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Aqua Australis

NEWSLETTER OF THE HYDROLOGICAL SOCIETY OF SOUTH AUSTRALIA

GROUNDING CONNECTIVITY: DO RIVERS HAVE AQUIFER RIGHTS?

Mike Young

When groundwater aquifers are connected to a river, they need to be managed as a single integrated system. A connected river gains water when an aquifer is higher than the river and loses water when the aquifer is lower than the river. The rate of gain or loss is determined mainly by an aquifer's gradient towards a river and its capacity to transmit water. Significant time lags can be involved.

How should entitlements be defined and allocations made when ground and river water systems are connected? Should river entitlement holders or the river be given an entitlement to the other resource? Is trade between ground and surface water systems possible? How should any impact of climate change be managed?

As is done in NSW, the state of the art when establishing a groundwater entitlement system is to issue unit shares in the system. In systems where shares have been issued, allocations are made in proportion to the number of shares held. The system is simple and can cope with changes in supply.

A formal announcement process is necessary. Each year an assessment of the amount of recharge needs to be made and, once enough water has been put aside for base flow and mandatory inter-system transfers, the remaining recharge can be allocated to share holders. Shareholders should expect allocations to vary from year to year and, if it gets drier, to receive a smaller allocation. In the simplest of systems, allocation announcements are varied with changes in the depth to the water table.

To ensure efficient water use, it is necessary to allow entitlement holders to carry forward unused allocations with adjustment for losses and flows out of the system.

Where the aquifer is contiguous and porous, water tends to move quickly from one location to another. In such systems, groundwater trading is possible. As porosity declines and/ or the aquifer becomes fragmented, trading rules become harder to set.
When discussing the effects of aquifers on river flow, Rick Evans has proposed that aquifers be zoned according to the time it takes for the act of extracting water from a bore to reduce river flow.

When an aquifer is situated right next to a river, pumping reduces river flow almost immediately and entitlements are more accurately defined as part of the river system. In much of Australia, however, aquifers right next to a river are not considered to be part of the river system. This means that those able to pump right next to a river gain access to an entitlement that is more reliable than any river entitlement.

It is interesting to note that Queensland legislation is now written so that a river boundary can be defined to include all groundwater bores within a specified distance of a river. Reflecting on the merits of such an approach, Evans has suggested that most groundwater licences within 5 kms of the River Murray should be defined as part of this river's entitlement system and managed accordingly. In a drought, this would mean that allocations to groundwater and surface water resources would reduced at a similar rate.

When an aquifer is situated further away from a river, there is often a transitional zone where the rate of contribution to or extraction from river flow depends upon river height. In these zones, allocation and pumping rules need to be based on river height and on the time it takes for changes in the rate of extraction to affect river flow.

These are the aquifers that tempt groundwater hydrologists to suggest they could be managed like a dam. In highly regulated rivers, river height tends to be constant and, hence, opportunity to do this may seem limited. If river management rules were changed, however, river height could be managed strategically with a view to reducing drought risk. Run the river high and the adjoining aquifers could be gradually filled. Run the river low and the water stored in the aquifer could be gradually returned back to the river. We think this opportunity is worth evaluating. New accounting would be necessary.

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GROUNDING CONNECTIVITY: DO RIVERS HAVE AQUIFER RIGHTS?

Mike Young

(Continued from page 1)

The time it takes for groundwater to flow from more distant zones to a river can take many years. Time lags of 20 to 50 years are not uncommon. As a result, entitlement trades which involve the movement of the point of extraction closer to the river need to be managed with great care.

The solution is to set trading rules by sub-zone. Entitlement trading from these sub-zones to a river is possible with adjustment for the time lags involved and to ensure that the trade does not result in long-term or even permanent "borrowing" of water from other zones or from the river.

Having set the scene, we can now explore one of the key questions posed in this article. In a system where a river gains water from an aquifer and it gets drier,

a) should river or aquifer users be protected from the impact of this decline in water availability; or
b) should the impact be shared?

If the latter sharing approach is taken then one option is to issue a "gaining" river formal shares in the aquifer system and, conversely, a "gaining" aquifer formal shares in the river system. Under such an arrangement, managers would be forced to manage connected systems as a single interacting system.

When recharge increases, those with an interest in a gaining river would get more water and when recharge declines, they would get less water. The result is a regime that would establish a level playing field between ground and surface water users. We think the approach has merit.

Pushing the envelope one step further, it is possible to imagine an entitlement regime where an irrigator or an environmental water manager could purchase a groundwater entitlement and, with appropriate adjustment, arranges either for

a) the entitlement to be converted into a river entitlement; or

b) the entitlement to be tagged so that any allocations made to it are transferred, with an appropriate volumetric adjustment and time delay, to a river account.

The main difference between these two options lies with the way allocation risk is distributed. When a groundwater entitlement is converted into a surface water entitlement and the exchange rate is wrong, the reliability of all other entitlements in the system changes. Under the second tagged approach, exchange rate errors can be corrected so that there is no long-term impact on the interests of others. Given the risks involved, in the case of groundwater to river water trading, a tagged approach is likely to result in more efficient decisions

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Obviously, careful aquifer-specific analysis of the options presented in this article needs to be undertaken. Significant investments in aquifer mapping, connectivity assessment and monitoring would be necessary. The challenge now is to work out how to get the foundations for such a aquifer-river sharing systems right, cut through the complexity and put systems in place that can be expected to improve with increased understanding and knowledge.

As a bare minimum, we recommend that system managers should start to define the size of each river's share of the water in each aquifer connected to it and vice versa. We also recommend that agencies trial the tagged trading of water entitlements among between connected river and groundwater systems.

The good news is that all this is not new. In places like the Arizona, California and Texas, existing regimes enable people to store water in aquifers. In these parts of the world, it is also possible to swap surface and groundwater allocations. In fact, some American States are doing ground-surface water trades with one another.

Examples of the early development of such ideas can also be found in Australia. In South Australia's Angas Bremer system, for example, irrigators are given credit for 100% of any surface water they drop into an aquifer on the condition that this water is used within 5 years.

Another example can be found in Queensland's Burdekin River Delta where up to 250 GL of water per year is pumped into a groundwater recharge system so that cane growers can access groundwater

REMOTE AREA HYDROLOGY – THE GAMMON RANGES SCIENTIFIC PROJECT

Sarah Jewell

I've long had a fascination and passion for water, and for me nothing provides greater physical and mental refreshment than escaping the noise and rush of the city to immerse myself in the rugged beauty of the more remote regions of our continent. So that's why I spent my July 2008 annual leave trudging through dry creek beds and up rocky spinifex slopes in the Gammon Ranges of South Australia, carrying a 20-kg pack, laden with food, water and camping supplies, as well as a collection of pluviometer data loggers.

For the last six years, I have been involved in a volunteer project studying the hydrology and ecology of the Gammon Ranges. Perhaps an unlikely place to be studying, considering the fact that it's so remote from civilisation – about 9

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REMOTE AREA HYDROLOGY – THE GAMMON RANGES SCIENTIFIC PROJECT

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hours' drive NNE of Adelaide, lying north of the Flinders Ranges, but that was its main attraction for me. But over the last year or so in my consulting work, I have been thrilled to be able to make practical use of hydrological data gathered over the course of this project in various hydrology studies for remote area mining environmental impact assessments.

The Gammon Ranges Scientific Project (GRaSP) was started about 20 years ago with the installation of a tipping-bucket pluviometer, equipped with batteries and a data logger, atop the Gammon Plateau, about 930 m above sea level, by a very determined group of volunteers. This would have been no mean feat, for the site is accessible only by foot, and to reach it requires over a day of strenuous hiking, the last 2-3 of kilometres of which must be fought through dense stands of low brush, requiring excellent orienteering skills to prevent one from becoming disoriented. Over succeeding years, volunteers installed a network of pluviometers throughout the Arcoona Creek catchment in the Gammons, as well as a stream flow gauge near the outlet of Arcoona Creek, which drains the western side of the Ranges towards Leigh Creek, a coal mining settlement west of the Ranges.

Inside a tipping-bucket pluviometer

Streamflows are infrequent in Arcoona Creek (eight out of fifteen years of streamflow data have been zero-flow years), but since recording began, several significant events have been measured. Rainfall and streamflows have been highly variable, and modelling of two flood events has indicated that the catchment has high loss rates, but a rapid response once flow commences.

To ensure that reliable data can continue to be gathered for further hydrological and biological studies requires expeditions several times a year by volunteers to change the data loggers and batteries, and service and calibrate the instruments. One of the pluviometers has been installed on Arcoona Bluff, a spectacular peak with grand views, and winds that threaten to blow you off the ridge-top. This pluviometer has been connected to a telephone relay system (recently upgraded from CDMA to NextG), so that the Bureau of Meteorology can dial in to download the latest rainfall data.

This is a bonus for volunteers like ourselves, as it means that we can keep track of moisture conditions in the ranges over the weeks leading up to an expedition. For in a remote location such as the Gammon Ranges, rainfall is everything. Sometimes even 5 or 10 mm of rainfall can make the Arkaroola Road inaccessible for days, delaying a trip and throwing expedition plans into disarray. Rainfall can make for miserable camping conditions and extremely slippery walking conditions, greatly increasing the risk of hypothermia, sprained ankles or worse. Any significant injuries can be life threatening in such a remote location, as it can take at least two days to reach medical assistance. But recent rainfall is also a great bonus, for the availability of clean water in rock pools high up in the ranges can significantly ease the burden of the trip, where you must carry upon your back camping gear, and enough food, water and supplies for several days of remote hiking. In the warmer months, when water is scarce, the weight of water you must carry can be prohibitive, limiting the distances that can be covered, or requiring expeditioners to raid emergency cache supplies hidden in various locations.

Inspecting the Gammon Plateau pluviometer

Much of the vegetation in the Gammon Ranges is tinder-dry, even in winter, so the area is subject to permanent fire bans. This means that expeditioners must prepare meals and keep warm using only simple spirit or butane burners. On winter expeditions, it also means that the best place to be during the frigid hours between dusk and dawn is tucked up tightly inside a tent and sleeping bag. And when one is spending the entire day walking on uneven terrain with a heavy rucksack, sleeping for 12 hours each night can be a necessity to ease aching muscles and limbs.

One of the highlights of a typical Gammon Ranges scientific expedition is the yellow-footed rock wallaby count. This is conducted by a team of three people walking slowly up a very steep creek gully to Arcoona Bluff, and then returning across a ridge and down another creek, carefully scanning the slopes with binoculars on the lookout for the evasive creatures camouflaged among the rocks. Over recent years, with annual rainfall across north-eastern SA having significantly decreased, and despite programs to reduce populations of feral goats and donkeys, the numbers of these beautiful animals, and their distant cousins, the euros, which live on the lower slopes of the Ranges, appear to have declined. I have seen yellow footed rock wallabies on previous expeditions, but unfortunately we were unable to spot any this July.

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Australian Rainfall and Runoff Update
Mark Babister

The Federal Department of Climate Change announced in June $2 Million dollars of funding to assist in updating Australian Rainfall and Runoff (ARR). The update will be completed in three stages over four years with current funding for the first stage. This will be the first major revision of ARR since 1987. There have been significant technological advances in many areas of rainfall runoff assessment since the 1987 update as such 21 revision projects will be undertaken with the aim of filling knowledge gaps. The outcomes of the projects will assist the ARR editorial team compiling and writing of the chapters of ARR. Steering and Technical Committees have been established to assist the ARR editorial team in guiding the projects to achieve desired outcomes. The 21 projects are to be undertaken over four years with ten projects commencing in stage 1 including the IFD data revision. The full list of projects is shown below:

1 Development of intensity-frequency-duration information across the country.*
2 Spatial patterns of rainfall.
3 Temporal pattern of rainfall.
4 Continuous rainfall sequences at a point.*
5 Regional flood methods.*
6 Loss models for catchment simulation.
7 Baseflow for catchment simulation.*
8 Use of continuous simulation for design flow determination.
9 Urban drainage system hydraulics.*
10 Appropriate safety criteria for people.*
11 Blockage of hydraulic structures.*
12 Selection of an approach.
13 Rational Method developments.*
14 Large to extreme floods in urban areas.
15 Two-dimensional simulation in urban areas.*
16 Storm patterns for use in design events.
17 Channel loss models.
18 Interaction of coastal processes and severe weather events.*
19 Selection of climate change boundary conditions.
20 Risk assessment and design life.
21 T Delivery and Communication Strategies.

* Project starts in stage 1.

It is expected that some projects will involve the engagement of a single supplier, while others will engage a consortium of organisations. Engineers Australia have been working closely with the Bureau of Meteorology (BoM) to update the Intensity-Frequency-Duration data across the country (Project 1). Any organisations with pluviograph or daily read rainfall data of considerable length that would be of use to BoM in its IFD revision should contact Janice Green (J.Green@bom.gov.au).

A series of general information workshops are being planned for November and February in capital cities around the country. Members of the ARR Editorial team, BoM representatives and key representatives from selected projects will be in attendance.

A number of projects will involve specialist workshops in order to bring together the best knowledge in the country on the relevant issues. The first of these workshops was held in Darwin at the Hydraulics in Water Engineering Conference in September and covered Two-dimensional Simulation in Urban areas (Project 15). Similar workshops are planned for the Blockage of hydraulic structures project early next year. Anyone with information relating to blockage of culvert structures should contact Bill Weeks (william.d.weeks@mainroads.qld.gov.au)

REMOTE AREA HYDROLOGY – THE GAMMON RANGES SCIENTIFIC PROJECT
Sarah Jewell

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We completed the expedition over the course of five days. There were five of us in all, three gentlemen who have undertaken numerous such expeditions over the years, a novice colleague, Annabel, and me. Annabel and I shared cooking equipment and a tent so as to reduce the weight we would have to carry. We set up base camp at the entrance to the National Park, and over the course of the next three days hiked into the ranges, setting up an intermediate camp, and undertook the various tasks that needed to be completed. These included servicing all the pluviometer data loggers located around the ranges, checking vegetation growth in various rabbit and kangaroo exclusion zones, undertaking animal counts and identifying and counting aquatic organisms present in semi-permanent rock pools.

The final day of our trip was spent servicing pluviometers installed in the Windy Creek and Emu Creek catchments south of the Gammon Ranges. These pluviometers are linked by mobile telephone relay to the pluviometer on Arcoona Bluff. Our last night was spent in the shearers' quarters at North Mooloolo Station; after having slept on the cold, hard ground for the previous few nights, we found the beds incredibly comfortable. The famed generosity of outback station owners is certainly not overstated – for upon our unannounced arrival, the manager promptly furnished us with abundant dry timber to fire up the shearers' kitchen stove and cook ourselves a hot dinner. We finally left the Gammon Ranges to return to Adelaide, tired but cheerful, but not without first stopping at the Copley Bakery, just north of Leigh Creek. Their famous quandong cheesecake and hot pasties, as always, did not disappoint.

http://www.communitywebs.org/ScientificExpeditionGroup/pages/Grasp.htm

SYNOPSIS - THIRSTY SEMINAR

Darren Ray

Chris Wright, Senior Hydrologist in the South Australian Regional Office of the Bureau of Meteorology (BoM), started the session with an acronym rich update of developments within the Bureau of Meteorology's new Water Division, and the BoM part in the National Water Initiative. These include WIRADA, a new analysis and reporting tool for water resources to enable the linking of data sets to hydrological models, in combination with a high resolution Digital Elevation Model. Also the new data transfer regulations are available in Bulletin 2 no.2 at www.bom.gov.au/water/publications.shtml.

Dr Bertrand Timbal, from the Centre for Australian Weather and Climate Research, presented results from his work within the South Eastern Australian Climate Inititiative, looking at drivers of changes in rainfall in recent decades across southern Australia.

The results show that, while annual rainfall totals in the recent drought are not lowest on record when compared to the Federation Drought or the 1939-1945 drought, there have been significant shifts in the seasonality of the rainfall. Autumn and early winter have seen a strong decrease in rainfall not seen in the other droughts, resulting in less 'wetting up' of the catchments for winter and spring rainfall.

There is also less variability than in recent droughts, meaning even fewer years of high rainfall to balance the low rainfall years. These features, combined with higher temperatures have resulted in record lowest runoff in the Murray Darling system.

Bertrand also looked at the major drivers of climate for Australia, the El Nino Southern Oscillation, Indian Ocean Dipole, Sub-tropical ridge intensity and sea surface temperatures around Australia, and what possible changes in these drivers might be responsible for the recent rainfall declines. The conclusions are that Autumn rainfall is most strongly affected by the strength of the sub-tropical ridge locally, with other features unable to explain the rainfall decline. Conversely, in Winter, while local sub-tropical ridge intensity was important, all of the other drivers do play a role.

Worryingly, connections were drawn between global warming and increasing sub-tropical ridge intensity, and also a decoupling of tropical moisture from the mid-latitude areas in southern Australia.

Bertrand finished looking at climate change projections from the Bureau of Meteorology and CSIRO Climate Change in Australia report (www.climatechangeinaustralia.gov.au), and showing the global climate model projection downscaling tool he has developed to fill a need for more localised climate change projections.

Darren Ray, Senior Meteorologist of the Climate Section in the South Australian Regional Office of the Bureau of Meteorology, briefly put forward the role of increasing temperatures and climate change more generally on the hydrological cycle, through increased evaporation and greater water content of the atmosphere, and pointed out that increased temperatures have a significant effect on bushfire risk, while the resulting regrowth also has large impacts on water availability.

Trends in rainfall intensity, both across Australia and other mid-latitude locations around the world were examined, showing that increase in rainfall intensity as expected under climate change is only just starting to be observable, as the strength of these changes in relation to the natural variability is not as strong as the marked temperature trends.

The latest climate change projections for changes in rainfall intensity, using IPCC Fourth Assessment Report climate modelling (from Sun et al 2007) highlighted that for South Australia under future climate change, rainfall is more likely to occur as moderate, heavy or very heavy falls, but with only a 0 to 2% increase in the frequency of these events as overall annual rainfall totals decrease.

Rainfall intensities are expected to increase for moderate, heavy and very heavy events but only ~1 to 2% causing only a slight decreases in average recurrence intervals in South Australia. So other locations in the world will more strongly see increases in rainfall intensity than South Australia.

The further complexities of making future climate change projections of flooding events for South Australia is complicated by questions of changes in the frequency of occurrence of major phases in the climate drivers, and changes at a synoptic level, with the possible impacts of climate change at this level as yet unknown. Despite slight increases in rainfall intensity the broader conditions that setup flooding events may occur less frequently in South Australia in the future. For instance major flooding events in South Australia in recent times seem to be associated with 'negative' Indian Ocean Dipole events and La Nina events, the opposite phase to Pacific El Nino events, and there are some indications these might be less likely under climate change.

Darren finished by presenting some new tools and information available such as the BoM 'Water and the Land' page (www.bom.gov.au/watl) which now has historical rainfall records available for thousands of BoM sites around Australia, and the Australian Water Availability Project page (www.csiro.gov.au/awap) which has maps and gridded data across Australia of many water related parameters.

Chris Wright finished by highlighting that lots of work still needs to be done on improving and updating rainfall intensity data so that there is a solid database available from which robust analysis can be done.

UPCOMING EVENTS

Engineering Education, Australia (EEA)

presents a two day Stormwater Management Workshop -

'Stormwater Management (source control)'

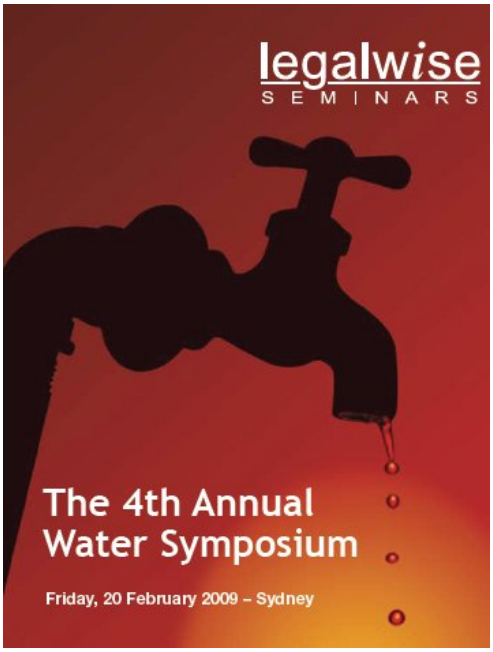
based on the award-winning manual *WSUD: basic procedures for 'source control' of stormwater – a Handbook for Australian practice*.

The workshop will be led by Professor John Argue

Adelaide, December 4 & 5, 2008.

The short course includes: design procedures based on state-of-the-art analyses and best overseas practices adapted to Australia-wide conditions; case study illustrations drawn from field installations with between nine and 15 years of Australian operational history; design 'worked examples'; introduction and access to rainwater tank sizing software applicable across Australia. The Workshop will be led by Professor John Argue.

Attendance at the Workshop earns 32 hours credit for continuing professional development purposes with Engineers Australia. More information about the workshop including course content, cost and Registration Forms may be obtained from Ms Ann Ellis on (03) 9326 9777 or ann@eeaust.com.au.



svc122.wic016v.server-web.com/Water%20Symposium%202009%204p_LR.pdf?campaign=EnviroInfo

Istanbul, Turkey, from 16 to 22 March 2009

A variety of events throughout the week will aim to focus on just one overarching theme: "Bridging Divides for Water". Some of the highlights of the week will include Heads of State, Ministers, Parliamentarians and Local Authorities meeting at the Forum to have both individual and joint working sessions aiming to foster discussion and consensus on priority water-related issues.

The programme of the Forum week will take shape over the coming months. This page will be constantly updated according to developments in the programme of the week. But don't wait until this programme is defined by others: join the Virtual Meeting Space today, the 5th World Water Forum's web-based interactive platform, propose your own activity, and take an active role in shaping the programme of the Forum yourself!

http://www.5thworldwaterforum.org/index.php?id=1870&L=%2522%2520onfocus%253D%2522blurLink%2528this%2529%253B

The 5th Annual Australian Water Summit 2009 being held on 1st – 3rd April 2009 at the Sydney Convention and Exhibition Centre is a flagship forum for Australia's $90 billion water industry.

Over the past four years, this summit has attracted more than 250 senior-level attendees to each event, representing major water utilities, financiers, project planners, policy heads and industry leaders.

The theme for the 5th Annual Australian Water Summit 2009 is "Sustainable Water Resources Management" Based on excellent delegate feedback from 2008, this year's forum features an expanded water management technical expo, offering industry suppliers the opportunity to demonstrate products, services and water management solutions.

This industry expo complements the 2 day summit that focuses on managing the commercial and business challenges of water supply and demand, while identifying major new contracts and projects in Australia and internationally for 2009-2010.

30+ CEO speakers will share a 21st century action plan to manage Australia worst drought this century, while ensuring security of supply across city, urban and regional areas. Discussions also focus on water trading, a renewed rescue package for the River Murray, impact of climate, demand management strategies and the investment outlook for water.

Delegates to this water summit have represented public and private sectors from Australia, New Zealand, Asia, the Middle East, Europe and North America, offering an excellent platform to showcase water management solutions.

http://www.acevents.com.au/water2009/

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MEDIA WATCH

Port Waterways Water Quality Improvement Plan

The plan details strategies for water quality improvement for nutrient levels in the Port Waterways. It considers the range of nutrient inputs to the area and has enabled stakeholders to agree on outcomes and the processes for achieving them.
http://www.epa.sa.gov.au/pdfs/pwwqip.pdf

Govt urged to rethink water buybacks

The Federal Opposition s water spokesman, Greg Hunt, says he has noticed a lot of public frustration about the Government s water policies while on a study tour of the Murray-He says the Government needs to rethink the water buyback scheme and opt for alternative water saving measures.
http://www.abc.net.au/news/stories/2008/10/29/2404577.htm

Federal subsidy for McLaren irrigators

About 120 irrigators at McLaren Vale, south of Adelaide, will be able to apply for a new federal subsidy to switch from mains to recycled water. The $3.5 million project aims to help irrigators use up to 800 million litres of recycled water a year from the Christies Beach sewage treatment plant.
http://www.abc.net.au/news/stories/2008/09/22/2370286.htm

Review of the 2007-08 water entitlement purchase round

In June 2008 the Department began reviewing the 2007-08 water entitlement purchase round. A consultant was engaged to conduct an independent assessment of the program, drawing on feedback provided by a Stakeholder Consultative Committee and eight regional consultation workshops. The final report of the independent assessment has now been publicly released.
http://www.environment.gov.au/water/mdb/entitlement-purchasing/2007-08.html#review

Murray-Darling Basin Small Block Irrigators Exit Grant package

Small block irrigators in the Murray-Darling Basin affected by drought and climate change can get help to leave irrigation through the Murray-Darling Basin Small Block Irrigators Exit Grant while remaining on their farms.
http://www.environment.gov.au/water/programs/entitlement-purchasing/small-block-irrigators.html

Murray Darling team win top CSIRO award

The team of scientists who developed The Murray Darling Basin Sustainable Yields Project has been awarded the 2008 CSIRO Chairman's Medal.
http://www.csiro.au/news/2008CSIROMedals.html

The Effects of Groundwater Pumping on Stream Flow in Australia.

Technical Report, based on the Land & Water Australia Senior Research Fellowship Report by Dr Richard Evans, Principal Hydrogeologist, Sinclair Knight Merz is available at http://products.lwa.gov.au/files/PR071283.pdf

Australian Guidelines for Water Recycling Managed Aquifer Recharge

Draft copy is available at
http://www.ephc.gov.au/pdf/water/200805_WQ_GL_Draft_AGWR_MAR.pdf

Australia's Low Pollution Future: The Economics of Climate Change Mitigation

The Treasurer and the Minister for Climate Change and Water released Australia's Low Pollution Future: The Economics of Climate Change Mitigation on the 30 October 2008
http://www.treasury.gov.au/lowpollutionfuture/

Lower Lakes potable pipelines construction begins

Lower Lakes communities can look forward to a more secure drinking water supply early in the New Year now that construction has commenced on 130 kilometres of pipeline.
http://www.environment.gov.au/minister/wong/2008/mr20081107.html

Emerging trends in desalination: A review

This report reviews the latest research and emerging trends in desalination technology from across the globe. This includes a discussion of energy minimisation and environmental protection issues with the economics of desalination. Information on the merits of various desalination technologies in Australia are discussed in the context of alternative supply options
http://www.nwc.gov.au/www/html/893-emerging-trends-in-desalination-a-review-.asp?intSiteID=1