of policy changes that make environmental water management more effective made after 2012

If option (c) is adopted and the Basin Plan used to establish an SDL register, there would be a need to differentiate between register changes that

i) are clearly in the interests of all; and
ii) might have adverse impacts on some users.

The process for amendment of the register when a change is 'clearly in the interests of all' could be quite simple. The Authority could require such applications to be co-signed by the chairs of the local catchment board, the local water supplier and the regional environmental water manager. If the application is judged by the Authority to be consistent with principles set out in the Plan and not to have unacceptable impacts or implications for other parties, they could agree to amend the register. If this degree of consensus is absent, or if the Authority is concerned that the proposal may have unacceptable impacts on others, then the proposed change would have to go through a full Basin Plan amendment process as required by the Act.

If an adaptive SDL register, as proposed in this droplet is established, communities would have an incentive to negotiate with one another and continue to search for ways to improve the Basin Plan after 2012.

A South Australian environmental water manager may, for example, be interested in exchanging some high security South Australian environmental water entitlements for some low security water entitlements held by Victorian irrigators. If all involved, think that this reconfiguration of their respective entitlement portfolios makes sense, then why stop them from benefiting?

Similarly, a local farmer may identify an opportunity to build a control structure enabling water levels to be raised and lowered in a manner that produces better environmental outcomes with less water. Once this structure had been shown to work, local community representatives could apply for 'their' SDL to be increased. The relocation of a supply channel could be used to achieve a similar increase in an SDL.

Another example is the possibility that an environmental water manager might be able to negotiate an options agreement with a local irrigation company. Options agreements that make more water available to the environment in very wet years and more water available to irrigators in very dry years are worth careful consideration. If such an options agreement was put in place then, instead of parting with money, those involved could apply to have 'their' SDL increased. Potentially, a win-win outcome for all involved.

Under this proposal, local people could be encouraged to search for policy changes that would lead to better environmental outcomes. This might, for example, encourage them to consider changing carry forward arrangements so that it is easier to supply water for the small flood-like events needed to sustain some species and some wetlands.

Another opportunity worthy of consideration is a change to the way 'planned' or 'rules-based' water is managed. In an average year, over 5,000 GL of MDB water in NSW lies outside the entitlement system and is used to 'run the river'. If more of this water can be turned to environmental benefit then it may be possible to increase an SDL.

Under this register approach, any approved sale or purchase of entitlements for the environment would be recorded in the SDL register.

When the draft Basin Plan is released, we urge careful consideration of the way that SDLs are specified and how adaptive the Basin Plan should allow management arrangements to be.

If governments want to allow adaptive improvements to the Basin Plan in partnership with communities, then section 23 (2) (c) is the way to go. If section 23 (2) (a) is chosen, SDLs will be cast in stone in a manner that could stifle improvement, discourage local initiatives and effectively freeze progress.

	Opportunities to adjust an SDL as adaptive improvements are made			
SDL_t =	SDL_{2012}	+ Effects of changes to the portfolio of environmental entitlements held after 2019	+ Effects of investments in environmental works and measures made after 2012	+ Effects of policy changes that make environmental water management more effective made after 2012

In practice, the structure of an adaptive SDL register for a regional water resource would look like this.

MANAGED AQUIFER RECHARGE (MAR) AND STORMWATER USE OPTIONS FOR ADELAIDE

Konrad Miotlinski

Dr Declan Page from CSIRO Land and Water delivered a talk entitled "Managed aquifer recharge (MAR) and stormwater use options for Adelaide" at a Hydsoc technical meeting on June 2 .

The principles of MAR were discussed, followed by a presentation of the advantages and disadvantages of the underground water storage.

Examples of MAR implantation in the Adelaide metropolitan area were presented, which included both aquifer storage and recovery (ASR). These methods entail injection and extraction of water with a dual-purpose borehole as well as aquifer storage transfer and recovery (ASTR) pertaining to a multi borehole system in which injection and withdrawal phases are split between at least two single-purpose boreholes.

Dr Page showed an example from the suburb of Andrew's Farm, where stormwater injection for non-potable reuse with the use of the ASR system was commenced in 1993. At Bolivar a full-scale ASR injection trial was initiated in 1997 with the aim of storing reclaimed wastewater for summer irrigation.

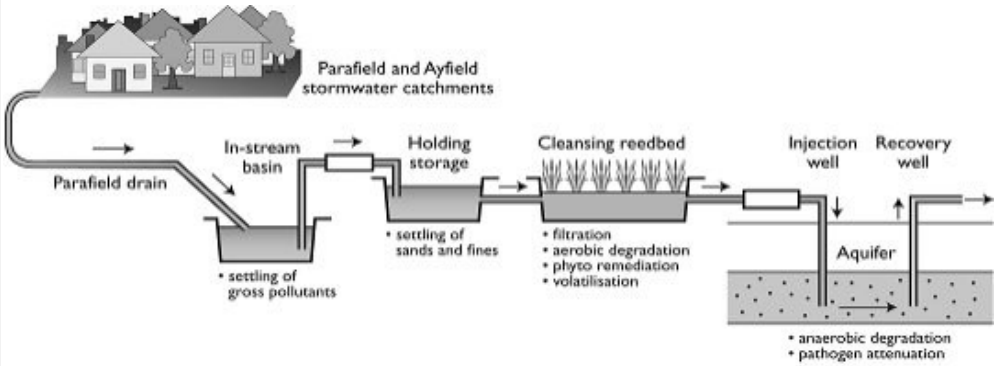
The particular emphasis of the presentation was the ongoing research into urban catchment stormwater injection for potable reuse conducted since which has been conducted since 2006 in the City of Salisbury .

Following a phase of aquifer characterisation, groundwater modelling and quantitative risk assessment were performed.

Water for irrigation from City of Salisbury ASR scheme

A recently updated risk assessment study embraced a geochemical characterisation of the aquifer focused on aquifer dissolution and metal mobilisation, as well as pathogen inactivation research which has been performed regularly since the start of the injection trial. The link between the current research and the regulatory targets required by the Australian MAR Guidelines was presented.

Further work is still warranted in optimising natural and engineered treatments and in assessment of natural treatment systems for pathogen and organic chemical removal.



Schematic of City of Salisbury ASR scheme at Parafield

MEET THE NEW DIRECTOR FOR CENTRE FOR WATER MANAGEMENT AND REUSE AT UNISA

Professor Chris Saint has been appointed as the new Director of the Centre for Water Management and Reuse (CWMR) at the University of South Australia (UniSA). CWMR was established in 2004 and is a highly successful collaboration between SA Water and UniSA.

Chris received his PhD in genetics and microbiology from the University of Wales before emigrating to Australia in 1990. Since 1995 he has been with SA Water in a variety of roles. Most recently, Chirs has been the SA Water Research, Development & Innovation Manager and their Principal Microbiologist.

His research has led to the development of improved monitoring tools for the detection of deleterious microorganisms in water and wastewater and the development of biological treatment of water for the removal of key contaminants.

Chris has published over 150 scientific papers and is an Editor of the *Journal of Applied Microbiology* and *Letters in Applied Microbiology*. He has been an invited keynote speaker at a number of international water related conferences.

He holds adjunct professorial positions at the University of Adelaide, the University of South Australia and the Research Centre for Eco-Environmental Sciences of the Chinese Academy of Science.

Chris has won competitive funding for over 40 R&D projects in the last 20 years totalling over $10 million in funds from organisations such as the ARC, Water Research Foundation (USA), CRC for Water Quality and Treatment and Water Quality Research Australia. Many of the projects have involved cross-disciplinary teams and international collaborators.

UPCOMING EVENTS

Contaminants of Concern in Water

Specialty Conference IV
8-9 November 2011
Mercure Hotel, Sydney NSW
http://www.awa.asn.au/EventDetail.aspx?id=4294971564

In order to maintain confidence in the public supply system and related services, those involved in the water industry need to be continually aware of potential threats to quality from pollutants. In the main, these "contaminants of concern" come from agricultural runoff, industrial and commercial chemical discharges, stormwater and domestic wastewater as a result of incidental or deliberate action. However, there are other newer sources of potential risk to public health and safety arising as a result of increased contact with reclaimed and recycled water by a wider range of the population. This conference attempts to examine current known and emerging contaminants of concern in water and follow the research on new issues and problems arising in the provision of safe and secure water supplies to the community.

Papers addressing all issues associated with the presence, effects and treatment of contaminants in waters, including the following, would be of interest for inclusion in the program:

- Inorganics, metals and metalloids – arsenic, chromium, manganese, radionuclides, lead.
- Nanoparticles in aquatic environments – health effects, organic carbon, treatment issues.
- Processes leading to mobilisation in acid sulphate soils.
- Low dissolved oxygen levels in source water – issues for treatment.
- Parasites beyond Giardia and Cryptosporidium.
- Microbial and algal toxins.
- Microbial activity in groundwater.
- Hormones and pharmaceuticals.

Australian Government
National Water Commission

Managing wetlands workshop

Tools and knowledge to support wetland managers

6 September 2011
CSIRO Discovery Centre, Canberra

The National Water Commission has developed a number of products and tools to assist wetland and environmental water management practitioners. The Managing Wetlands Workshop will give participants the opportunity to gain hands-on experience with the new products and tools available and engage directly with scientists and practitioners. If you are a professional in wetland and environmental water management and want to advance your skills and knowledge through the interactive sessions, join us for this free workshop.

http://www.nwc.gov.au/www/html/3085-wetlands-workshop.asp?intSiteID=1

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MEDIA WATCH

External review of the National Water Commission

The National Water Commission will be reviewed to assess the effectiveness and continuing appropriateness of its roles in promoting water reform objectives and outcomes.
http://www.environment.gov.au/minister/farrell/2011/mr20110726.html

Alice Springs becoming water smart

Alice Springs will save up to 1.6 billion litres of drinking water a year as part of a two-year initiative to reduce the pressure on groundwater resources in the local aquifer.
http://www.environment.gov.au/minister/farrell/2011/mr20110712.html

Analysing fluorescent natural organic matter in groundwater

Measuring the fluorescence of organic matter dissolved in groundwater can provide new insight into how surface water infiltrates into aquifers, and the quality of the groundwater.
http://www.connectedwaters.unsw.edu.au/news/fluorescentorganicmatter.html

World watching plans to restore health to wetlands and rivers

RIVERS and wetlands will bear the brunt of climate change and governments around the world are failing to manage many of the more vulnerable areas properly, says a series of new papers
http://www.smh.com.au/environment/water-issues/world-watching-plans-to-restore-health-to-wetlands-and-rivers-20110321-1c3w5.html

Stormwater management strategy to provide road map for future

The State Government released a Stormwater Strategy which provides a comprehensive 'road map' for future stormwater management in South Australia.
http://www.premier.sa.gov.au/images/stories/mediareleasesJUL11/stormwater%20strategy.pdf

Urban water in Australia: future directions

The National Water Commissions report *Urban water in Australia: future directions* - considers whether the sector's underlying institutional and policy settings need reshaping to improve performance now and in the future, and sets out the Commission's findings and recommendations.
http://www.nwc.gov.au/www/html/3025-future-directions-.asp?intSiteID=1

Stormwater harvesting and reuse projects Third Competitive Grants Round

The Australian Government is calling for applications for funding to support eligible stormwater harvesting and reuse projects under the National Urban Water and Desalination Plan: stormwater harvesting and reuse grants round. Projects are sought that capture, treat and use stormwater to ease the pressure on drinking water supplies and deliver improved water quality to our urban waterways. Applications are due by Wednesday, 7 December 2011 (5pm AEDT).
http://www.environment.gov.au/water/programs/urban/stormwater-harvesting.html

A framework for managing and developing groundwater trading

A new report published by the NWC report sets out a management framework for groundwater trading that provides a structure to establish or develop groundwater markets in a range of situations. It builds on economic theory, existing groundwater management arrangements, the National Water Initiative (NWI) agreement and related developments in national water management
http://www.nwc.gov.au/www/html/3086-waterlines-52.asp?intSiteID=1

Fewer rain storms across southern Australia

Decreasing autumn and winter rainfall over southern Australia has been attributed to a 50-year decrease in the average intensity of storms in the region – a trend which is forecast to continue for another 50 years.
http://www.csiro.au/news/Fewer-rain-storms-across-southern-Australia.html

CSIRO dam break modelling to help flood planning

CSIRO scientists have developed powerful modelling techniques to help understand the full impact of flooding that occurs when dams collapse. CSIRO dam break modelling to help flood planning
http://www.csiro.au/news/CSIRO-dam-break-modelling-to-help-flood-planning.html

Review of the Bureau of Meteorology's Capacity

The Australian Bureau of Meteorology is being reviewed to assess its capacity to provide seasonal forecasting services and to respond to extreme weather events and natural disasters.
http://www.environment.gov.au/minister/farrell/2011/mr20110718.html