Aqua Australis

The magazine of the Hydrological Society of South Australia no 1 vol 4

ISSN 1323-0077

March 1998

"It will rain soon, you see if it doesn't"

AA Milne in *Winnie the Pooh*

The Hydrological Society of South Australia, c/- Water Resources Group, Department of Environment and Natural Resources, GPO Box 1047, Adelaide, South Australia 5001. Email bvanderwel@denr.sa.gov.au
Webpage: http://www.aelmg.adelaide.edu.au/civeng/hssa/hssa.html

CONTENTS

National Water Week 18-24/10/98 Prizes for the best newsletter article	1
Annual Ian Laing prize	1
The Australian Water and Wastewater Association competition	1
Pasture irrigation: is it worth changing from flood to a pivot?	2
CSIRO to probe urban water cycle	4
Urban runoff reuse	4
Affordable water	4
New Centre for Groundwater Studies project	5
El Niño impact planning	5
Hydsoc symposium 1997	6
Water accounting	10
Moral rights	10
How much water does it take?	11
Irrigation publications for farmers	11
Web directory	12
Software	12
Hydsoc seminars	14
1997 Water Resources Group/Environment Policy Technical seminar series	15
Australian Water Quality Centre, Bolivar: autumn seminar series	15
Conferences	16
DEHAA Water Resources Group demise	21
Hydsoc business	23

National Water Week 18-24/10/98

Should HYDSOC have any activities? Give us your ideas to Bart van der Wel, telephone (08) 8204 9129; email bvanderwel@denr.sa.gov.au

Prizes for the best newsletter article

A prize of $50 for the best article in each newsletter will be continued for 1998. Get out your laptop now! Articles may be serious technical articles, or any aspect of hydrology, such as book reviews, biographies of South Australian hydrographers, news.

The annual **Ian Laing Prize** for outstanding studies in hydrology for 1997 was presented to Mr ***Ian Burns*** for work in the Department of Civil and Environmental Engineering at the University of Adelaide. Congratulations to Mr Burns, who was presented with a cheque for $ 500. The Society looks forward to receiving applications for the 1998 award.

The Australian Water and Wastewater Association is funding an Australia-wide competition to select a candidate for the Stockholm Junior Water Prize. Entrants will submit reports of water-related projects in February 1999. 3 finalists will present their reports at the 18th Federal Convention in Adelaide in April 1999. The prize is a trip to Stockholm and cash. Contact Clare Porter (02) 9413 1288; email awwa@inta.net.au

Extracted from *Crosscurrent* 16/3/1998

1998 International Year of the Ocean

Pasture irrigation: is it worth changing from flood to a pivot?

Tony Thomson, Irrigation Engineer, Primary Industries and Resources South Australia, tel (08) 8389 8839 and **Robert Mugford,** Agricultural Consultant, Millicent.

Summary:
For similar gross margin return per hectare:
Pivot gives 3X return on water
Pivot gives 6X return on labour
Flood gives 2X return on capital

Irrigated pasture worth $ 1460/ha generates meat from lambs worth only $ 1132/ha

Reedy Creek flood irrigators have measured annual growth of 13.5t/ha of dry matter from flood irrigated pasture. Of this 3.5t/ha was produced "dryland" from the winter rainfall. Of the 10 t/ha produced from flood irrigation the gross value was $1460/ha and the gross margin was $640/ha.

Under a pivot, irrigated pasture production would be increased by about 20% from l0 t/ha up to 12 t/ha giving a gross margin of $730/ha.

Reedy Creek flood irrigators used an average of 1500 mm of irrigation; a pivot would need less than half this amount of water, 600 mm.

The gross margin on water for flood irrigation was 4 cents/kL and for pivot irrigation three times as much, 12 cents/kL.

The gross margin on labour for flood was $213/hour and for a pivot it was six times as much, $1466/hr.

The capital cost of installing flood irrigation was $625/ha and for a 30 ha pivot was $2100/ha. Flood gave a return of 62% on capital which was double the 29% return from a pivot.

Prime lambs weighing 40 kg, grazed on flood irrigated pasture, eating 70% of the dry matter grown, and stocked at an average of 12.4 lambs/ha for the year, would produce meat at 0.25 kg/lamb per day. Annual production would be (12.4x0.25)x365 = 1132 kg/y of meat valued at $1.00/kg. This is only $1132/ha of meat after grazing pasture worth $1460/ha. The meat production includes costs for managing the sheep, the capital value of the sheep, and risks of sheep losses.

The pasture with gross margin of $64/t could be sold as hay (or silage) selling ?90% of the dry matter at a cost of $ 50/t to cut, rake, bale, load on truck, store in shed, deliver to customer.

Comparison between Flood and Pivot irrigation for 30 ha pasture

			Flood	Pivot
a	Irrigation	mm/y	1500	600
b	Irrigation	kL/ha	15000	6000
c	Dry Matter (due to irrigation)	t/ha	10	12
d	$ Dry Matter grown ($146/t)	$/ha	1460	1752
e	$ Dry matter grazed (70%)	$/ha	1022	1226
f	Capital (bore)	$/ha	100	100
x	Capital (pump+diesel +watchdog)	$/ha	400	400
g	Depreciation (bore+ pump+diesel+watchdog) @ 10%	$/ha	50	50
h	Capital (irrigation system)	$/ha	375	1850
I	Depreciation (irrigation system)(Flood at 4%, Pivot at 6%)	$/ha	15	111
v	Capital (electric fencing)	$/ha	150	150
w	Depreciation fencing at 10%	$/ha	15	15
j	Pasture renovation	$/ha	25	25
k	Fertiliser	$/ha	175	150
l	Pump head (1 m = 1.5 psi)	m	5	25
	Cost diesel net of rebate	$/L	0.33	0.33
	Cost energy	$/kWh	0.12	0.12
m	Pumping energy (if $0.10/kWh, cost is $0.005/kL per 10m head)	$/ha	45	90
n	Weeds & pests	$/ha	7	7
o	Labour (watering+ repairs & maintenance)	hours	3	0.5
p	Labour	$/ha	30	5
q	Repairs & maintenance	$/ha	20	40
r	Gross Margin (r=e-g-i-w-j-k-m-n-p-q)	$/ha	640	733
s	Return on labour [s=r/o]	$/hour	213	1466
t	Return on capital [(t=r/(f+x+h+v)]	%	62	29
w	Return on water [u=r/b]	$/kL	0.04	0.12

Assumptions:

1. Pasture under pivot needs 600 mm; pasture under flood needs 1500 mm
2. Water level in bore is 3 m below ground level; flood pump pressure: 5 m = 3 m lift+ 1 m above ground + 1 m friction; pivot pump pressure: 25 m = 3 m lift + 2 m above ground + 15 m at centre (14m at spray) + 5 m across dirty strainer; bore located at centre of pivot (no mainline)
3. Electric pumping energy cost $0.0005/kL.m head, if energy cost is $0.10/kWh (ETSA day rate starts $0.137/kWh; night and weekend rate $0.066/kWh)

Diesel pumping energy cost $0.0006/kL.m head, if, after rebates, diesel costs $0.33/L then for 2.74 kWh diesel costs $0.12/kWh

4. Labour $10/h
5. Pasture dry matter in the cages, measured by weight of dry matter in the irrigated pasture, on average analysed metabolisable energy of 9 000 MJ/t. Assume that the pasture being grazed (outside the cages) contained 10 500 MJ/t. Meadow hay which contains 90% dry matter typically contains 8 000 MJ/t. To buy 10 500 MJ as meadow hay means buying 10 500/(8000 x 0 9) = 1.46 t of meadow hay. If meadow hay costs $2.50 per small (25kg) bale or $100/t then the pasture dry matter has a replacement value of $146/t.
6. Animals graze only 70% of the dry matter which is grown
7. More fertiliser is needed for flood irrigation to compensate for losses in runoff from the end of the bay and also for losses in the drainage water leaching below the pasture roots. Use nutrient composition 1P:2K:1S (6.5%P), spread at a cost of $250/t. Apply P at 45 kg/ha to flood and at 40 kg/ha under pivot.
8. Estimate 20% additional yield under pivot due to reduced plant stress from more frequent waterings and better use of fertiliser

Notes:

1. A pivot can be sold (and bought) secondhand, flood can only be sold by selling the property.
2. A pivot location is not restricted to flat, gently sloping land.
3. A pivot enables growth of a range of alternative crops.
4. Fertiliser and insecticide can be distributed through a pivot to save labour, machinery and compaction.
5. With saline water, a pivot may need black polyethylene drop tubes to lay the water on the soil and hence avoid wetting the plant foliage.(Low Energy Precision Application (LEPA))

Some grazing facts:

1. Average production (total of irrigated plus dryland) by the Reedy Creek group from flood irrigation was 135 t/ha of dry matter, including an assumed 35t/ha from winter dryland production.
2. Under the pivot at Flaxley, Greg Mitchell has used dairy cattle grazing 17 t/ha of dry matter
3. Dry matter consumed by growing lambs is 4.6% of live-weight/day. A 40 kg lamb eats 40x0.046 = 1.85 kg dry matter/d. Greg Mitchell advises that 70% utilisation is achievable. The average annual stocking rate for flood growing 10 t dry matter at 70% utilization is (10 000x0.7)/(1.85x365) = 10.4 lambs/ha. For pivot irrigation, growing 12 t/ha, the stocking rate is 12.4 lambs/ha.
4. A 40 kg lamb growing at 0.25 kg/d and eating 1 85 kg dry matter/day is consuming 1.85x105 = 194 MJ/day. If 1 dse uses 10 MJ/d, a lamb is 2 dse.
5. Greg Mitchell advises that irrigated pasture should contain 12 000 MJ/t dry matter of metabolisable energy. In 1993/4 the Reedy Creek Group measured in the cages an average of 9 000 MJ/t dry matter. Kyabram quoted metabolisable energy as 10 600 MJ/t dry matter. Assume that the pasture grazed outside the cages contained 10 500 MJ/t.
6. Under pivot, grow 12 t/ha of dry matter worth $1752/ha. Graze only 70% at 10 500 MJ/t = graze 12x10 500x0.7 = 88 200 MJ/ha. In one day, 40 kg lambs use 1.85 kg dry matter at 10.5 MJ/kg = 19.4 MJ to grow 0.25 kg meat, ie 77.7 MJ to grow 1 kg. So grazing produces 88 200/777 = 1135 kg/ha of lamb valued at $1 00/kg, ie grow $1 752 of feed to sell only $1135 of meat plus skin ($9) and wool ($1). For 12.4 lambs/ha => $124/ha ie. ?Better off by $ 1752 – (1135+124) = $493/ha if fed is harvested sold as hay rather than grazed to produce meat from prime lambs. Hay costs: cut, rake, bale $30/t, load and deliver $20/t, additional fertiliser $??/ha. At 12t/ha would exceed the $493/ha.
7. Capital cost per dse: Pivot $2100/ha; flood $625/ha. Dryland pasture carries 5 dse/ha, pivot-irrigated pasture 30 dse/ha ie increase due to irrigation is 25 dse/ha. Pivot capital $/dse = 2100/25 = $84/dse. Compare land purchase capital of $150/dse. Return $ 25/dse from irrigated land, less from dryland.

Issues

1. 70% utilization means that at least 30% ($500/ha) of the pasture being grown is being wasted by grazing. If waste of this $500/ha could be avoided it would increase gross

margin of $730/ha by 70%.

2 How can metabolisable energy be increased from 10 500 to 12 000 MJ/t of dry matter? This would increase gross margin by $340/ha. White clovers = ?50% of sward? Use different rye-grasses (Nui NZ and other rye instead of Vic)?

3 Can dry-matter production be increased from 13.5 t/ha under flood to above 20 t/ha under pivot? Kyabram commercial 13-16 t/ha; research 18-19 t/ha; Kathy Kelly at Kyabram was almost doubling production (commercial 15 t/ha, experiments 20-32 t/ha) by breaking up sub-soil and using sprinklers. Urea 200 kg/ha, single P 500 kg/ha (40 kg/ha of P). Maize grows about double the dry matter produced by pasture but maize is lower in crude protein.

4 Is grazing the best use of the water resource? No other country in the world irrigates for grazing.

5 Water charges: Kyabram paying $0.02/kL.y Kyabram licence sells for $4/kL. At Kyabram at $0.02/kL it is not economic to irrigate for meat production, it is only economic to irrigate for dairy production.

6 Kyabram P in surface runoff contains average 1-5 mg/L; 200-300 mg/L just after applying fertilizer. For Reedy Creek flood irrigation, if drainage contains 3 mg P/L, the 750 mm of drainage would remove 22 kg P/ha out of 40 kg P/ha applied.

CSIRO to probe urban water cycle

The CSIRO Divisions of Land and Water, Building and Construction and Molecular Sciences has commenced looking at water-use from first principles to identify those approaches, which, if applied holistically, can deliver a better outcome overall, to be followed by demonstration projects. Wider industry involvement will be sought. The project builds on previous foresighting by the Australian Science and Technology Council (ASTEC) in 1995. Contact Chris Davis AWWA

Extracted from *Crosscurrent* 16/3/1998

Urban runoff reuse

Denmark is undertaking research into the use of urban runoff for the drinking water on a national scale, including health, resources and economy aspects. Currently 98% of the water supply is sourced from groundwater.

The Tokyo Metropolitan Government has launched a comprehensive water cycle restoration program to include rainwater use, stormwater infiltration and sustainable use of water resources. Already many commercial buildings recycle their sewage and use roof runoff for toilet flushing.

Extracted from newsletter 11 of the IAHR/IAWQ Joint Committee on Urban Storm Drainage 12/97.

Affordable water

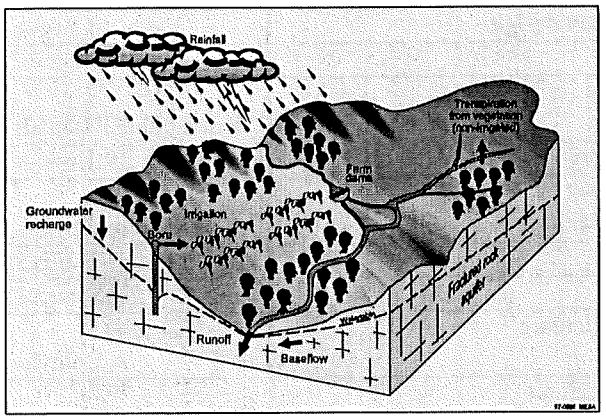
"The direct issue is not food but water. With water, food can be grown on lands where it is not now grown. Just as surely without water, food production falls. Currently, eighty poor countries with 40 percent of the world's population already have water shortages that could cripple agriculture. But to say that the issue is water is to misstate the real issue, which is not water per se but affordable water. With enough money, oceans can be desalinated and food can be grown where it is not now being grown, as Saudi Arabia does. But the costs of desalinization and the infrastructure (pipes and pumping stations) necessary to get the water to where it is needed are enormous. If an analysis was made of the energy it took to grow food in the middle of the Saudi Arabian desert, more energy would be used up in getting fresh water to the fields than was generated by the food grown on those fields. Only very wealthy countries, such as those in the Persian Gulf region, can even dream of making such investments - and even there it does not make sense. What are by other standards wealthy places such as Hong Kong have mothballed their desalinization plants as too expensive even for drinking water."

Quoted from Thurow L (1996) *The future of capitalism.* Allen and Unwin

New Centre for Groundwater Studies Project

Topic: "Groundwater Flow and Solute Transport in Fractured Rock"

Fractured rock aquifers contain a significant proportion of the potable water supplies in Australia. Despite this, there is still no accepted and reliable method for estimating recharge rates, groundwater velocities or contaminant transport velocities in fractured rock systems.

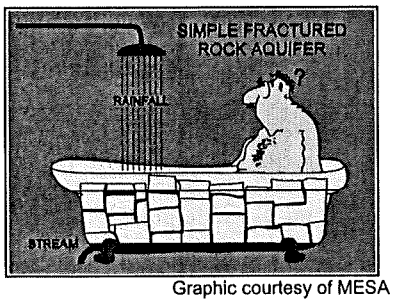


Graphic courtesy of MESA

In this project, numerical simulation of solute and contamination transport in fractured rock systems will be carried out in order to further elucidate the governing processes in such systems. Both hypothetical and field based computer modelling will be undertaken. Data collected in the Clare Valley in the mid-north of South Australia will be used for model calibration and this will take advantage of the large drilling program undertaken by Mines and Energy, SA and field measurements undertaken by MESA and CSIRO. Numerical simulations will also be compared with field based hydrogeological, piezometric, hydrochemical and isotopic observations. Funding for the project has now been approved by LWRRDC.

Project Partners

Mines & Energy Resources of South Australia (MESA)
Flinders University of SA (FUSA)
CSIRO Land and Water (CLW)



Graphic courtesy of MESA

Fractured Rock Workshop, Clare 9-10 October 1997

The Clare Valley is located in the northern Mount Lofty Ranges, approximately 100 km north of Adelaide. Groundwater in the region is stored and transmitted in fractured rock aquifers with slates, dolomites and quartzites being the major host geologies. Groundwater in the fractured rock system displays a large spatial variability of physical and chemical properties. After 10 years of monitoring salinity and groundwater levels, no regional trends can be recognised, and no sustainable yield for the region has been established.

Land and Water Resources Research & Development Corporation (LWRRDC) has recently funded a joint research project with Mines and Energy Resources South Australia (MESA), and CSIRO Land and Water, to develop methods for estimating groundwater recharge, and vertical and horizontal flow velocity of fractured rock aquifers.

In a workshop organised by the Centre for Groundwater Studies, the project team met with national representatives in the Clare Valley, to review the project objectives and assess the opportunities to transfer any resulting technology gains to other hard rock aquifers within Australia.

The peer review proved to be successful in focussing on the Clare objectives, describing the character of the Clare model, and identifying a number of issues associated with the management of groundwater in fractured hardrock aquifers throughout Australia. The national perspective will be reported in a later paper.

Contributors to the discussion were:

Chairman:		
Graham Allison	LWRRDC	
Project Team:		
Andrew Love	MESA	
Peter Cook	CSIRO	
Dawn Morton	MESA	
Kerryn McEwen	CSIRO	
Craig Simmons	Flinders University	
State Representatives:		
Sarah Bish	Dept LWC	NSW
Phil Commander	W & R Comm	WA
Daryl Chin	PAWA	NT
Tony Endres	Uni WA	WA
Ray Evans	AGSO	ACT
Bryan Harris	MESA	SA
John Hillier	DNR	QLD
Lloyd Matthews	Min.Res	TAS
Andrew Shugg	DNRE	VIC
Observers:		
David Cresswell	DENR	SA
Robin Gill	MESA	SA
Proceedings Reporter:		
Darryl Harvey	MESA	SA

El Niño impact planning

A DRAFT resolution has been put before the UN General Assembly seeking creation of an early-warning mechanism to prevent damages caused by the El Niño phenomenon and for the development of long-term strategies for the prevention, mitigation and rehabilitation of damages caused by El Niño, such as financial assistance, transfer of appropriate technology and dissemination of information and knowledge.

The resolution calls on the UN Secretary-General to promote an intergovernmental meeting of experts and scientists to exchange information and national experiences on the monitoring of El Niño, as well as to suggest strategies for the reduction of its impact.

Extracted from *Water Quality International* 11-12/97

HYDSOC SYMPOSIUM 1997

At the Hydrological Society symposium in National Waterweek 1997 (October), the following papers were presented. Copies of the proceedings are available from the Treasurer at $10.

Table of contents

Monitoring stormwater quantity - some hints and pitfalls	T Daniell, BG Williams and G Fisher
Monitoring stormwater quality at the Barker Inlet wetlands	D Walker and R French
Monitoring river health in South Australia using macroinvertebrates as biological indicators	P Goonan
Stormwater management and ESD: "Water-sensitive" urban design	J Argue
Reuse of urban stormwater	RE Desmier
A strategic perspective on stormwater management for the Northern Adelaide Plains	N Fleming and T Daniell
South Australian experience in aquifer storage and recovery	N Gerges and SR Howles
The RSF 4000 solid pollutant filter/oil and grease arrester - Ecosol's latest weapon in the fight against stormwater pollution.	R Gapper and S Roy
Ultraviolet disinfection of stormwater	S Pullens
Design and cleaning of gross pollutant traps	P Menzies
The challenge of bringing water perspectives into the curriculum. What choices do we have?	A Colliver
Feasibility and cost analysis of recycling stormwater and effluent for a city of 25 000 – Whyalla	AL Telfer
Catchment Boards facilitating innovative stormwater management	A Ockenden
State Government funding - the "Subsidy Scheme"	WR Lipp

Abstracts:

Monitoring stormwater quantity - some hints and pitfalls

T.M.DANIELL Senior Lecturer, Dept of Civil and Environmental Engineering, University of Adelaide
B.G.WILLIAMS, Postgraduate Student, Dept of Civil and Environmental Engineering, University of Adelaide
G. FISHER, Office of the Catchment Boards

The measurement of stormwater quantity from a catchment forms an integral part of any water monitoring program in the urban environment. Discharge measurement in the past has relied on measurement weirs and maintaining stable stage/discharge relationships. Newer Ultrasonic Doppler velocity probes offer an alternative method of flow measurement. The importance of accurate flow measurement cannot be underrated as the flow rate and event runoff volumes directly affect the determination of event water quality loads. Experience at stormwater channels at the Barker Inlet Wetlands has shown us that many undesirable occurrences can affect the quality of information collected. Gauged runoff is also important in the process of calibrating rainfall runoff routing models and the determination of design flows for pipe systems, water detention basins and in flood plain management. However to achieve good results requires conscientious and trained staff. For added value from runoff the catchment rainfall needs to be defined so that volumetric runoff coefficients can be determined. This is extremely important now with increasing concern for design of sedimentation ponds and wetlands as catchment management solutions.

Monitoring stormwater quality at the Barker Inlet wetlands

D Walker, Senior Lecturer
R French, Postgraduate Student, Department of Civil and Environmental Engineering, The University of Adelaide

As part of a multi-year study of water quality entering and leaving the Barker Inlet Wetlands a number of data collection stations have been set up. The duration of the study, and the importance of the results, means that reliable field quality data need to be collected. This has involved not only the choice of which parameters would be measured, but also the selection of appropriate instrumentation and system design, to obtain the required data and to allow ease of maintenance.

The need to determine temporal variations in sediment, nutrients and heavy metals has lead to an intensive data collection and analysis system, but one that is giving results and information that will be used to characterise the catchment loads and allow the development of accurate numerical models of the runoff processes.

The combination of continuously recording probes, automatic water sampling and laboratory analysis allows an efficient data collection program to be set up and maintained.

Monitoring River Health in South Australia using macroinvertebrates as biological indicators
PETER GOONAN, Environment Protection Authority, 77 Grenfell Street, ADELAIDE SA 5000
The Monitoring River Health Initiative (MRHI) is a coordinated national river bioassessment and prediction scheme which aims to assess and monitor the health of our rivers and streams, assess the impact of pollution on our waterways (including stormwater), and to assess the effectiveness of water and catchment management actions. The scheme is similar to the approach used in the United Kingdom called RIVPACS (River invertebrates Prediction And Classification System) which was also based on the use of macroinvertebrates as biological indicators.

The MRHI is based on sampling a large number of relatively unimpacted ('least-disturbed') reference sites and comparing the faunas with impacted 'test' sites to determine whether different disturbances, pollution sources or other impacts have a measurable detrimental effect on biological communities. The approach adopted associates key chemical and physical features with macroinvertebrate communities present in our rivers and streams, thereby recognising the need to integrate chemical and biological disciplines in environmental monitoring studies.

In South Australia a total of 111 reference and 30 test sites were sampled in autumn and spring 1994 and 1995, covering the major catchments in the State and ranging from Eight Mile Creek in the lower South East to Cooper Creek in the north. Further work is underway in 1997 to sample another 200 test sites as part of the AUSRIVAS (AUStralian RIVer Assessment Scheme) program, the first national assessment of river health to be conducted on a continental scale anywhere in the world.

Stormwater Management and ESD: "Water-sensitive" Urban Design
JOHN R ARGUE, Associate Professor of Water Engineering, Director, Urban Water Resources Centre, University of South Australia, THE LEVELS SA 5095

The principle which has dominated storm drainage design for most of the past 150 years has been "to collect and remove stormwater as completely and as quickly as possible". This has led to severe problems of flooding and pollution of downstream waterways. In recent time more sustainable approach has been developed which is to "hold the rain where it falls": this has not only improved flood management but it has also reduced pollution of receiving waters and created an awareness of stormwater as a valuable resource. The scope covered by this approach is termed "water-sensitive" urban design. In Adelaide, the available options and opportunities, involving soil permeability and geological conditions, have been set out in the Comprehensive Reports of both the Patawalonga and Torrens Catchments. This information is generating interest among Councils, institutions, developers and the public, and leading to the construction of sustainable stormwater management installations. The paper concludes with four illustrations of "water-sensitive" urban design.

Reuse of urban stormwater
RE DESMIER, United Water International

Stormwater runoff is now acknowledged as a major source of pollutants, which enter the urban waterways and the coastal environment. To provide some degree of treatment to the runoff before it is discharged to the natural environment, stormwater retention basins and wetlands are being constructed in increasing numbers. The development of these facilities provides a source of treated water that can be attractive for use as a replacement for more conventional water supplies. There do not appear, however, to be any published guidelines specifically targeted at the reuse of stormwater.

This paper discusses some of those factors that need to be considered when evaluating the potential to use the stormwater either as a sole resource, or combined with reclaimed water from a wastewater treatment facility.

A strategic perspective on stormwater management for the Northern Adelaide Plains
NICHOLAS FLEMING, Water Resources Consultant, PPK Environment & Infrastructure Pty Ltd, 101 Pirie St, Adelaide, SA 5000
TREVOR DANIELL, Senior Lecturer, Department of Civil 8, Environmental Engineering, The University of Adelaide, Adelaide, SA 5005

The resource potential of stormwater is examined for the Northern Adelaide Plains, within the context of

established goals for stormwater management and the emerging trends in the management of all water resources.

The seasonality and volume of stormwater runoff is compared with the potential demand and the 'capturability'. The impact of changing urban form due to urban consolidation or adoption of alternative urban development patterns is also considered. Issues of water quality are also addressed with respect to the origin of pollutants, the impact of stormwater on the marine environment and methods of mitigating adverse environmental impacts.

The conclusion is that a large proportion of storm runoff cannot be effectively captured for use, and the primary consideration becomes that of water quality improvement. Furthermore, there is some way to go to achieve appropriate stormwater management, and a large part of that journey involves the establishment of more effective integration of land and water management.

South Australian experience in aquifer storage and recovery
N Z GERGES and S R HOWLES, Mines and Energy Resources, South Australia

It is estimated that 390,000 ML of storm water/effluent is generated in South Australia annually. Most is discharged, less than 5% being reused. In recent times attitudes have changed and the resource potential of this water is being recognised, particularly in situations where a potable standard is not required. South Australia currently leads the nation in experimenting and implementing a policy of reuse, particularly for irrigation. This involves aquifer storage and recovery, a management tool which enables conjunctive surface water and groundwater resource management as an alternative to the traditional methods used by today's managers, such as licencing and quota restrictions. Research and development in South Australia indicates that aquifer storage and recovery is practical in different aquifer environments. This paper summarises selected technical information on aquifer storage and recovery activities in the state of South Australia including well construction, clogging mechanisms, aquifer hydraulics and other related issues.

The RSF 4000 solid pollutant filter/oil & grease arrester - Ecosol's latest weapon in the fight against stormwater pollution
RICHARD GAPPER, Operations Manager, Ecosol Pty Ltd,
SCOTT ROY, Technical Research Director, Ecosol Pty Ltd

Ecosol's Rapid Stormwater Filtration (RSF) technology is at the forefront of the fight against stormwater pollution. The RSF 100 and RSF GSP at-source units were the first in Australia to incorporate a fail-safe overflow mechanism and yet still collect more than 95% of solid pollutants down to the size of a match head. The at-source technology was refined to produce the RSF 1000, which is suitable for high-fall end-of-line situations.

Ecosol has now developed the RSF 4000 in-line/end-of-line unit, which separates and retains solid pollutants as well as oil and grease. Unlike many other products it has no moving parts and uses a unique, patented hydraulic weir to improve capture performance and prevent blockage. This paper traces Ecosol's beginnings, its holistic approach to stormwater filtration, and its continued commitment to innovative solutions to stormwater pollution.

The challenge of bringing water perspectives into the curriculum: What choices do we have?
ANGELA COLLIVER B.A. Grad. Dip. Ed, School and Community Educator, Water Resources Group, Department of Environment and Natural Resources

The purpose of this paper is to provide an overview of a curriculum initiative in Water education within South Australia. For the past four years, a joint initiative between the National Landcare Program (now National Heritage Trust) and the South Australian Department of Environment and Natural Resources, with input from representatives in other states, has resulted in three stages of Watercare - a curriculum resource for schools, aimed at teachers across all years of schooling.

Feasibility and cost analysis of recycling stormwater and effluent for a city of 25,000- Whyalla SA
AL TELFER B App Sc (Grad Dip), Principal - Water Resources, PPK Environment and Infrastructure

PPK were engaged by the City of Whyalla to undertake a Water Recycling Feasibility Study for the City. The objective of the study was to "gauge the viability of recycling wastewater from a range of effluent sources in Whyalla". This paper describes the resources and presents a financial analysis of the most promising water

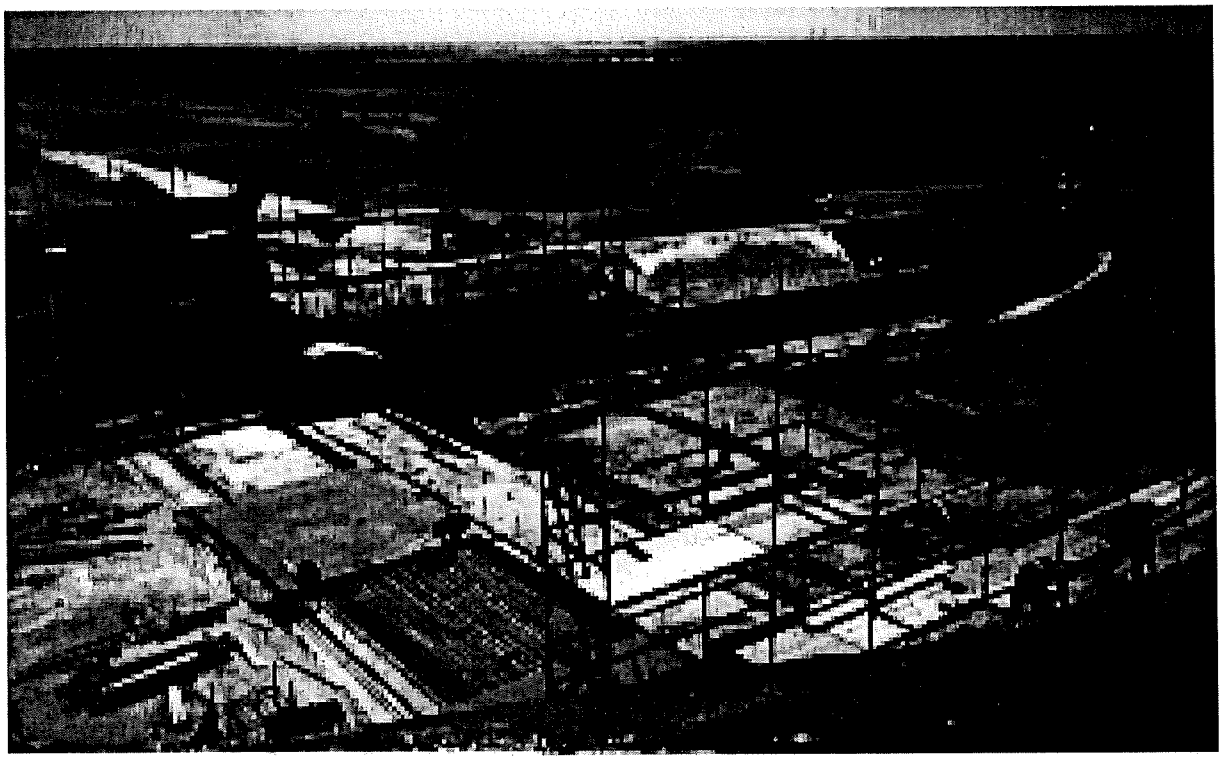
venue schemes. Additional detail is contained in (Rust PPK 1996).

State Government funding - the "Subsidy Scheme"
W.R. LIPP B Tech (Civil), Grad Dip Maths, Manager, Stormwater Services, Department of Transport

Since its inception 30 years ago the State Government Stormwater Drainage Subsidy Scheme has successfully contributed to a dramatic reduction in stormwater drainage and flooding problems in South Australia. As part of its ongoing evolution it has just been transformed into a wider ranging Catchment Management Subsidy Scheme. Of more recent years "research" activities have received support. This support will continue with the revamped Scheme, albeit with a more formalised approach.

Catchment boards facilitating innovative stormwater management.
ALAN OCKENDEN BE (Civil) Hons, General Manager, Patawalonga and Torrens Catchment Water Management Boards

The Patawalonga and Torrens Catchment Water Management Boards have been operating for two years to clean up Adelaide's waterways, improve stormwater quality and enhance catchment environmental values. Just over $2m per catchment per year has been collected from residents to fund the catchment water management program. These funds enable the Boards to function and to undertake projects in accordance with their approved catchment plans. The plans set out a carefully designed mix of physical works, planning measures and community education and awareness programs. The program and its levy funding concentrates on practical outcomes. the program is expected to be ongoing for at least the next 5 years. The Boards' program and their role is one of integrating and initiating innovative catchment (and stormwater) management. The program has met with considerable community acceptance and provides a way for the future for funding and delivery of innovative urban water management programs.



Cobbler Creek dam on the preconference tour of the Hydrological Society Symposium (Photo Doug Smith)

WATER ACCOUNTING

Christina Jackson
Environment and Energy Statistics Section
Australian Bureau of Statistics, Canberra
Telephone: (02) 6252 7876 Facsimile (02) 6251 6009

Thank you for forwarding the article entitled "Water resource accounting" from the July 1997 edition of Aqua Australis. I am writing to clarify the approach intended to be used in the ABS Water Account Project.

The Australian Bureau of Statistics (ABS) is currently developing environmental accounting systems for a number of Australia's natural resources. The Water Account for Australia is one of the physical accounts being developed and will consist of water stock and flow tables. It is intended to present data based on a financial year basis and match this to the flows in the existing monetary national accounts.

The ABS intends to develop a physical Water Account based primarily on the water quantity data. This will be achieved by working cooperatively with State/Territory governments and through utilising existing data collection activities. The ABS's Water Account Project is not part of the National Land and Water Audit, it is highly likely that data collected through the Audit process will be relevant to the Water Account Project.

The methodology which has been developed for the Water Account has required the integration environmental data into a framework that is applicable for economic analysis. The Water Stock Tables will describe the changes in stocks of water over a particular period of time (such as annual variations), The structure of the Water Stock Tables will be based on the physical resource accounts concepts in United Nations System for Integrating Environmental and Economic Accounts (SEEA) and spatial and physical parameters which will consider the variability of Australian water resources.

The Water Flow Table will describe the usage of water by different industries and households in order to measure the flow of water through the economy. The basis for the Water Flow Table will be the ABS's Input Output tables which once suitably augmented, provide a useful framework to study the interaction between the environment and economic activity. Such a framework will allow the quantification in physical terms of the volume of water supplied and used within the economy, based on standard industry classifications.

MORAL RIGHTS

Extracted from Headlines "*Intellectual Property*", no 20, September 1997, a newsletter of Allens Arthur Robinson Group

The Federal Government is proposing amendments to the Copyright Act 1968 which will introduce significant "moral rights" for authors of literary, dramatic, musical and artistic works and for producers and directors of cinematograph films.

Moral rights are different from the usual "economic" rights associated with copyright material. They belong to the author, rather than attaching to the work, and their aim is to give the author or creator some control over the use of the work.....

The draft legislation provides for authors to have the following moral rights:

- The right of attribution of authorship - the right for the author to be identified in a clear and reasonably prominent fashion whenever the work is reproduced, published, performed in public, transmitted or adapted.
- The right not to have authorship of a work falsely attributed - this translates very broadly into an obligation not to identify someone as the author when they are not the author and, where a work has been altered by someone other than the author, not to deal with work as being the unaltered work of the author. (This right already exists in the current legislation.)
- The right to prevent derogatory treatment - broadly the doing of anything in relation to a work that is "prejudicial to the author's honour or reputation"

Unlike copyright, these rights will not be able to be assigned and will continue to be enforceable by the author and his or her estate for as long as copyright subsists in the relevant works.....

This will be of particular concern to businesses who have had works created for them in the past (such as packaging designs and logos) and who intend to keep using those works.....

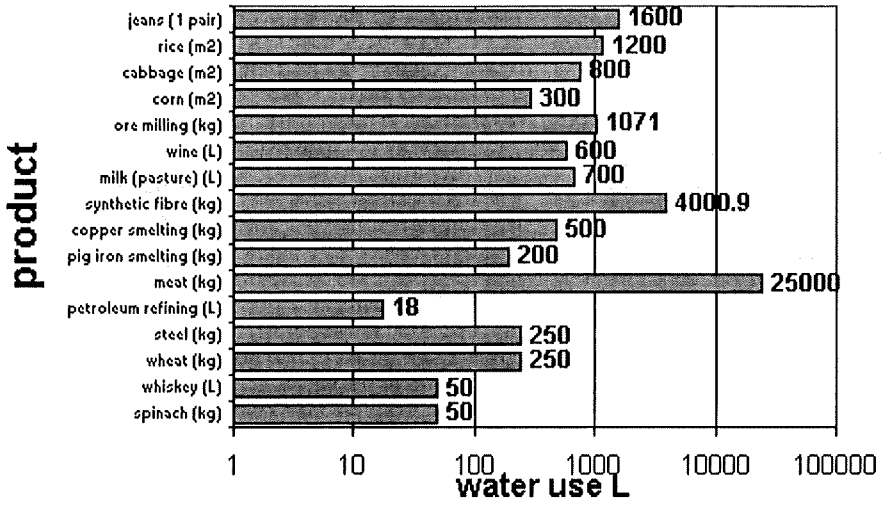
Waiver of moral rights will be possible and the author can also consent to what would otherwise be infringing actions. However, unless the author makes the work in the course of employment, a waiver can only be given for an existing work and must be in writing.....

FOR FURTHER INFORMATION PLEASE CONTACT
Allen Allen & Hemsley Philip Kerr, Jim Dwyer, Sydney; Andrew Buchanan, Brisbane; or George Marques, Canberra
Arthur Robinson & Hedderwicks Richard Hamer, Tim Golder, Melbourne; or Bill Manning, Perth
Finlaysons Lee Dewhirst, Adelaide

How much water does it take?

Water use varies according to the product treated or irrigated. This highlights the need to target the product according to water availability, amongst other infrastructure. Often, in proposed developments, water is assumed to be readily available

Sources: Compiled by Bart van der Wel from: Sinka RJ, Indira Ghandi Centre for Human Ecology, Environmental and Population Studies, Jaipur, Rajasthan, India; Western Mining Corporation (1996), Environment Progress Report 1994-95; Thomson T (1997) pers comm.



Irrigation publications for farmers: by Tony Thomson, tel (08) 8389 8839

Publication	Pages	Cost $
Irrigation Notes	82	12
Farm Water Supplies	136	12
Six steps to improve irrigation: including Irrigation recording sheets for: • investigation of irrigation pump • investigation of watering uniformity of irrigation system • recording each irrigation for drippers • recording each irrigation for sprinklers • recording each irrigation for flood	10	5
The Soil and Irrigation	62	5
Chemical injection and fertigation	60	5
Filtration	25	5
Experiences with soil moisture devices		5
Answers to 10 irrigation questions		5
Water Quality and interpretation of water analyses		5
Control of iron in irrigation water		5
Technical Report: Irrigation statistics 1986-7 and 1992-3: area and value within each irrigated area of SA and in each state		20
Irrigation in South Australia: an overview with facts and figures		5
Waste water use at the Bolivar HIAT (Hardwood Irrigated Afforestation Trial): the innovative woodlot irrigation and data collection system		
Trial to determine optimum soil moisture at which to re-irrigate: Compare results from 3 levels of soil moisture		2
The wide variation in irrigation practices: grape-Mclaren Vale; almond-Willunga; potato-Adelaide Hills-Virginia-Bordertown; pasture-Kingston S.E.		5
Storing water in farm dams		5
Returns from, and costs of, irrigating pasture		5
Target Irrigation Needs (TIN) calculation for each crop in each location		
On Farm Irrigation Investigation Service (OFIIS): Irr-E-pak		

WEB DIRECTORY

South Australian Department for Environment, Heritage and Aboriginal Affairs (DEHAA)
www.denr.sa.gov.au/wrg

Information on ***South Australian Acts of Parliament****, including the Water Resources Act 1997, can be found at*
www.austlii.edu.au/au/legis/sa/consol_act/
Other Australian Acts can also be found on the home page of Australasian Legal Information Institute

---

Information on the ***National Heritage Trust (NHT)*** *(the Commonwealth Government fund for environmental restoration from the part sale of Telstra) and application forms can be found at* **http://www.nht.gov.au**
coasts and clean seas:
www.erin.gov.au/marine/clean_seas/info.html
Lands and Water Resources Research Development Corporation (LWRRDC):
www.lwrrdc.gov.au
Fisheries Action Program Restocking Guidelines:
http//www.dpie.gov.au/fish/action/index.html
Directory of important wetlands:
www.anca.gov.au/environm/wetlands.wwwhp.htm
Ramsar wetlands: ***www.erin.gov.au/ahc.html***
World Heritage:
www.erin.gov.au/land/conservation/wha/auswha.html

Extracted from NHT guidelines

International Year of the Ocean (IYO):
http://www.unesco.org/ioc/iyo/activities.htm

Australian National Marine Information System *(NatMIS)*
http://www.environment.gov.au/marine/natmis/

Australian Marine and Coastal Data Directory (Blue Pages)
http://www.environment.gov.au/marine/mcdd/

Extracted from Waves ***4/3*** *1997, the newsheet of the Marine and Coastal Community Network*

Desline™ Desalination Directory 1998,
www.desline.com

South Australian Water Corporation Tenders
http://tenders.sawater.sa.gov.au; *or contact SAWC Supply Branch on john.mcgeever@sawater.sa.gov.au*

Australian Water and Wastewater Association
http://www/awwa/asn.au

International Water Quality Association (IAWQ)
http://www.iawq.org.uk

Urban drainage discussion group *by IAWQ. To join the list and have your discussion automatically circulated to other members, send an email with content:*

join urban-drainage *yourfirstname yourlastname*

to mailbase@mailbase.ac.uk. Further information from webpage
http://www.mailbase.ac.uk *or David Butler at Imperial College, London UK, email d.butler.ic.ac.uk*

Extracted from the newsletter of the Joint Committee on Urban Storm Drainage IAHR/IAWQ No11, 12/97

Urban Technology Journal contents page
http://www.carfax.co.uk/jut-ad.htm

SOFTWARE

Australian Coastal Atlas*, includes on-shore coastal features, water quality and monitoring programs, climate, socio-cultural, geoscience, marine biology, fisheries and physical oceanographic features at 1:250 000. Web page*
http://www.environment.gov.au/marine/coastal_atlas

Extracted from Waves ***4/3*** *1997*

Hydraulics, *water resources and environmental software*
Download freeware, shareware and demos from **http://www.100folhas.pt/software**

Catchment Management Support System (CMSS), originally developed for nutrient calculations in the Onkaparinga River catchment by the CSIRO for the then Scientific Services Group of the Engineering and Water Supply Department

can be purchased from the CSIRO. Contact Keith Farquhar 0419 493 138

*Extracted from the newsletter of the International Association of Hydrogeologists, Australian Chapter **14**/3 1997.*

Australian irrigation studies CD Rom *Waterlines*. First disc features Barmah-Millewa Red Gum Forest and the effects of river regulation on it. Contact Hilary Huggan, Murray Darling Basin Commission tel (06) 279 0113.

Extracted from *Wetlands Australia* 12/97 No 5.

***Groundwater data library**. The National Groundwater Committee, with assistance from the National Landcare Program has initiated a project to establish a uniform groundwater database, with anticipated substantial savings in data management costs. The proposed guidelines will cover borehole construction, location, water quality and GIS datasets. Contact the working group through Ross Brodie, tel (02) 6249 9396, fax (02) 6249 9985, email rbrodie@agso.gov.au*

***Map of Great Artesian Basin** at 1:2 500 000 scale now available for $25 from Australian Geological Survey Organisation (AGSO) Sales Centre, GPO Box 378, Canberra ACT 2601, tel (02) 6249 9982, fax (02) 6249 9519, email sales@agso.gov.au*

***Parallel PEST. The optimisation model** PEST which runs on the output of other models, now is available in a form to run the model to be optimised over several networked computers, in order to reduce running time. See* **www.ozemial.com.au/~wcomp;** *contact Dr John Doherty, Watermark Numerical Computing, 336 Cliveden Avenue, Corinda Qld 4075; tel (07) 3779 1664; email: jdoherty@gil.com.au*

***Geological commercial software** demonstration:*
WinLog for plotting borehole logs;
POLLUTE v6 contaminant migration analysis;
MIGRATE v9 contaminant transport modelling
on **http://www.osha.igs.net~gaea.** *Contact Michael Fraser GAEA Environmental Engineering Ltd, 44 Canadian Oaks Drive, Whitby, Ontario, Canada;*
tel 905 725 4487; fax 905 725 9657;
email gaea@osha.igs.net

*Extracted from the newsletter of the International Association of Hydrogeologists, Australian Chapter, **14**/4 1997.*

*An information directory on **Ecologically Sustainable Technologies** (ESTs) is now available from the International Technology Centre (IETC) of the United Nations Environment Program (UNEP) using maESTro software, which is compatible with UNEP's Global Resources Information database (GRID), NASA, CEOS and NASDA. The databases are being developed in collaboration with partner EST information systems such as EnviroNET Australia.*

maESTro currently serves 3 databases:

- *a survey on EST information systems;*
- *a compilation of 130 institutions dealing in EST;*
- *an overview of indigenous eco-friendly technologies on urban and freshwater lakes/reservoirs.*

IETC is inviting technology owners to add their EST to future updates at:
maESTro, UNEP/IETC Shiga Office, 1091 Oroshimocho, Kusatsu City, Shiga 525, Japan; email maestro@unep.or.jp

*An ICPIC **diskette on cleaner production** lists examples, policy applications, abstracts, expert contacts and information on sources. Information on UNEP IE's web page:* **http://www.unepie.org**

"For Life on Earth". *UNEP interactive CD Rom for those interested in environmental problems, their solutions and important trends. Users can select Natural Resources, Production and consumption, Human Health and Global Trends. Cost USD 35 (educational and bulk rate USD 25) from UNEP Regional Office for North America, 2 UN Plaza, Room 803, New York NY 10017 USA, fax +1212 963 7341, email uneprona@un.org*

Extracted from Environmental Technology Assessment *1-6/97 and* Insight *(IETC newsletter) 12/97*

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 1998 is listed in the following table. Please take note of changes as advised by the flyer prior to the meeting.

Date 1998	Subject	Speaker
19 February	Patawalonga catchment management plan	Kim Read, Hugh Orr, Paul Lightbody (BC Tonkin and Associates)
30 April	Katherine, Northern Territory, floods of 1998	Ken Schalk (BC Tonkin and Associates), David Kemp (Department of Transport)
18 June	Environmental flows in Australian watercourses	Tim Fisher (Australian Conservation Foundation), Anne Jensen (consultant, formerly DEHAA), Michael Good (DEHAA)
27 August	Catering for climate variability; and AGM and joint meeting with Australian Meteorological Society	Neville Nicholls (Bureau of Meteorology)
September	Aquifer Storage and Recovery student research	Corinne La Gal le Sal, John Hutson, Craig Simmons (Flinders University)
TBA	Joint meeting with Soil Science Association	
TBA	Joint meeting with Stormwater Industry Association	
3 December	TBA	TBA
March 1999	HYDSOC Oration and 30 th Anniversary (14/3/99)	Skip Tonkin, former HYDSOC President

International Year of the Ocean 1998
World Water Day 22 March 1998
National Water Week: Sunday 18/10/98 to Saturday 24/10/98

2nd Australian Stream Management conference:

The 2nd Australian conference on stream management will be held in a beautiful part of South Australia in the second week of February 1999. The theme of the conference will be stream rehabilitation/restoration, with a strong emphasis on community involvement.

Information will be coming soon regarding field-trips, submission dates for abstracts and papers as well as the exact times, costs and venue. If you would like to be placed on an email or snail-mail mailing list then send an email to Jim Burston (SA Dept for Environment Heritage and Aboriginal Affairs jburston@denr.sa.gov.au). Similarly, if your office or Department would like to hear more about this conference generally, please send us some address details.

DEPARTMENT FOR ENVIRONMENT, HERITAGE AND ABORIGINAL AFFAIRS

1997 WATER RESOURCES GROUP/ENVIRONMENT POLICY 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. Please verify the program prior to the date as it is subject to change without notice. Telephone (08) 8204 9129, email bvanderwel@denr.sa.gov.au

21 January	Dry Creek Catchment Management Plan	*Andrew Telfer PPK Consulting Engineers*
18 February	Current issues in water resources management: An OUTLOOK 98 perspective	*Doug Young South Australian Centre for Economic Studies*
18 March	A comparison between New Zealand and South Australia on catchment management	*Andrew Emmett/Mike Smith/John Rolls*
15 April	How to export water industry capabilities	*Chris Barber (CSIRO Groundwater Studies, Perth); Jim Killick (SA Water)*
20 May	Sharing rural water	*Michael Good*
17 June	Community involvement	*Ian Grant/ Johnathon Noble(KESAB)/ Alan Ockenden (Patawalonga/Torrens Catchment Boards)*
15 July	Water Resources education	*Trevor Daniell (University of Adelaide)/Barry Johnson (Regency TAFE)/Angela Colliver (consultant)*
19 August	The future of desalination technology	*Chris Colby (Roger Stokes &Associates)*
16 September	Innovation in stormwater and wastewater management in SA Housing Trust developments	*Dennis Mitchell SAHT*
21 October	The first year of the new South Australian Water Resources Council	*J Fargher and members of the Water Resources Council*
18 November	Environment Policy: the next five years	*Peter Hoey*
16 December	Rethinking the state hydrologic network for new technology and new indicators	*Graeme Tomlinson*

AUSTRALIAN WATER QUALITY CENTRE, BOLIVAR: Autumn Seminar Series

Tuesdays 10.30 am, Bolivar Wastewater Treatment Plant, Hodgson Road, Bolivar

Attendance from people outside of the Australian Water Quality Centre is welcomed. Please advise the AWQC (Kaye Spark tel. 8259 0349) if you are interested in coming to give us an idea of numbers and to ensure that you are informed of any adjustments which may have been made to the program.

3 February	Kaye Spark - Organic Chemistry Unit, Australian Water Quality Centre: *Soluble natural organic matter in soils – nature, and significance in transport processes*
10 February	Chris Saint - Microbiology Unit, Australian Water Quality Centre: *Just Genes*
17 February	Cam Grant - Dept Soil Science, Adelaide University: *Taking P out of water with sludges*
24 February	Robert Walsh - Aquatic Ecology Unit, Australian Water Quality Centre: *Tasmanian Wetlands*
3 March	Karen Simpson - Mass Spectrometry Unit, Australian Water Quality Centre: *Off-Flavour episodes in the Anstey Hill Distribution System 1995-6*
10 March	Renate Velzeboer - *Microbiology Unit, Australian Water Quality Centre: The cynobacterium* Cylindrospermopsis raciborskii*: a genetic challenge*
17 March	Mike McLaughlin - CSIRO Land and Water, Adelaide: *Can water treatment sludges improve food quality*
24 March	Frederick Recknagel - University of Adelaide: *Impact of degraded flood plain wetlands on the River Murray*
31 March	Pascale Sztajnbok - United Water: *Water Treatment and Membrane Technology*
7 April	Trevor Leymeyer - Flinders University: *Benthic biomonitoring in the acid stressed reaches of the Dawesley Creek SA.*
5 May	Clive Jenkins - University of South Australia: *Constructed wetlands and stormwater*
12 May	Peter Baker - Biology Unit, Australian Water Quality Centre: *The role of resting stages Akinetes in population development of* Anabaena circinalis *in the lower River Murray*
19 May	Paul Pavelic - CSIRO Land and Water, Adelaide: *Aquifer storage and recovery at Andrews farm - What we know after 4 years.*
26 May	John van Leeuwen - Organic Chemistry Unit, Australian Water Quality Centre: *Degradation and transformation of chlorophenols by fungi*
2 June	Tamilla Heresztyn - Organic Chemistry Unit, Australian Water Quality Centre: *Detection of mycrocystins by protein phosphatase inhibition assay*

CONFERENCES

Date	Title	Organiser	Location	Abstracts close	Contact
2-6/3/98	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@cbipdel.globemail.com
8-11/3/98	Weftec Asia. Conference and exposition on water quality and wastewater issues	Water Environment Federation	Singapore	14/7/97	Fax + 1 703 684 2471; tel +1 703 684 2452; email: confinfo@wef.org
11-13/3/98	Options for closed water systems; sustainable water management. International congress	Wageningen Agricultural University	Wageningen, The Netherlands		Department of Environmental Technology, WAU, Marjo Lexmond, Bomenweg 2, 6703 HD Wageningen, The Netherlands; tel +31 317 4820123; ax +31 317 48 2108; email Marjo.Lexmond@Algemeen.MT.WAU.NL
24-26/3/98	Aquatech Asia 98		Singapore		Rai Exhibitions Singapore Pte Ltd, 1 Maritime Square, No 09-01, World Trade Centre Singapore 099253; tel +65 272 2250; fax +65 272 6744
25-27/3/98	Man and river systems - the functioning of river systems at the basin scale		Paris, France		F Bourgain, Conference Secretariat ENPC, 28 rue des Saints-Peres, 75007 Paris, France; tel +33 1 4458 2822; fax + 33 1 4458 2830; email: bourgain@paris.enpc.fr
20-22//4/98	International workshop on non-structural flood control in urban areas		Sao Paulo, Brazil		General Secretary, Av Brigadeiro Luis Antonio, 317-jc33, 01317 901 Sao Paulo, Brazil; tel +55 11 604 6412; fax +55 11 604 3406; email urban_floods@edu.usp.br
20-23/4/98	Headwater '98: hydrology, water resources and ecology in headwaters		Merano, Italy		Headwater '98, c/- European Academy, Weggensteinstrasse 12/A, I-39100 Bolzano, Italy; tel +39 471 30 6111; fax +39 471 6099; email: headwater98@ms.sinfo.interbuisness.it
21-23/4/98	Hydrotop		Marseille, France		Hydrotop, 314 avenue du Prado, 13008 Marseille, France; tel +33 4 9122 7272; fax +33 4 9122 7171
26-28/4/98	Arab water	MAGICX	Cairo , Egypt		German-Arab Chamber of Commerce, 3 Abdul Feda Street, Zamale, Cairo, Egypt. Tel +20 2 342 3962; fax +20 2 341 3663; email magicx@gerarcham.com
27-28/4/98	WaterTECH conference promoting technology, science and business in the water industry	Australian Water and Wastewater Association	Brisbane	18/8/97	AWWA, PO Box 388 Artarmon NSW 2064; tel (02) 9413 1288; fax (02) 9413 1047
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		Bernard Chocat, GRAIE, BP 2132, 69603 Villeurbanne Cedex, France fax +33 47243 9277 Email: CHOCAT@URGC-HU.INSA-LYON.FR
4-7/5/98	Biennial conference of the Water Institute of Southern Africa (WISA)		Capetown, South Africa		Conference Planners, PO Box 36782, Menio Park 0102, South Africa; tel +2712 348 4493; fax 2712 348 1563; email wissing@iafrica.com
20-23/5/98	6th International conference on contaminated soil	FZK/TNO	Edinburgh, Scotland		Forschungszentrum Karlsruhe-PSA, Mrs B Mathes, PO Box 3640, D-76021, Karlsruhe, Germany. Tel +49 7247 82 3967; fax +44 7247 82 3949; email mathes@psa.fzk.de
18-21/5/98	6th International conference on highway and urban pollution		Ispra, Italy		Prof R Hamilton, School of Health, Biological and Environmental Sciences, Middlesex University, 10 Highgate Hill, London N19 5NS, United Kingdom. Tel +44 181 362 6638; Fax +44 181 362 6299; email r.hamilton@mdx.ac.uk

20-23/5/98	International conference on water quality management in national parks and other protected areas		Primosten, Croatia		Bojan Zmaic, Rakusina 1, 10000 Zagreb, Croatia; tel/fax +385 1 611 9588; email: bzmaic@zg.igh.hr
25-30/5/98	Ecwatech-98		Moscow, Russia		Ecwatech-98 Secretariat, PO Box 173, 107078 Moscow, Russia; tel/fax +7 095 207 6360; email: ecwatech@sibico.msk.ru
3-6/6/98	International conference on world water resources at the beginning of the 21st century		Paris, France		
21-26/6/98	Water Quality International 1998: 19th Biennial Conference, including wetlands, coastal pollution, diffuse pollution, reservoir management, river basin management, urban drainage, water quality monitoring	International Association for Water Quality	Vancouver, Canada	Full papers 1/7/97	WQI'98 Conference Secretariat, 645-375 Water Street, Vancouver BC, Canada, V6B 5C6; tel +1 604 681 5226; fax +1 604 681 2503 congress@venue west.com
24-27/6/98	International symposium on mineral and thermal groundwater		Miercurea Ciuc, Romania		Romanian Association of Hydrogeologists, Symposium Secretariat, c/- Iulina Popa, 6 Traian Vuia Str, R-70139 Bucharest, Romania; fax +40 1 212 3385
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
7-10/7/98	Pollutex Asia 98		Singapore		HQ Link Pte Ltd, 150 South Bridge Road, No 13-01 Fook Hai Building, Singapore 058727; tel +65 534 3588; fax +65 534 2330; email: hqlink@singnet.com.sg
7-10/7/98	Innovation 2000-treatment for the next century		Cambridge, United Kingdom		Peter Matthews, Anglian Water, Anglian House, Ambury Road, Huntingdon, Cambridgeshire PE18 6NZ, United Kingdom. Tel +44 1480 443000; fax +44 1480 443115
12-16/7/98	Future groundwater resources at risk		Changchun, China		Dr Zhao Yongsheng/Dr Sui Wiguo, FGR'98 Conference Secretariat, PO Box 298, Changchun University of Earth Sciences, 6 Ximinzhu Street, Changchun 130026, China; fax +86 431 892 8327
19-24/7/98	1st International conference on fog and fog collection		Vancouver, Canada		DR RS Schemenauer, Conference Chair, Environment Canada. Tel 416 739 4606; fax 416 739 4211; email robertss@armph3.dow.on.doe.ca
20-25/7/98	10th Afro-Asian regional conference on irrigation		Bali, Indonesia		DR Ahafied A Gany, c/- Director General, Water Resources Development, JL Pattimura 20, Kebayoran 12067, Indonesia. Tel +6221 739 6616; fax +6221 726 1956
23-24/7/97	International workshop on use of brackish and saline water for irrigation	ICID	Bali, Indonesia		ICID Workshop, Dr R Ragab, Institute of Hydrology, Wallingford Oxon OX10 8BB, United Kingdom. Tel +44 1491 692303; fax +44 1491 692424; email R.Ragab:ua.nwl.ac.uk
21-24/7/98	**National Waterwatch conference, *Getting better at getting wet***	**Waterwatch Australia**	**Roseworthy Agricultural College, South Australia**		**National Waterwatch Conference Organiser, Environment Australia, PO Box 636, Belconnen ACT 2601; tel (06) 250 0797; fax (06) 250 0384; email kate.gowland@dest.gov.au**

9-12/8/98	Environmental geotechnology and global sustainable development		Boston, USA		Dr VO Ogunro, Center for Environmental Engineering Science and Technology (CEEST),University of Massachusetts (North Campus Room E-114), One University Avenue, Lowell MA 01854, USA; tel +1 508 394 3185; fax +1 508 394 4014; email: ogunrov@woods.uml.edu
10-13/8/98	8th Stockholm water symposium		Stockholm, Sweden		Stockholm Water Symposium, SE_10636, Sweden; tel +46 8 736 2021; fax +46 8 736 2022; email sympos@siwi.org
17-20/8/98	2nd International conference on climate and water		Espoo, Finland		Risto Lemmela, HUT/Water Res Eng, Huhtatie 12, 04300 Tuusla, Finland. Tel +6358 9275 3835; fax +358 9451 3827; email rlemmela@ahti.hut.fi
24-26/8/98	Hydroinformatics '98	Danish Hydraulics Institute	Copenhagen, Denmark		Dr Vladan Babovic, Danish Hydraulics Institute, Agern Alle 5, DK-2970 Horsholm, Denmark; tel +45 45 76 9555; fax +45 45 76 2567; email hic98@dhi.dk
26-28/8/98	Coping with water scarcity	International Association of Hydraulic Research	Hurghada, Red Sea, Egypt		Hydraulics Research Institute, Delat Barrage,13621, Egypt. Fax 202 218 9539 or Prof D Stephenson, PO Box 277, WITS 2050, United Kingdom?.
31/8-4/9/98	3rd international IAWQ conference on diffuse pollution	Scottish Environment Protection Agency (SEPA)	Edinburgh, Scotland UK	15/12/97	Ms Rosemary Plessis, IAWQ Conference Coordinator, Scottish Environment Protection Agency, Erskine Court, The Castle Business Park, Stirling FK9 4TR, Scotland UK tel +44 1786 457700; fax +44 1786 448040 email: rplessis@sepa.org.uk
6-11/9/98	Kinneret symposium on limnology and lake management 2000		Lake Kinneret, Israel		Tom Bermna, Kinneret Limnological Laboratory, PO Box 345, Tiberias 14-102, Israel. Tel +972 6 672 1444; fax +972 6 672 4627; email tberman@inter.net.il
7-10/9/98	Comprehensive watershed management ISWM-'98		Beijing, China		Mr Tan Ying, IRTCES, PO Box 366, Beijing 100044, China. Tel +86 10 6841 3372; fax 86 10 6841 1174; email irtces@public2.net.cn
13-16/9/98	Management of large river basins.		Budapest, Hungary		TRIVENT Conference Office, Szamoca u6/b, H-1125 Budapest, Hungary. Fax +36 1 156 6240; email trivent@mail.elender.hu
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 Brahana. USGS, 114 Ozark Hall, University of Arkansas, Fayetteville AR 72701 USA Tel +1 501 575 2570
13-16/9/98	Management of large river basins	IAWQ	Budapest, Hungary	15/12/97	Trivent Conference Office, Szamóca u.6/b, H-1125 Budapest, Hungary; tel/fax +36 1 156 6240; email: trivent@mail.elender.hu
14-16/9/98	Advanced wastewater treatment, recycling and reuse. 2nd international conference	International Association of Water Quality	Milan, Italy	5/9/97	Segretaria Scientifica AWT98, c/- Politecnico di Milano, DIIAR Sez Ambientale, Piazza Leonardo da Vinci 32, 20133-Milano, Italy; tel +39 2 2399 6416; fax +39 2 2399 6499; email milano98@amb1.amb.polimi.it
15-17/9/98	Environmental contamination in Eastern Europe		Warsaw, Poland		Dr RC Herndon, Institute for Central and Eastern European Cooperative Environmental Research, Florida State University, 2035 East Paul Dirac Drive, Morgan Building (226) Tallahassee Fl 32310-3700, USA. Tel +1 904 644 5524; fax +1 904 574 6704; email warsaw98@mailer.fsu.edu

16-18/9/98	Hydrosoft 98		Como. Italy		Rachel Jibson, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, United Kingdom; tel +44 1703 292 223; fax 44 1703 292 853; email rjibson@wessex.ac.uk
16-18/9/98	1st inter-regional conference on environment water, innovative issues in irrigation and drainage.		Lisbon, Portugal		Portuguese National Committee of ICID, Instituto da Agua, Av Almirante Gago Coutinho 30, 1000-Lisboa, Portugal; fax 351 1 847 3023; email lenamar@inag.pt
21-24/9/98	UDM'98: Urban drainage modelling	Imperial College of Science, Technology and Medicine	London, United Kingdom	31/10/97	Dr D Butler, Department of Civil Engineering; Imperial College of Science, Technology and Medicine, Imperial College Road, London SW7 2BU, United Kingdom; tel +44 171 594 6099; fax +44 171 225 2716; email: d.butler@ic.ac.uk
21-25/9/98	**Humic Substances Downunder Understanding and managing organic matter in soils, sediments, and waters: 9th International Meeting**	**International Humic Substances Society**	**University of Adelaide, Australia**	**31/3/98**	**Dr Kaye Spark, IHSS-9 Conference Secretary, CRC for Water Quality and Treatment, PMB 3, Salisbury, SA 5108 Tel (08) 8259 0349, fax (08) 8259 0228 Email: IHSS-9@sawater.sa.gov.au Internet: http://www.clw.csiro.au/conferences/ihss9/**
21-25/9/98	Groundwater quality-remediation and protection		Tubingen, Germany		Conference secretariat, GQ 98, c/- Lehrstuhl fur Angewandte Geologie, Sigwartstr 10, D_72076, Tubingen, Germany. Tel 49 7071 297 4692; fax +49 7071 297 5059. email mike.herbert@uni-tuebingen.de
23/25 9/98	International conference on environmental contamination, toxicology and health		Hong Kong		Prof MH Wong, Hong Kong Baptist University., Hong Kong; tel +852 2339 7050; Fax +852 2336 1440 email biol@hkbu.edu.hk
21-25/9/98	Third International Symposium on artificial recharge of groundwater: store or restore		Amsterdam, Netherlands		Symposium Secretariat, Buerweg 51, 1861 CH Bergen, The Netherlands. Tel +3172 5899062; fax +3172 5899040; email R.R. Kruize@inter.nl.net
22-25/9/98	Aquatech 98		Amsterdam, Netherlands		Amsterdam Rai, PO Box 77777, NL-1070 MS Amsterdam, The Netherlands. Tel +31 20 549 1212; fax +31 20 646 4469; email mail.rai.nl
24-25/9/98	Application of models in water management		Amsterdam, Netherlands		Symposium Secretariat, Buerweg 51, 1861 CH Bergen, The Netherlands. Tel +3172 5899062; fax +3172 5899040; email R.R. Kruize@inter.nl.net
27/9-2/10/98	8th International conference on wetland systems for water pollution control		San Pedro, Brazil		Dr Samia Maria Tauk-Tornisielo, Centro de Estudos Ambientals/UNESP, Avedida 24A, 1515 Bela Vista, CEP 13506-900, Rio Claro (SP), Brazil. Tel +55 019 534 7298; fax +55 019 534 2358; email cea@life.ibrc.unesp.br
28-31/9/98	**Hydrastorm '98: Urban drainage and hydraulics**	**Institution of Engineers, Australia**	**Hilton Hotel, Adelaide**	**14/2/98**	**Dr David Walker, Department of Civil and Environmental Engineering, Tel (08) 8303 4319; fax (08) 8303 4359; email dwalker@aelmg.adelaide.edu.au**
4-8/10/98	Modflow '98	International Ground Water Modeling Center (IGWMC), Colorado School of Mines	Golden, Colorado, USA	15/1/98	Office of Special Programs and Continuing Education, Colorado School of Mines, Golden Co 80401 USA; fax 303 273 3314

13-15/10/98	International conference to explore new perspectives in waste management, particularly those applicable to Southern Africa		Kempton Park, South Africa		Piet Theron, Institute for Waste Management; tel +271 787 1151; fax 27711 787 1086
13-17/10/98	Water China		Beijing, China		Business and Industrial Trade Fairs Ltd, Unit 1223, HITEC, 1 Trademart Drive, Kowloon Bay, Hong Kong. Tel +852 2865 2633; fax +852 2865 0030
21-23/10/98	2nd Black Sea international conference on environmental technologies for coastal areas		Varna, Bulgaria		Black Sea conference, BNAWQ, Tzvetanka Anguelova, Oborishte Str N:3, Sofia 1504, Bulgaria. Tel +359 2 43 5129; fax +359 2 43 5519; email waterql@rtm.bg
27/9-2/10/98	Gambling with groundwater: physical, chemical and biological aspects of aquifer-stream relationships. IAH XXVIII Congress and Annual meeting AIH	International Association of hydrogeologists and American Institute of Hydrology	Las Vegas, Nevada USA		Helen Klose, IAH/AIH Conference Las Vegas, 2499 Rice Street, Suite 135, St Paul, MN 55113-3724, USA. Tel 612 484 8169; fax 612 484 8357; email AIHydro@aol.com
2-5/11/98	Integrating the urban water cycle	Australian Water and Wastewater Association et al	Sydney NSW	26/9/97	Convention Secretariat, PO Box 388 Artarmon NSW 2064; tel (02) 9413 1288; fax (02) 9413 1047; email: awwa@peg.apc.org
10-12/11/98	Envirosoft 98		Las Vegas, USA		Sue Owen, Conference Secretariat, Envirosoft 98, Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, United Kingdom. Tel +44 1703 293 223; fax +44 1703 292 853
19-20/11/98	International water supply symposium		Tokyo, Japan		Ms Ohnba, Congress Corporation, 7th Akiyama Bldg, 5-3 Kojimachi, Chiyoda-ku, Tokyo 102, Japan. Tel +81 3 3263 4031; fax 81 3 3262 4032
8-12/2/99	**2nd Australian Stream Management conference**		**South Australia**		**Jim Burston, Water Resources Group DX 138, SA Dept for Environment Heritage and Aboriginal Affairs, GPO Box 1047, Adelaide SA 500 email: jburston@denr.sa.gov.au**
21-25/3/99	Contaminated site remediation conference	Centre for Groundwater Studies	Fremantle WA	4/9/98	The Secretariat 1999 Contaminated Site remediation Conference, PO Box 568, Kalamunda, WA 6076; tel (08) 9291 9306; fax (08) 9291 9978; email petrconf@iinet.net.au
4-8/5/99	IFAT99		Munich, Germany		Messe Munchen GmbH, Messegelande, D-81823 Munchen, Germany. Tel +49 89 94901; fax 49 89 94909; email info@messe-meunchen.de
23-27/8/99	28th IAHR Congress on informatics in urban drainage management	IAHR/IAWQ	Graz, Austria		Prof RK Price, IHE Delft email rkp@ihe.NL http://www.joanneum.ac.at/events/iahr
6-10/9/99	Hydrogeology and landuse management. XXIX Congress	International Association of Hydrogeologists	Bratislava, Slovak Republic		Marian Fendek, Geological Survey of Slovak Republic, Mlynska dolina 1, 81704 Bratislava, Slovakia tel +421 7370 5355; fax +421 7371 940 email IAHCONGR@GSSR.SK
11-14/9/99	**Water Solutions. 18th Federal Convention**	**Australian Water and Wastewater Association**	**Adelaide**	**8/5/98**	**Convention Secretariat, PO Box 388, Artarmon NSW 2064. Tel (02) 9413 1288; fax (02) 9413 1047 Email awwa@abol.net**
30/8-3/9/1999	8th International conference on Stormwater Drainage	International Association of Water Quality (IAWQ)	Sydney NSW	31/7/98	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

17-25/3/2000	Water 2000		Auckland, New Zealand		New Zealand Water and Wastes Association, PO Box 15-974, New Lynn, Auckland 1232, New Zealand. Tel +64 9 827 5757; fax +64 9 *27 2003; email water@nzwwa.org.nz
2002	9th International conference on urban storm drainage	IAWQ	Portland, Oregon,.USA		Prof WC Huber

DEHAA Water Resources Group demise

After 25 years existence the Water Resources Group, once the only organisation in South Australia with the capability for installing hydrological instrumentation, and the premier team for hydrological data assessment, will disappear in a restructure of the Department for the Environment and Natural Resources.

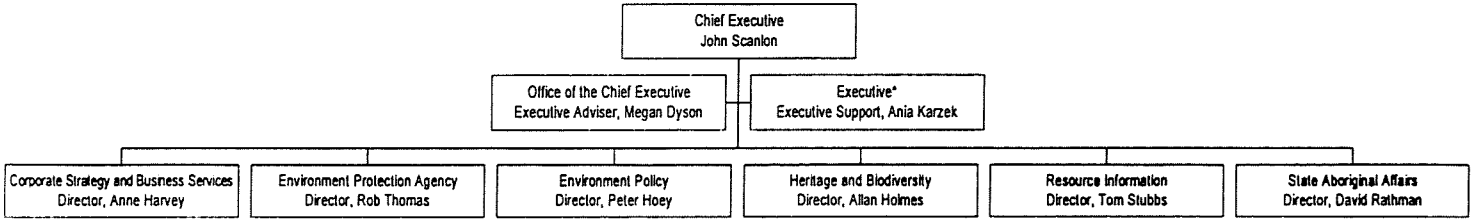
The Water Resources Group will be carved up into two sections:

- data collection and assessment to go to an operations section, the Environment Protection Agency serving the Environment Protection Authority, and
- policy and catchment Board support to go to a Policy section, which will also encompass the former Natural Resources section.

National Parks will be amalgamated with the Botanic Gardens, and renamed Biodiversity. Aboriginal Affairs will remain a separate entity.

The proposed structure is shown in the chart.

Department for Environment, Heritage and Aboriginal Affairs



1997/1998 EXECUTIVE COMMITTEE OF THE HYDROLOGICAL SOCIETY OF SOUTH AUSTRALIA

Name/Position	Work	Home	Fax	Email
Chairman: Chris Burton	8272 3299	8297 3905	8271 4811	ccburton@a011.aone.net.au
Vice Chairman: Geoff Fisher	8271 9190	8339 6545	8271 9585	gfisher@cwmb.sa.gov.au
Treasurer: Bill Lipp	8343 2508	8277 5802	8343 2747	lipp@roads.sa.gov.au
Secretary: Chris Purton	8223 5583	8339 3112	8223 5237	chris.purton@bctonkin.com.au
Ordinary Committee Members elected 1996 for 2 years				
Fraser Bell	8235 7431		8232 2944	fraserbell@finlaysons.com.au
Paul Pavelic	8303 8741	8410 0096	8303 8750	paul.pavelic@adl.dwr.csiro.au
Bart van der Wel	8204 9129		0204 9144	bvanderwel@denr.sa.gov.au
Ordinary Committee Members elected 1997 for 2 years				
David Walker	8303 4319	8376 0457	8303 4359	dwalker@civeng.adelaide.edu.au
Barry Johnson	8303 2743	8297 5697	8303 2752	barryjoh@tafe.sa.edu.au
Patricia Tewkesbury			8274 1239	ptewkesbur@msgate.mesa.sa.gov.au
Past Chairman: Trevor Daniell	8303 5454	8331 9085	8303 4359	tdaniell@civeng.adelaide.edu.au
Newsletter Editor: Bart van der Wel	8204 9129		8204 9144	bvanderwel@denr.sa.gov.au
Auditor: R Shepherd	8331 8491			
Membership Officer Anwen Aukland				aaukland@portal.net.au
Returning Officer: Kim Read	8223 5583		8223 5237	kim.read@bctonkin.com.au
Charles Hawker Centre, Waite Institute				
Director-Secretary: Mrs Kath Muir	8303 7201		8303 7105	kmuir@waite.adelaide.edu.au

MEMBERSHIP FEES

Membership of the Hydrological Society is still only $ 10 per year (tax deductable 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

If undeliverable please return to:
Hydrological Society of South Australia Inc
c/- Environment Policy Group DX 138
Department for Environment, Heritage and Aboriginal Affairs
GPO Box 1047, Adelaide SA 5001
Australia