

# Aqua Australis

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*Human beings were invented by water as device for transporting itself from one place to another* Tom Robbins

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## Chairman's Message

On looking out of my window to see if the weather offered anything but sunshine in late November, I pondered over what would be appropriate for the Xmas and New Year Message. Privatisation (a word that doesn't appear in my spell checker) and outsourcing (another word not in the spell checker) are words that are going to affect us in what we do in the future in South Australia. What fundamental activities will be affected that all of us have a concern about? Obviously the delivery of water into the household, but also where we swim, how much water we have and the quality of the water will be affected. But it goes much deeper than that, the programs of monitoring that were set up in the 70s and 80s are gradually being dismantled.

The collection of basic hydrological data does not earn the State Government much ready cash. The network is being split and managed by different groups ostensibly because they need it for operational purposes. Who is thinking about the data required for the State Government's vision? Why do we need long records of data or any data for that matter?--It only gets in the way of trying to do things even if they are the wrong things. It does however make long term decisions on the sustainability of our water resources systems a lot easier to make. Consideration of developments of all different kinds with real data would be a nice Xmas present for those people that have to justify these projects. We can all fantasise.

Many conferences and seminars that I have attended from the late 70s through the 80s and into the 90s have all concluded that more hydrological data needs to be collected and analysed (that includes water quality data as well). We need to turn this basic data into information for the decision makers. The extreme

## World Water Day

Saturday 22 March 1997

World Water Day is declared by the United Nations' World Meteorological Association each year. The theme for 1997 is *Assessment of Water Resources* posing the question *Is there enough water?* Many countries world wide are facing water shortages, such as the Middle East and Singapore. The next major war has been predicted to be about sharing water sharing than any other resource. The deplorable and deteriorating water resources assessment in South Australia is highlighted in the Chairman's message.

for the decision makers. The extreme variability of the Australian climate necessitates that long periods of records are needed to establish satisfactory relationships for drought, flood and water resource estimations. The governments around Australia obviously consider there are no votes in stream gauging stations and water resources archives albeit development depends on having satisfactory water supplies.

The stations cannot be used for marketing Macdonald's burgers or KFC to the wandering bushwalker or fleet footed wallaby. Perhaps they all need to be sponsored by a particular industry eg the Milko's station or the SouthCorp Cabernet station. Collecting data is not cheap and to do it properly needs dedicated and reliable employees. The system does not seem to foster and recognise these qualities right at the moment. We talk about marketing our expertise to SE Asia. This is one area that is crying out for consultants and AID money to enhance their development programmes. At a recent meeting in Yogyakarta where I was representing Australia at a Regional Steering Committee of UNESCO's International Hydrology Program this was deemed to be an area of great concern to all attending.

If we were going to have a Xmas wish then perhaps wishing that all our hydrological models can be calibrated with real data this year would be a useful one. It does make modeling much more difficult having real data. I know what I would like is a couple of major events ( not to cause any damage of course ) but just to supply data and results for the projects that I am associated with.

Enough of this idealism, the sun's out, who needs water we shall drink wine instead (apologies to Queen Antoinette).

**Trevor Daniell**

### **The Ian Laing Prize**

for outstanding student work in hydrology for 1996 has been awarded, as 3 equal prizes, to :

**Julianne Martin  
Theresa Benham and  
Glen Passfield.**

The prize is awarded annually by the South Australian Hydrological Society in memory of Ian Laing, a founding member of the Hydrological Society of South Australia, a former outstanding civil engineering student of the University of Adelaide and an avid practitioner of hydrology before his premature death.

### **Eco-design products**

The Centre for Design in Melbourne and six companies used environmental protection as the focus for new designs such as dishwashers and office furniture beginning with a Federal Government grant of \$M 0.76 and industry investment of \$M 15. Less resources have been used in the production of some items, whilst others have been redesigned to reduce resources during operation. The dishwasher, if used nationally, is claimed to reduce water consumption by 10.6 GL. Information Matt Brown tel (06) 277 7640.

*Abstracted from Crosscurrent 11/11/96.*

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### **Environmental indicators**

Experts are being commissioned by the Federal Department of the Environment to develop environmental indicators, including water quality, to identify environmental trends. Additional funding in the Federal Budget will allow enhanced monitoring of environmental conditions. Information from Tracy Bell (06) 274 1966 [scope to develop indicators on the naturalness of flow regimes - Ed]

*Abstracted from Crosscurrent 11/11/96.*

## Irrigation in South Australia

Tony Thomson

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*The following is an extract from a report by Tony Thomson entitled Irrigation in South Australia (1996), giving the distribution, yield, water use and value of irrigated crops. The report is available from the Department of Primary Industries South Australia for \$20.*

Irrigated crops in South Australia with a farm gate value of \$M 530 are grown by 6000 irrigators using 1 000 GL of irrigation water on 100 thousand hectares of land. Irrigated production represents 25% of the total agricultural production in South Australia (\$M 2 200).

Two thousand irrigators in the Riverland Region grow crops with a farm gate value of \$M 226 using 214 GL on 25 thousand hectares, that is, most of the irrigation in South Australia occurs outside the Riverland.

Crops and pastures irrigated for animal fodder use 70% of the irrigation water on 50% of the irrigated land to generate 12% of the farm gate value.

The irrigated crops producing the highest farm gate returns to South Australia are grapes (\$M 101), oranges (\$M 76), pastures (\$M 62), potatoes (\$M 59), nursery and flowers (\$M 33), and apples (\$M 32). Onions, carrots and pasture seed each produce more than \$M 10.

The tonnage per hectare from irrigated crops varies across South Australia and interstate as given in following table.

Potato production (t/ha) ranges from 44.1 in Tasmania, 41.0 in Western Australia, 35.4 in lower South-East 33.1 in the Mallee and 22.1 in the Angas Bremer and central Mount Lofty ranges.

The farm gate return \$/ha irrigated land in South Australia varies from 13 900 on the Northern Adelaide Plains, 11 400 in the

central Mount Lofty ranges and 1200 near Kingston in the South-East. Of the main irrigated crops, the returns \$/ha are strawberries 62 000, tomatoes 37 700, grapes 4 920, pasture 1000 and lucerne seed 531.

The farm gate return \$/kL irrigation water varies from 4.31 in the Southern Vales, 3.57 in the Barossa, 3.19 on the Northern Adelaide Plains, 2.52 in the central Mount Lofty Ranges 1.05 in the Riverland and 0.16 in the upper South-East. For the main irrigated crops, returns \$/kL are: nursery and flowers 17.54, apples 5.15, carrot, lettuce, onion and tomato respectively 5.04 4.32 3.80 and 3.79 and lucerne seed 0.05.

The annual irrigation depth applied varies from 1400 mm oranges, 1000 pasture and lucerne seed, 500 vegetables and 300 apples. There is a wide variation in the depth applied to the same crop.

### The value of irrigation water in South Australia

Pressurised, filtered and chlorinated water for domestic use is sold by SA Water for 89c/kL. In Government irrigation areas along the River Murray, irrigation water is supplied for 4c/kL. A levy on all River Murray water users of 0.3c/kL has been introduced.

In addition to the capital cost invested in a bore (or dam), electricity supply cables, a pump and pipes, the energy cost for pumping irrigation water in South Australia is typically 4c/kL.

In proclaimed areas of South Australia, water licences change hands for prices ranging from 50c/kL along the River Murray, \$1/kL on the Northern Adelaide Plains, \$1-2 in the upper South-East and up to \$7/kL in the Southern Vales.

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**YIELDS OF IRRIGATED CROPS (t/ha)**

LOCATION	CROP		
	GRAPES	ORANGES	APPLE
Victoria	22.2	24.7	20.4
New South Wales	18.4	26.0	
Riverland	17.7	34.3	17.4
South Australia	12.2		
Padthaway	10.4		
Southern Vales	9.8		
Barossa	8.2		
Coonawarra	7.1		
Central Mount Lofty Ranges	6.3		12.9

**Sustainability of supplies from a coastal aquifer and the impact of artificial recharge; Le Fevre Peninsula, South Australia**

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Coastal aquifers constitute an important source for water, especially in arid and semi-arid zones which border the sea. The expected impact of urbanisation is that there will be a net decrease in groundwater recharge as a result of an increase in the amount of impervious surfaces and the piping away of stormwater.

In an urban environment, a net decrease in groundwater recharge, coupled with high rates of abstraction due to high concentration of water demand, contributes to a lowering of the water table which results in decreased freshwater discharge to near-shore estuaries and bays, and intrusion of salty water into fresh water parts of the aquifer.

Le Fevre Peninsula is located within metropolitan Adelaide, and, like most of the coastal environs, is heavily urbanised. The existence of a relatively shallow groundwater source beneath the peninsula makes the aquifer economically accessible to a large number of domestic users. For this reason, domestic irrigation demand is expected to exceed natural recharge to groundwater through the sand dunes. As a result, there exists the potential for saline intrusion and degradation of this groundwater resource.

A knowledge of the regional groundwater flow system is important for planning and management of groundwater resources. Many groundwater issues such as potential over-exploitation, sustainable yield, and groundwater contamination, depend upon an understanding of the hydrogeology, and, in particular, recharge to the system.

In semi-arid zones, urbanisation drastically alters the spatial and temporal pattern of recharge. In addition to the recharge from precipitation happening over areas which are not covered by buildings nor paved, there are various sources of seepage recharge such as from runoff, leaking water mains, underground storage tanks and sewers, septic tanks, and extensive irrigation of domestic and municipal gardens and parks, all of which contribute to the aquifer and may result in the water table rising.

A rising water table in an urban area can result in structural damage to buildings; soil instability as a result of water logging; the re-emergence of springs and seeps; potential damage to underground infrastructure; and increased freshwater discharge to near-shore estuaries and bays

which may result in increased erosion of beaches.

This study provides the opportunity to assess the impact of urbanisation on a shallow unconfined coastal aquifer and formulate appropriate strategies for sustained aquifer management.

Like other saltwater intrusion studies, the existence of a sharp interface can be inferred along the western margin of Le Fevre Peninsula. Unlike other studies, connate brackish water trapped in pore spaces of the estuarine sediments at, or subsequent to, the time of deposition contributes significantly to the existence of an extended transition zone over the eastern boundary of the peninsula. Additionally, the position of the salt/fresh-water interface is heavily influenced by "incidental" recharge to the aquifer as a result of urbanisation.

The existence of the underlying calcrete layer and the impervious sediments of the Hindmarsh Clay has resulted in the development of a perched aquifer. As the peninsula prograded northward, salinity levels in the soil profile along the eastern margin increased due to diffused discharge from the freshwater lens developing beneath the dunes and successive periods of tidal inundation. Containment of the Port Adelaide River and land reclamation over the eastern margin in the past 100 years has resulted in a greater area for the expansion of the freshwater lens.

All recharge to the unconfined aquifer is of local origin, either from rainfall accessions or domestic irrigation using reticulated mains water. Principal losses occur as a result of evapo-transpiration, discharge to sea and discharge to wells.

The specific findings of this study show that: recharge to the shallow unconfined aquifer of Le Fevre Peninsula has been significantly altered, both spatially and temporally, as a result of urbanisation; recharge occurring during spring, summer and autumn (of which 60% occurs from irrigation) is almost three times that of the winter recharge; losses due to

evapo-transpiration are considered to be the dominant mechanism for groundwater discharge; and evapo-transpiration, coupled with an increase in the number of wells abstracting from the aquifer will ultimately lead to a more frequent and serious incomplete annual recovery of the Q1(a) aquifer.

The decline in the volume of water in storage that has been occurring over the past decade, although slight (0.04 m/year), indicates that the present level of use is not sustainable. As the cost of reticulated mains water increases, greater demand will be placed upon the shallow aquifer to supply water to meet irrigation needs. For every householder who chooses to install an irrigation well, the demand on the aquifer increases, but more importantly, recharge from irrigation using reticulated mains water diminishes. An increase in the number of wells will ultimately lead to a more frequent and serious incomplete annual recovery of the unconfined aquifer.

If the current trends concerning the demand for groundwater continue over the next ten years, it is estimated that a landward shift of the fresh-/salt-water interface of 17 m from its present position will occur. A shift of this magnitude positions the toe of the saline wedge within 20 m of adjacent groundwater users and potentially within the cone of influence of pumped wells.

The implications of this study are that the aquifer is at risk of quality deterioration as a result of saline water intrusion, and that planning strategies which include artificial recharge must be adopted in order to sustain the resource. Aquifer storage and recovery presents a means of countering the continual decline of water table levels, and preventing the eventual salinisation of the aquifer. However, in order to avoid potential problems associated with rising watertables, small projects, utilising either soakage trenches or wells, would provide the best method of distributing the harvested stormwater runoff to the aquifer.

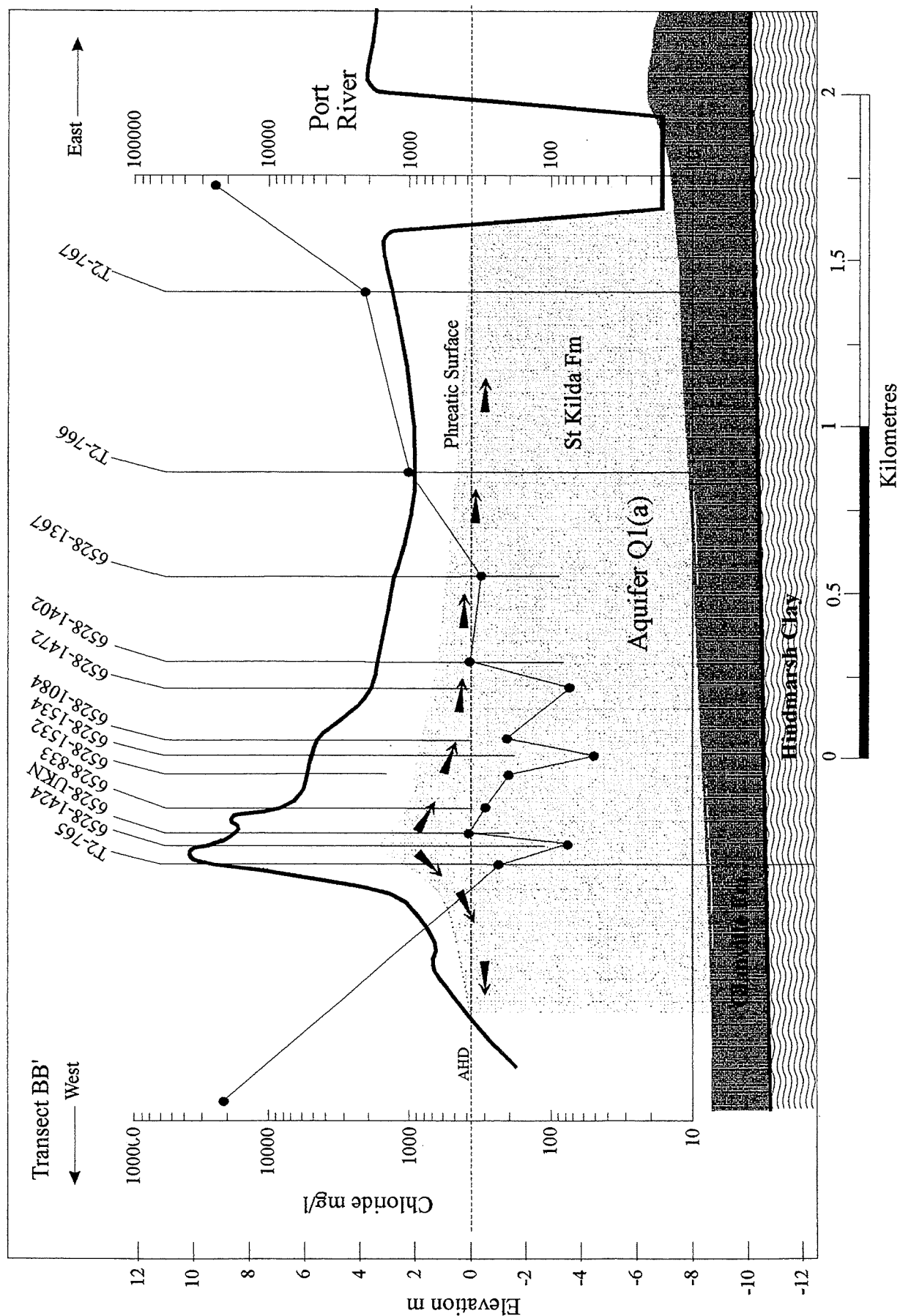


Figure 1. Phreatic surface and spatial distribution of chloride east - west transect across middle of LeFevre Peninsula. Because of groundwater mound beneath the coastal dunes discharge is to both the east and west.

# What's Happening In The Murray-Darling Basin

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The recent history of the Murray-Darling Basin Initiative<sup>1</sup> has a number of important milestones to its name. The SA vs NSW court challenges of the late 1970s and early 1980s, the internationally renowned Salinity and Drainage Strategy and the metamorphosis of the River Murray Commission into the Murray-Darling Basin Commission all spring to mind. However these milestones are arguably overshadowed by the issues now under consideration.

## Consumption Based Cost Sharing

For the first time since the initial River Murray Waters Agreement of 1914 consideration is being given to replacing the equal cost sharing arrangements, through which each government contributes to the operation and maintenance of the works which regulate River Murray flows, with a consumption based cost sharing arrangement. South Australia would benefit from this change through a reduction in its contribution to the total costs of managing the Murray-Darling Basin Commission's water supply infrastructure.

## Cap on Water Diversions

At the same time, the fundamental water sharing principles, which have also been in place since 1914, are being reconsidered.

The existing water sharing arrangements give both NSW and Victoria an equal share of the water which flows into the River Murray above Hume Dam and into Menindee Lakes as well as full use of their own tributaries. The only demand placed on them is that they each supply one half of South Australia's so called entitlement supply. This is an amount specified in the

Murray Darling Basin Agreement and equals 1 850 000 megalitres per annum. Theoretically therefore NSW and Victoria could use as much as they wanted, provided that they supplied South Australia with its agreed entitlement.

Of course this is not practically achievable even if they wanted to do so because it is virtually impossible to harness all flood flows. However they have been giving it a good go over recent years with storage capacity and diversions increasing dramatically. There are also explicit licences which allow irrigators to divert as much as they like once the river flow exceeds a given level. Some of the pumps and off river storages in northern NSW and southern Queensland are comparable with metropolitan water supply reservoirs.

The end result is that we have dramatically altered flow regimes in the River Murray and its tributaries. The median annual flow to the sea has been reduced from a once very healthy 11 800 000 megalitres to only 2 500 000 megalitres each year.

This, as you might expect, has quite important repercussions on the health of the river and the riverine environment. What's more it threatens the sustainability of the very resource on which we now rely for our prosperity.

Precisely because of this the Murray-Darling Basin Ministerial Council decided that there needed to be a cap established on the consumptive use from the rivers and streams of the Basin.

## Corporatisation of the Snowy Mountains Scheme

The reliability of regulated water supplies in the River Murray to all three southern States could well be affected as a result of moves to corporatise the Snowy Mountains Scheme and as the operation of Lake Victoria is reviewed in the light of evidence

<sup>1</sup> The Murray-Darling Basin Initiative is the term adopted for the united efforts of the Commonwealth, NSW, Victorian, South Australian and Queensland governments to manage the natural resources of the Basin within the terms of the Murray-Darling Basin Agreement 1992.

about the significance of the Lake as an aboriginal heritage site.

The Snowy Mountains Scheme provides about 5% of the flows in the River Murray system during most years but up to one third during the drier years. These are very significant contributions which the Murray-Darling Basin Commission would clearly like to retain. However these flows could be affected if only electricity generation interests are pursued by the proposed Snowy Mountains Corporation. Accordingly the Commission is negotiating to ensure that the existing rights to water inflows from the Snowy Mountains Scheme are secured in any new arrangements.

### **Lake Victoria**

Lake Victoria storage is an integral and significant component of the total regulating capability through which South Australia, New South Wales and Victoria receive their share of the waters harnessed from the River Murray system. It has been in operation since 1929.

Lake Victoria is also a very significant aboriginal heritage site; on some accounts as significant as Uluru, Lake Mungo or Kakadu. It is particularly significant because of the large number of burial sites.

The operation of Lake Victoria is now under review in light of evidence about the significance of the Lake as an aboriginal heritage site. The Commission is working with the aboriginal community to develop a comprehensive management plan to enable the storage to be operated as it is presently, whilst providing the appropriate protection of the aboriginal sites.

### **Community and Government Partnership in Natural Resources Management**

As well as this we are now entering an era of greater community involvement in integrated catchment management throughout the Murray-Darling Basin. In South Australia this is delivered through the CARE program and will soon be enhanced with the establishment of the proposed River Murray Catchment Board. The Murray-Darling 2001 project will see more

funds available for on ground works over the next five years than ever before.

The project, initiated by the South Australian Premier, will see an additional \$300 million over the next five years provided by the Commonwealth and State governments to help communities throughout the Basin implement their regional strategies and local action plans. Commonwealth funding will be provided as part of the Natural Heritage Trust. South Australia's contribution of up to \$35 million over the five years will be provided from a levy on River Murray water users. For 1996-97 the levy is \$30 per megalitre.

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### **PARTNERSHIP FOR LOCAL AGENDA 21**

Local Agenda 21 is strategy to bring about change that will lead to achieving sustainability at a local level in the 21st century. It had its genesis in the Rio Earth Summit in 1992, having recognised that no global environmental strategy will succeed without coordinated local action.

The Local Agenda 21 program devised by the Department of Environment and Natural Resources (DENR) and the Local Government Association (LGA) built upon the DENR's guidelines handbook on Local Environment Policy. The results will be used to update the handbook.

Five councils of diverse land use and demographics were invited to pilot the program. These were Adelaide, Marion, Whyalla, Happy Valley and Streaky Bay.

The results were reported during local Government Week, March 1996.

All the Councils addressed the issue of stormwater management and water quality, including reuse potential.

Abstracted from information provided by Graham Adams, Policy Secretariat, Department of Environment and Natural Resources, tel (08) 8204 9277 Email: gadams@denr.sa.gov.au



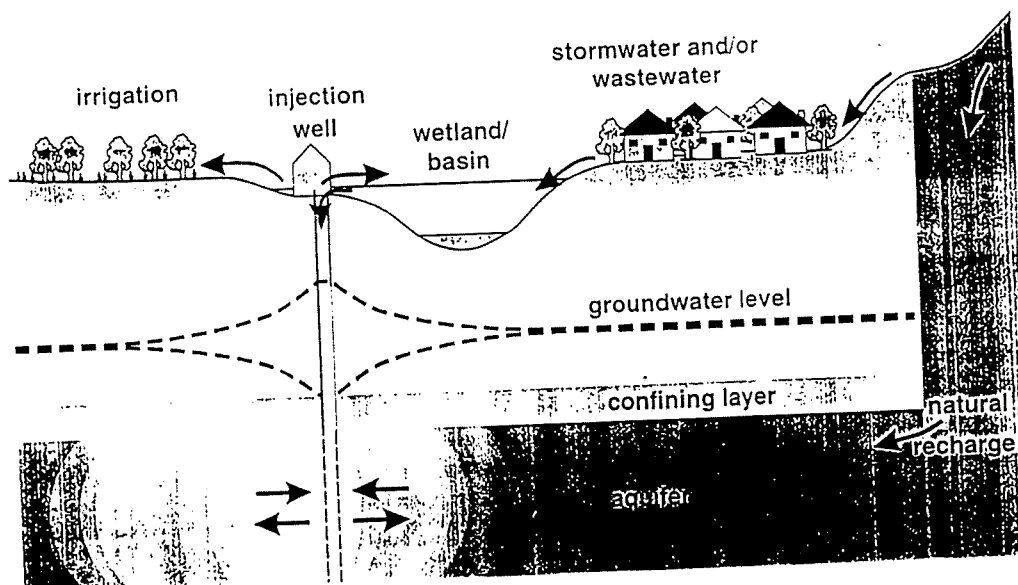
## BIOGEOCHEMICAL REACTIONS IN ARTIFICIAL STORAGE AND RECOVERY SYSTEMS

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Biogeochemical reactions, which occur as a direct result of artificial recharge by injection, have the potential to limit the long-term feasibility and economic viability of Artificial Storage and Recovery systems. This field-based investigation examines the biogeochemical reactions taking place at Andrews farm, Strathalbyn and Clayton in South Australia, as a result of artificial recharge with surface waters into carbonate bearing aquifers. Mass balance calculations are used to determine the types of reactions predominating at each site and the geochemical modelling programs PHREEQE and WATEQ used to calculate the saturation indices for possible mineral phases and the chemical species in the recovered waters. Sulphur and carbon isotopes are being studied in conjunction

with the chemical data in order to gain more comprehensive understanding of the processes taking place in these systems. It has been found that the predominant reactions at Andrews Farm are calcite dissolution, cation exchange of Ca for Na, sulphide oxidation and microbially mediated redox reactions which result in the oxidation of organic matter and the reduction of sulphate. Sulphur isotopes in conjunction with the chemical data have shown that the reactions taking place in the sulphur cycle have a direct impact on the carbonate and iron cycles. The predominant reactions at Strathalbyn and Clayton appear to be redox reactions which progress through the redox sequence from the microbial oxidation of organic matter, to, in at least one instance, the production of methane. Calcite dissolution and cation exchange reactions are also likely.

The above is an abstract. The full paper can be obtained from the author.



**Schematic representation of aquifer storage and recovery:** Aquifer Storage and Recovery (ASR) is a specialised form of artificial recharge where surface water is injected into a confined or semi-confined aquifer during wet seasons and extracted for use later during dry seasons (Pyne, 1994).

### ***In search of sewage***

A report on the 7th International Stormwater Drainage Conference, Hannover, Germany (International Water Quality Association)

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When I enquired about sites to see in Germany where effluent reuse is being practised, I was told by a German *we are living in area where we are overblessed with rainfall*. Whilst direct reuse did not appear common, there are definitely areas of shortage. Berlin wants to reduce its water consumption of 130L/p.day to 100 (compare Adelaide 300) since mine dewatering, which fed their water source, ceased with closure of the mine on German reunification. In 1995 water was charged in Berlin at DM 3.80/kL\* and sewage at DM 4.90/kL\*. The Berlin Water Authority is investigating advanced effluent treatment to top up natural lakes. Schemes using soil filtration (Drewes and Jekel 1996) and tertiary treatment by ultrafiltration to remove both phosphorus and pathogens (Gnirß and Dittrich 1995) are being tried.

In many German cities, return of the effluent to the river is in itself reuse, as water levels would fall below navigable levels, and the towns downstream would suffer water shortages.

In blocks of flats in Hannover, pilot greywater reuse used four schemes: reed bed treatment, manual diversion of bath water to a holding tank and two systems of biological rotating filter in the basement, all for toilet flushing (Deutsche BauBeCon AG 1996). In a cinema and an hotel, roof runoff was captured, again for toilet flushing.

The Hannover stormwater conference heard much about stormwater infiltration (including porous pavements), which has been institutionalised in Germany through a national standard, mainly to reduce the load on combined sewers. Soil movement and groundwater quality seemed not to be of great concern. Several papers dealt with real-time monitoring, including radar monitoring of rainfall and measurements of drop size, for operation of sewer systems to

minimise overflows. Rainwater quality and its (re)use were discussed. Amongst the hydro-informatics sessions, the use of artificial neural networks applied to stormwater management, including the prediction of runoff coefficients, was elaborated. Deposition and erosion of sediments in sewers figured prominently. An emerging issue is the resuspension or resolubilisation of toxicants attached to deposits.

One author described the impact of a design manual put out by the Construction Industry Research and Information Association of UK, on how to design roads to control stormwater pollution (Payne and Osborne 1996). An author from a privatised water authority in Scotland implied that it was the responsibility of researchers to make sure that their research was fit for water authorities to profit from, and that it was other people's responsibility to provide the data to verify the modelling of a sewage system.

The post-conference tour took us to Emscher River Valley, in the Ruhr. With a catchment area of 865 km<sup>2</sup> and a population of 2.5 million its area is 4 times, and its population 10 times, that of the Patawalonga. The river had been converted to a channelised sewer over the last century and a half of industrialisation, because coal mining caused subsidence up to 20m. Innovative projects are being undertaken to rehabilitate the area environmentally and socially. A massive sewage treatment works (5x10<sup>6</sup> equivalent population) was constructed in 1976 at the mouth to divert river flow through it. Upstream treatment plants were abandoned, although it is now realised that for ecological restoration of the river, smaller plants are required throughout the catchment. DM 8 billion\* will be spent on restoring the river over the next 25 years. Compare this to a budget of \$ 50 million for the Patawalonga over the same period.

Industrial buildings are being converted to offices and the industrial heritage restored

as a tourist attraction. Projects are used to train long-term unemployed. Special projects included housing designed and built by women.

One housing project varied the roof line to divert roof runoff against the contours to a detention pond. On the ground, porous pavement further maximised infiltration.

Along the Rhine River, vines were growing on slopes so steep that opponents of the proposed Brownhill Creek (Adelaide) vineyards would blanch.

The 8th International Conference on Stormwater Drainage will be held in Sydney in 1999.

I presented a paper on the Patawalonga water quality, the abstract of which appears below.

\* \$A1=DM1.1

#### References

- Deutsche BauBeCon AG (1996). *Ökologische Wasser- und Energiesparsysteme. Versuchspark, Hannover, Hägewiesen. Ein Pilotprojekt der Deutschen BauBeCon AG in Zusammenarbeit mit der Stadtwerke Hannover AG.*
- Deutsche BauBeCon AG (1996). *Zwischenbericht. Grauwasseranlagen - Versuchspark, Hannover, Hägewiesen. Ein Pilotprojekt der Deutschen BauBeCon AG in Zusammenarbeit mit der Stadtwerke Hannover AG.*
- Drewes JE and Jekel M (1996). *Reuse of advanced treated wastewater for groundwater recharge - experiences and problems.* Water Management Conference, United Arab Emirate
- Emschergerossenschaft (1993). *Tasks, organisation, data.*
- Gnirß R and Dittich J (1995). *Microfiltration of municipal wastewater for disinfection and advanced phosphorus removal.* IAWQ/IWSA Workshop on removal of micro-organisms from water and wastewater.
- Nolde E (pers comm 1996) Fachgebiet Umweltmikrobiologie und Technische Hygiene, Technische Universität Berlin.
- Payne J and Osborne M (1996). *Control of pollution from highway drainage discharges.* Proc. 7th International Conference on Urban Storm Drainage.

#### New age chemistry

The Advertiser reports the results of a survey of American children that was allegedly conducted by New Scientist magazine. Some answers included: Water is composed of two gins, Oxygen and hydrogen. Oxygen is pure gin. Hydrogen is gin and water. H<sub>2</sub>O is hot water and CO<sub>2</sub> is cold water.

#### INTEGRATION OF AT-SOURCE POLLUTION CONTROL MEASURES IN THE STURT RIVER CATCHMENT, ADELAIDE, SOUTH AUSTRALIA

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The 119 km<sup>2</sup> Sturt River catchment is about half rural and half low density urban. Both areas are drained by ephemeral watercourses. Measures are being undertaken to reduce the pollution of the runoff so that the ecological integrity of the water course can be restored wherever possible, the amenity of local urban communities improved and greater use made of water for habitat provision, recreation and irrigation. Simple methods to trace the source of pollutants are being developed so that the effectiveness of at-source controls can be evaluated and contribute to a total approach to catchment management. The methods combine sampling of deposited silt to identify sources and composite water quality sampling to identify pollution mechanisms to reinforce the suspected pollution sources. It is found that the contaminants from the rural area behave substantially differently from those in the urban area, and require different control strategies

#### Surveyed rivers in USA are too polluted for fishing

Nearly 40% of the surveyed rivers in the US are too polluted for fishing or swimming, largely because of silt, sewage, disease causing bacteria, fertiliser, toxic metals, oil and grease. So begins an article in Engineering News Record (23/9/1996) by Robert Perciasepe on the transition since 1991 of the US EPA to a catchment management approach to diffuse pollution control. Tradeable rights have been established in wetlands (natural and artificial) and in pollution rights including the establishment of trust funds to facilitate exchange. The issue of national Permits for point source discharges has been reorganised to coordinate with State permits, so that cumulative impacts can be gauged. Water-shed related items are now available on the Internet at URL: <http://www.epa.gov/OW> and a participating catchment can be surfed on [www.epa.gov/surf](http://www.epa.gov/surf)

## WEB DIRECTORY

### SWMM on the net

Information on the stormwater model SWMM is now available on world-wide web page (the model may be downloaded at no charge):

<http://www.orst.edu/dept/ccee/swmm.htm>

An anonymous ftp site:

[engr.orts.edu/pub/swmm/pc](http://engr.orts.edu/pub/swmm/pc)

useful CHI www site (Wm James):

<http://www.chi.on.ca>

news and discussion group (Wm James)

[swmm-users@listserv.uoguelph.ca](mailto:swmm-users@listserv.uoguelph.ca)

EPA CEAM www site (CEAM = Centre for Exposure Assessment Modelling located at Athens, Georgia, USA):

[ftp://ftp.epa.gov/epa\\_ceam.wwwhtml.ceam\\_home.html](ftp://ftp.epa.gov/epa_ceam.wwwhtml.ceam_home.html)

Information provided by Wayne Huber (author of SWMM) at 7th International Conference of Stormwater Drainage at Hannover, Germany.

### Fora for groundwater research, discussion and strategy

Groundwater researchers, funders and information users are now brought together in the United Kingdom in the UK Groundwater Forum. Visit the forum's site at <http://www.nwl.ac.uk/gwf> or email John Keslick jr, the UK Groundwater Forum Secretariat, at [GW.Forum@unixa.nerc-wallingford.ac.uk](mailto:GW.Forum@unixa.nerc-wallingford.ac.uk)

In the USA the American Groundwater Trust has similar aims. Contact them at  
16 Centre Street  
PO Box 1796  
Concord New Hampshire 03302-1796  
tel +1 603 228 5444  
fax +1 603 228 6557

### Land-atmosphere models available on CD ROM

A 5-volume CD set of temporally and spatially consistent data sets for global climate studies is now available free of charge. The data are currently being used to drive land-atmosphere models and to support soil moisture modelling, modelling of net primary productivity for the terrestrial component of Earth, and global climate models. The data sets cover 5 areas: vegetation;

hydrology and soil; snow, ice and oceans; radiation and clouds; and near surface meteorology. Currently data covers the period for 24 months 1987-88 on a common spatial grid of 1° by 1°. Documentation, ordering information and sample images can be found on World Wide Web site:

[http://daac.gsfc.nasa.gov/CAMPAIGN\\_DOCS/SLSCP/islscp\\_il.html](http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/SLSCP/islscp_il.html)

Abstracted from BAHC News no 4 April 1996.

### Electronic trading in water allocations in California

Farmer cooperative, Westlands Water District (WWD) and the University of California have launched *Waterlink* - an online electronic market enabling member farmers to buy and sell water using a personal computer and modem. Trading is in short-term amounts for use in a single season. Trading volumes and post bids can be viewed and transactions negotiated. The system will expedite transferrals, which have occurred for many years.

Abstracted from *Water Resource Management News* June 1996

### A call to all puzzlers

Claus Schonfeldt

Tel 8204 9154 fax 8204 9144

Email [schonfeldt@denr.sa.gov.au](mailto:schonfeldt@denr.sa.gov.au)

Well, yes! I am a puzzle freak. OK, so I've admitted it. I enjoy the thrill of the chase, the mental stimulation and the delight of discovering the secret to a seemingly impossible problem.

I can still remember the real excitement I felt when I finally cracked the solution to the problem below. It was late at night. I hadn't been able to let it go and then I couldn't get to sleep for some time thereafter.

It is a terrific problem. I hope you enjoy it too.

What then is the answer to the following:

- (1) dslxs bh kifhmg gfm nvxs bh gsbm ru
- (2) lbrmwoks'h yf lh row ofnh hvn bh Obwz
- (3) dbh btf, zfbih ifbxsfh lh bh gsf gfm
- (4) dlou Hli Ulfmw gdlxf gsf glmfh Ulfmw gsf
- (5) lbrmwoks lbrmwoks? Ulfmw Ulfmw Ulfmw  
bg wluufimxf btfh
- (6) Obwz Ulfmw dbh Lu gsf lbrmwoks btf  
kifhmg,
- (7) Hli Hli bmw btfh row Obwz ru ru
- (8) Obwz dsfm lh dsfm Hli gsfl srds gsbm

## HYDSOC SEMINARS

All seminars are at the Charles Hawker Auditorium, Waite Institute, Waite Road, Urrbrae, commencing at 5.30pm for 6.30 to 8.00 pm except as noted. The audience is invited to join the guest speaker at dinner afterwards.

Tentative program for 1997 is listed in the following table:

Date	Subject	Speaker
20/2/97	Great Artesian Basin	Zac Sibenaler Department of Mines and Energy (MESA)
9/4/97 Wednesday	USA EPA legal framework	Carl Dierker USA EPA
22/5/97	Recent floods of northern South Australia. Joint meeting with Australian Water and Wastewater Association at Institution of Engineers, Australia building, 11 Bagot Street, North Adelaide.	Joint speakers including David Kemp (Department of Transport), Mark Harvey (Department of Environment and Natural Resources) and Chris Wright (on leave from Bureau of Meteorology))
26/6/97	D'Arcy Lecture: Groundwater	Phillip Bennett CSIRO
21/8/97	Joint meeting with Scientific Expedition Group (SEG ) Seasonal forecasting	Grace and Holton, Bureau of Meteorology
18/9/97	Irrigation	Tony Thomson PISA, Greg Rowberry DENR Stephen Pugh MESA
23/10/97*	Stormwater seminar	Industry speakers and professional organisations
4/12/97	Chile groundwater	Peter Smith MESA

\* National Water Week: Sunday 19/10/97 to Saturday 25/10/97

## ENVIRONMENT AND NATURAL RESOURCES WATER RESOURCES GROUP

### 1997 TECHNICAL SEMINAR SERIES

In the South Australian Water Corporation "Learning Centre", Level 8, Australis House, 77 Grenfell Street, Adelaide 10.15 am for 10.30 am to 11.45 am. Please verify the program prior to the date as it is subject to change without notice.

22 January	Urban water management	Richard Clark
19 February	Water licensing system	John Vanzo
19 March	Setting up the South Australian State Water Data Archive	Graham Blair/Jim Barratt/Peter Stace
16 April	International and interstate trends in water reuse and demand management	Bart van der Wel and Gordon McIntosh
21 May	Water Resources Act update	Megan Dyson Crown Solicitors Office
18 June	Watercourse management guidelines	Jim Burston/Alison Pryder
16 July	Irrigation in South Australia	Tony Thomson (PISA)
20 August	Integrated water systems model for the Spencer Gulf Region	Shiroma Maheepala (CSIRO Melbourne)
17 September	Aquifer recharge potential in the Spencer Gulf area	Russell Martin (MESA)
15 October	Surface water sharing: balancing environment and development	Michael Good
19 November	Is the local runoff from Glenelg swimmable? - A review of the joint Universities/Local Government (QQ) study on water quality	Peter Scott (University of South Australia)
17 December	Willunga Basin management plan	Steve West

## CONFERENCES

Date	Title	Organiser	Location	Abstracts close	Contact
9-11/12/96	Waterborne Contaminant Risk Assessment	University of New South Wales	Sydney NSW		Ms Gillian Phillips, Centre for Post-Graduate Studies, School of Civil Engineering, University of New South Wales, Sydney NSW 2052. Tel (02) 9385 5091 Fax (02) 9385 6139
10-12/12/96	Water cycle management				
January 97	Drought, groundwater pollution and management, international workshop				Managing Director, Tamilnadu Water Supply and Drainage Board, TWAD House, Chepauk, Madras 600 005, India
10-14/3/97	Regionalisation in hydrology international conference		Braunschweig, Germany		Prof Dr K Hofius tel +49 0261 1306 313 fax +49 0261 103 6422
16-21/3/97	Water in the balance: 17 th Federal Convention	Australian Water and Wastewater Association	Melbourne, VIC	closed	AWWA Conference Secretariat Email: awwa@peg.apc.org tel (02) 9413 1288 fax (02) 9413 1047
17-19/3/97	WasteTECH (including groundwater contamination)	Australian Water and Wastewater Association/Waste Management Association o Australia	Melbourne, VIC	1/11/96	
7-10/4/97	Analytic-based modelling of groundwater flow		Nunspeet, The Netherlands	1/12/96 (papers) 15/12/96 (posters, software, videos)	M Kruijs-Ooms, Buerweg 51, 1861 Bergen, The Netherlands. Tel +31 7258 99062 fax +31 7258 99040 Email: R.R.kruijs@inter.nl.net
23-24/4/97	Specialised conference on models for organisation and management in water supply and sanitation	IWSA	Berlin, Germany		fax +44 171 222 7243
23/4-3/5/97	5th Scientific Assembly of the International Association of Hydrological Sciences	International Association of Hydrological Sciences	Rabat, Morocco	15/3/96 (symposia) 15/7/96 (workshops)	
25-29/4/97	Clear Water - technical response	Stormwater Industry Association	Coffs Harbour NSW	not requested	Conference Secretariat, PO Box A398, Sydney South NSW 2000; tel (02) 9810 7805; fax 1800 659 382
5-6/5/97	Introduction and advanced modelling in HEC-RAS	Stormwater Industry Association	Sydney NSW		Stormwater Industry Association, PO Box A398, Sydney South NSW 2000; tel (02) 9810 7805; fax 1800 659 382
16-21/5/97	Water in the balance	Australian Water and Wastewater Association	Melbourne VIC	12/4/96	AWWA Conference Secretariat Email: awwa@peg.apc.org tel (02) 9413 1288 fax (02) 9413 1047
19-22/5/97	Reservoir management and water supply - an integrated system	IAWQ/IWSA	Prague, Czech Republic		Fax +42 38 41624
24-29/8/97	9th National Local Government Engineers Conference: Local Government Engineering, delivering the community's aspirations. International public works	Institution of Engineers, Australia, IMEA	Australia		Fax (03) 9690 4217

26-28/8/97	Pipes Wagga 97		Australia		(069) 23 5424
September 1997 (tentatively)	Asian water summit Climate change conference Environmental resources conference	Australian Water and Wastewater Association	Adelaide SA		Neil Palmer AWWA Tel (08) 8204 2097 Fax (08) 8204 2054 Email palmern@ephp.dep.sa.gov.au
16-19/9/97	Landcare. Changing Australia	Primary Industries South Australia	Adelaide	closed	Andrew Curtis, State Landcare Coordinator Tel (08) 8303 0339 Fax (08) 8303 9320 Email: landcare@pi.sa.gov.au http://www.pi.sa.gov.au/landcare
21-27/9/97	Groundwater in the urban environment: XXVII Congress	International Association of Hydro-geologists	Nottingham, Britain		Conference Nottingham tel +44 115 985 6545 fax +44 115 985 6612
30/9-3/10/97	Flow regimes from international experimental network data. 3rd international conference (regionalisation of hydrological parameters and integrated catchment management)	for UNESCO/MO by National Committee of Slovenia, the Steering Committee of the Alpine Mediterranean Hydrology FRIEND project and IAHS	Postojna, Slovenia	closed	Conference Secretariat c/- Dr Mitja Brilly tel + 386 61 1254 333 fax +386 61 219 897 email mitja.brilly@uni-lj.si
18-22/10/97	WEFTEC '97	Water Environment Federation	Chicago USA	16/12/96	Federal Office (02) 9413 1288
4-7/11/97	Distribution 2000: 4th International distribution utility conference (includes water)	Electricity Supply Association of Australia/Australian Electrical and Electronic Manufacturers' Association Ltd	Sydney NSW		Distribution 2000, Convention Network 224 Rouse Street, Port Melbourne Vic 3207 Tel (03) 9646 4122 Fax (03) 9646 7737 Email: convnet@peg.apc.org
24-28/11/97	24th Hydrology and water resources symposium. Water/land Wai Whenua. Focusing on urban development and a sustainable environment	New Zealand Hydrological Society and Institution of Engineers, Australia.	Auckland, New Zealand	28/2/97	The Conference Company PO Box 90-040 Auckland New Zealand Tel +649 360 1240 Fax +649 360 1242 Email info@tcc.co.nz
10-12/11/97	2nd International symposium on ecology and engineering: Engineering the aquatic environment	CWR/COE/IAHR	Australia		(09) 380 1015
4-6/5/98	Innovative technologies in urban storm drainage: Novatech 98	GRAIE The Rhone-Alps Group for Research of Infrastructure and Water; EURYDICE 92; The Urban Community of Lyon	Lyon, France		31/5/97 Bernard Chocat, GRAIE, BP 2132, 69603 Villeurbanne Cedex, France fax +33 47243 9277 Email CHOCAT@URGC-HU.INSALYON.FR
25/2/98-1/3/98	Water quality and its management	Central Board of Irrigation and Power and Indian Association for Environmental Management and the National Committee of IAWQ	New Delhi, India	31/3/97	CVJ Vamma, member Secretary, central Board of Irrigation and Power, Malcha Marg Chanakyapuri Tel +91 11 301 5984/6567 Fax +91 11 301 6347 Email cbip@cchipdel.globemail.com
6-10/7/98	Hydrology in a changing environment	British Hydrological Society	Exeter, United Kingdom		Dr Bruce Webb, University of Exeter. Email: B.W.Webb@exeter.ac.uk
13-19/9/98	Physical, chemical and biological aspects of stream-aquifer inter-relations. XXVII IAH Congress	International Association of Hydrogeologists	Las Vegas, Nevada USA		Dr John van Brahm: USGS, 114 Ozark Hall, University of Arkansas, Fayetteville AR 72701 USA Tel +1 501 575 2570
30/8-3/9/1999	8th International conference on Stormwater Drainage	International Association of Water Quality	Sydney NSW		Dr James Ball (ICUSD99), UNSW Water Research laboratory, 110 King Street, Manly Vale NSW 2093; fax (02) 9949 4188; email J.BALL@UNSW.edu.au

## HYDSOC BUSINESS

### 1996/1997 EXECUTIVE COMMITTEE OF THE HYDROLOGICAL SOCIETY OF SOUTH AUSTRALIA

Name/Position	Work	Home	Fax	Email
<u>Chairman</u> Trevor Daniell	8303 5454	8303 9085	8303 4359	tdaniell @ civeng.adelaide.edu.au
<u>Vice Chairman</u> Chris Burton	8272 3299	8297 3905	8271 4811	
<u>Treasurer</u> Bill Lipp	8343 2508	8277 5802	8343 2747	lipp@roads.sa.gov.au
<u>Secretary</u> Chris Purton	8223 5583	8339 3112	8223 5237	chris.purton@bctonkin.com.au
<b>Ordinary Committee Members elected 1995 for 2 years</b>				
David Kemp	8343 2534	8266 2794	8343 2747	kemp@roads.sa.gov.au
Andrew Love	8274 7602	8297 7675	8274 1239	alove@msgate.mesa.sa.gov.au
David Walker	8303 4319	8376 0457	8303 4359	dwalker@civeng.adelaide.edu.au
<b>Ordinary Committee Members elected 1996 for 2 years</b>				
Fraser Bell	8235 7431		8232 2944	
Paul Pavelic	8303 8742	8410 0096	8303 8750	pcp@adl.dwr.csiro.au
Bart van der Wel	8204 9129		8204 9144	bvanderwel@denr.sa.gov.au
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<b>Records Secretary:</b> Anwen Aukland	8274 7539		8274 1239	aaukland@msgate.mesa.sa.gov.au
<b>Auditor:</b> R Shepherd	831 8491			
<b>Returning Officer:</b> Kim Read	8223 5583		8223 5237	kim.read@bctonkin.com.au

### MEMBERSHIP FEES

Membership of the Hydrological Society is still only \$ 10 per year (tax deductible for practitioners). Contact Bill Lipp, Treasurer, Hydrological Society of South Australia, Stormwater Services Section, Department of Transport, PO Box 1, WALKERVILLE SA 5081, telephone (08) 8343 2508, fax (08) 8343 2747.

PLEASE ADVISE YOUR EMAIL ADDRESS FOR FUTURE DELIVERY OF NOTICES AND NEWSLETTERS TO THE SECRETARY AT [chris.purton@bctonkin.com.au](mailto:chris.purton@bctonkin.com.au)

If undeliverable please return to  
Hydrological Society of South Australia Inc  
c/- Water Resources Group  
GPO Box 1047 Adelaide SA 5001  
Australia