



# International Association of Hydrogeologists

AUSTRALIAN NATIONAL CHAPTER

## NEWSLETTER

Vol. 10 No. 1 JUNE 1993

<b>President</b>	<b>Vice President</b>	<b>Secretary</b>	<b>Treasurer</b>
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## FROM THE PRESIDENT

The timely question of validating groundwater models has been raised recently by the well known team, Bredehoeft and Konikow; see the latest issue of *Groundwater* (Vol.31, No.2, 1993). I must admit I have always found it uncomfortable in lectures referring to "validation" of models when in fact the process really is one of matching or adjusting the model to fit the observed historical data before projecting into the future. I totally support the thrust of their argument that leads to the substitution of "validation" by "history matching" which is apparently the term used by Petroleum Engineers in their Basin Modelling.

Bredehoeft and Konikow also note that projecting models beyond the time period available for "History Matching" will accumulate errors. They stress that there is a need for considerable care in this regard and statements of relative confidence about predictions are needed. A true test of a modeller's confidence is to revisit model predictions and carry out "Post Audits" to check on accuracy. It could be timely in Australia for post audits to be made in say irrigation areas etc. where predictions of water table rises were made in the past.

The conference on *Aquifers at Risk: Towards a National Perspective* held over the three days in February 15-17 was a great success. The venue was Burgmann College at Australian National University and over 100 attended. The team who put it together (Gerry Jacobson, Chris Barnes, John Bauld, Shirley Kral, Libbie Lau, Geoff Smith and Alan Wade) are to be congratulated. Peter Dillon also had a leading role in the workshop sessions. I personally found it most stimulating and timely. The workshops proved to be very helpful.

The media appeared to be attracted to report comments I made regarding petrol leaking from Service Station facilities. It is of interest to review how the media went about their task.

There were two waves of interest; one at the time of the Conference, the other 3 months later in May.

At the Conference there were interviews with journalists from the Canberra Times and ABC Radio Country Hour. Both interviews were published directly they were balanced and helpful. Spin off reports occurred in several ABC news forums (radio) and a live to air interview with Andrew Olle occurred on February 18. Information was requested by a number of oil companies, the Service Station Association etc. Then the heat went out of the story until early May when the April edition of Service Station and Convenience Store News hit the streets with a sensational and emotive article titled "Leaking Tanks Under-Ground Time Bombs". The bright red cover showed a billowing red/orange fire with 6 cigar shaped petrol tanks tied together and linked to a clock showing 7 seconds to midnight and the word "Blow tank" on the dial!!

The bomb like inference could not be missed by the reader and I believe there is some evidence to suggest that the sensational approach of the cover and associated article were really designed to market the magazine. It certainly got people reading. My phone ran hot after this. First came an Australian Associated Press fellow who put the story on the wire which then lead all the Sydney and some interstate newspapers to chase information. Another live to air radio interview followed (ABC Radio National, Wagga). At each Stage I endeavoured to bring the journalists back to the facts and hopefully some reality.

It is important that we do seize opportunities to promote and educate the public about groundwater but the challenge is to have it done in a balanced and rational manner.

By now every should be in receipt of brochures on our IAH 1994 congress and I would like to encourage as many as possible to think about contributing a paper. The deadline for Abstracts is fast approaching (October 1, 1993). The added incentive to submit is that your paper could be chosen to receive the IAH price of \$250 provided the topic is on work carried out in Australia. You don't even have to be a member of IAH!!

## **NATIONAL CENTRE FOR GROUNDWATER MANAGEMENT PROVING TO BE POPULAR AT THE UNIVERSITY OF TECHNOLOGY, SYDNEY**

Since the establishment of the National Centre at the University of Technology, Sydney (UTS) in August, 1992, Staff have been active in developing a range of research and coursework Postgraduate programs, as well as meeting consultancy and research contractual commitments. We have also had the creative opportunity to design our new office complex and see it constructed.

The past ten months have been very busy but at the same time stimulating and rewarding. Over the period, we have appreciated the enthusiastic support of UTS Staff and Students.

### **Postgraduate Teaching**

There has been considerable interest and participation in groundwater postgraduate programs at UTS. Students in the postgraduate programs come from a range of countries; Australia (majority), Indonesia, Nigeria, Botswana, Iran and Libya and include both geological and engineering backgrounds. Some 43 post-graduate students are enrolled in the 1993 across the seven programs offered;

PhD: 7 (Engineering and Science)

Master (Research): Engineering; 3  
Science; 4

Master (Coursework): Engineering; 4  
Science; 17

Graduate Diploma: Science; 6  
Engineering; 2

Both part-time and full time (one year) Masters courses are popular. In the Masters by Coursework and the Graduate Diplomas students select from a range of subjects followed by a research project of variable size. The subjects include;

Core:

- Hydrogeology
- Hydrogeochemistry
- Groundwater Modelling
- Surface Hydrology and Groundwater
- Computing for Groundwater Specialists

Electives:

- Geopollution Management (groundwater pollution, contaminated sites, waste management issues)
- Geophysics and Remote Sensing of Groundwater Resources
- Groundwater Geophysics
- Groundwater Computing
- Other Appropriate Subjects

Research Project: Any appropriate groundwater topic

The full-time course work is completed in the first semester (Autumn) and the project in the second half of the year. The National Centre is based in a new office complex in the UTS tower (Building 1) which provides opportunity for students to come and relax, read the latest journals seek advice from Staff etc.

Staff are involved in active programs of research and consultancy in addition to teaching.

**The research/consultancy fields of interest include:**

*Associate Professor Michael J. Knight (Director)*

Contaminated Sites  
Chlorinated hydrocarbon (DNAPL) contaminant in soil and groundwater  
Light non-aqueous phase liquid (LNAPL) interactions with DNAPLS.  
Water Resources Management  
Design of Safe Land Based Waste Management Systems

*Dr. William A. Milne-Home, Senior Lecturer in Hydrogeology*

Pesticide leaching in the unsaturated zone  
Application of modelling techniques to herbicide behaviour in groundwater  
Dry land salinity and its management

*Mr. Noel P. Merrick, Senior Lecturer in Groundwater Modelling*

Groundwater Modelling  
Optimisation techniques (technical and economic coupling)  
Groundwater geophysics applications to mapping contaminant plumes)

*Dr. Robert G. McLaughlan, Research Fellow in Contaminant Hydrogeology*

Adsorption/Desorption Processes for Chlorinated Hydrocarbons  
Risk assessment/legal issues and auditing of contaminated sites  
Fouling/corrosion of groundwater bores and pipes.

**Consultancy**

Some of the larger organisations that we have contracted with in recent times include ICI, Department of Defence, Melbourne Water, Waste Recycling and Processing Service, N.S.W. Department of Agriculture and the Commonwealth Environment Protection Agency. Centre Staff find it helpful and relevant for training programs to be involved with research and consultancy problems that are live issues in the Community and Industry.

**International Training**

The Centre has recognised the need to provide its services to the wider International Community. To this end, training contracts have been sought and won from Finnish Aid (through IDP) and UNESCO (jointly with NSW Department of Water Resources). These programs have involved developing appropriate modules to service Water Supply Engineers and Hydrogeologists in Vietnam (course in Vietnam) and Libya (Great Man Made River Authority Staff) in Australia.

**Co-Operative Ventures**

A number of other UTS Staff are becoming involved in joint teaching/research activities of the Centre.

These include:

Associate Professor Geoff O'Loughlin, School of Civil Engineering  
Surface and Urban Hydrology

Associate Professor S. Vigneswaran, School of Civil Engineering  
Land based Waste Water Treatment Systems  
Adsorption/Desorption Processes

Dr. Michael Dawson, Department of Chemistry  
Environmental Chemistry  
Heavy metals in the Environment

Dr. Howard Sharp, Department of Chemistry  
Electrochemistry of Natural Waters

Dr. G. Skilbeck, Department of Applied Geology  
Remote Sensing

The National Centre is about to enter a consortium arrangement with Staff at the University of N.S.W. to research the remediation of Chlorinated Hydrocarbons (DNAPL) at an industrial site in Sydney. Researchers from the United States Environment Protection Agency (USEPA) and an associate of the Groundwater Research Institute, Waterloo, Canada are also planning to join the team.

### **Financing and Managing the Enterprise**

There is a trend in many Public Sector enterprises towards cost recovery and a greater financial accountability. Universities are no exception. The Centre is running along small business financial lines with the goal of full operating cost recovery from the commencement in August 1992. This should be achieved by July, 1993. We believe in concepts such as chargeable time and are grateful to UTS for allowing us to generate income from teaching, competitive research, training courses and consultancy contracts. These income sources off-set our salaries as well as other recurrent and capital costs.

Operating such an enterprise in a University environment is an administrative challenge which is met very ably by Ms. Romy Peters, the Centre's Administrative Assistant.

At a broader scale, considerable support has been provided by the Water Industry that is represented on the Centre's Management and Technical Advisory Committees.

A vote of thanks is due to the UTS Faculties of Engineering and Science and the Land and Water Resources Research and Development Corporation that provided establishment grants and thus share in the vision of truly National Groundwater Centre.

### **Further Information**

Enquiries about any aspect of the Centre's operation including courses may be sent to:

Associate Professor Michael J. Knight  
Director  
National Centre for Groundwater Management  
University of Technology, Sydney  
PO Box 123, Broadway 2007

Phone: (02) 330 1984      Fax: (02) 330 1985

Or if you wish to visit; Room 1715 (17<sup>th</sup> Floor), Tower Building, Broadway Campus.

## NATIONAL COMMITTEE NEWS

### TREASURER'S ANNUAL REPORT

1992 was another growth year for the Australian Chapter of IAH. Financially, the Australian Chapter is in a good position with over \$18000 in the bank as at the 31st of December 1992. This balance covers most member's 1992 subscriptions, however some 43 subscriptions are still outstanding. Please check your records, see the list below, or contact the Treasurer if you are unsure as to whether your 1992 subs have been paid or not. Thankyou to everyone else for paying their 1992 subs so promptly. In March this year an amount of \$10199 (11770DM - exchange rate DM 1.15) representing 214 subscriptions was remitted to the United Kingdom to cover the 1992 memberships and some arrears collected during 1992. At the time of writing this newsletter, the Australian Chapter had:

- \* 214 fully paid up members for 1992 and 1993
- \* 36 members in arrears for 1 year
- \* 7 members in arrears for more than 1 year

### New Members

The number of new members continues to increase. Thanks to all those actively signing up new members and promoting IAH. The following new members are welcomed :

Ms M O'Rorke (Vic)	Mr G Street (WA)
Mr X Yu (NSW)	Dr S Alam (NSW)
Mr M Dudding (Vic)	Mr B Dudgeon (NSW)
Mr N Hundi (NSW)	Mr N Kontos (NSW)
Mr D Ife (Vic)	Mr A Horn (QLD)
Mr A Dawkins (NSW)	

(NOTE. Those who joined after 1 July 1992 are financial members for 1993 as this is the first year they will receive publications from overseas).

Membership now totals 259 (current financial members plus those in arrears for 1991 and 1992). Distribution on a State by State basis is WA(71), NSW(54), VIC(51), QLD(34), NT(15), SA(12), ACT(7), TAS(0) and OVERSEAS(12). There are currently 297 people on the National Committee's Newsletter circulation list.

### Financial Statement

The Australian Chapter's Statement of Income and Expenditure for 1992 is shown below.

STATEMENT OF INCOME AND EXPENDITURE FOR YEAR ENDED  
31.12.92

( SUBSCRIPTION YEAR 1992 )

DOLLARS

(\$)

INCOME

Membership Subscriptions		
1989 (in arrears)	- 1	55.00
1990 (in arrears)	- 4	225.00
1991 (in arrears)	- 36	2160.00
1992 (at \$55)	- 3	165.00
1992 (at \$60)	- 172	10320.00
1992 (at \$65)	- 1	65.00
1993 (in advance at \$60)	- 11	660.00
1993 (in advance at \$65)	- 3	195.00
Advertising		40.00
UN Software Distribution		220.00
Bank Interest		
Cheque Account		90.43
Savings Investment Account		407.72

TOTAL INCOME \$ 14603.15

LESS EXPENDITURE

Remittance of Subscriptions to Germany	9249.28
Reimbursement of Overpayments	135.00
IAH Newsletter Production	1106.00
Postage	699.70
Envelopes, Paper and Sundries	631.35
1994 IAH Congress Expenses	270.00
UN Software Distribution	377.60
Robbery	50.00
Government Charges	17.43

TOTAL EXPENSES \$ 12536.36

NET SURPLUS FOR THE YEAR 2066.79  
Add BALANCE FROM LAST YEAR 16710.44

ACCUMULATED FUNDS ON HAND (as at 31.12.92) \$ 18777.23  
Represented by -

Cash at Bank - Savings Investment Account	15632.05
Cheque Account	3144.53
Cash on Hand	0.65

TOTAL \$ 18777.23

### 1993 Subscriptions

The 1993 subscriptions are now due. The Executive has decided to retain the current membership fee at \$60 as the fee determined by the International body has remained the same and the National body's expenses are not expected to increase substantially during 1993.

The International Body has suggested that fees are likely to rise for the 1994 subscription year.

### Members in Arrears

The following members are in arrears for the years shown. The treasurer would appreciate if fees (\$60 for 1992 and \$60 for 1991) could be forwarded as soon as possible.

In arrears for 1992 -

Aldam, Bauld, Binch, Bolger, Boyd, Briese, Brinkley, Corpuz, Day, Gates, Hair, Harwood, Hawkes, Jiwan, Kevin, Leech, Love, Martin (K), Nolan, Olshina, Page, Pantellis, Pettifer, Please, Rayner, Robertson, Rowston, Ryan, Schwartz, Shoebridge, Ventriss, Wall, Williams, Young.

In arrears for 1991 and 1992 -

Carney, Hearne, Hoxley, Maltby, Phillips, Rivera, Stillwater.

IAH membership rules state that memberships in arrears for more than two years will lapse. Hence the following members who have not paid since 1989 are deemed to have resigned -

Bleys, Grounds, Hailu, Jasmer, Johnson, Lloyd (T), Tickell, Tuckson, Wainwright.

### Address Changes

Members are reminded to send any changes of address to me at the following address :

JB ROSS  
IAH Treasurer Fax (02) 8915884  
c/- Hydrogeology Unit  
Dept. of Water Resources  
PO Box 3720  
PARRAMATTA. NSW. 2124



**'AQUIFERS AT RISK' CONFERENCE, CANBERRA, 15-17 FEBRUARY 1993  
RECOMMENDATIONS OF THE ORGANISING COMMITTEE**

This conference attracted 130 delegates representing government agencies, consultants and research institutes to a timely discussion of groundwater quality issues. It was organised by the Australian National University as part of its series on 'Issues in water Management', and was supported by the Australian Geological Survey Organisation and the Centre for Groundwater Studies.

A good blend of overview papers and case studies of groundwater pollution and remediation were presented. These ranged through pollution by organic chemicals, pesticides, nitrate, and salts. Special discussion sessions were held on aquifer remediation and on groundwater quality protection.

Three specialist workshops were held on an LWRDC project 'A systematic basis for groundwater quality protection in rural areas'. These were led by Chris Barber, Peter Dillon and Graham Aylmore, respectively, on aquifer vulnerability, design of effluent land spreading operations, and pesticide leaching.

The conference responded positively to the draft Guidelines for Groundwater Protection for the proposed National Water Quality Management Strategy. Discussion centred around the need for funding mechanisms for groundwater quality monitoring, investigation and remediation. A conceptual proposal for a National Groundwater Quality Assessment Program was presented.

The conference contributed to a significantly better understanding of groundwater quality management across Australia. There was substantial consensus on the need for groundwater quality protection guidelines. Arising from discussions at the Conference, the following recommendations are submitted by members of the Organising Committee:

*Recommendations to AWRC on the National Water Quality Management Strategy*

It is recommended that:

1. A community education program be embarked upon by the AWRC to provide materials and speakers for schools, community groups, industry and rural associations in order to inform them about groundwater and how they can protect it from pollution. There is a need to promote an understanding and appreciation of groundwater, and a desire to protect it, within the Australian community. This is a high priority. Target groups should include state environmental agency officers, industry, farmers, and communities that live above groundwater resources.
2. A coordinated program be undertaken to quantify the impact of various industrial, residential, and agricultural, land and waste management practices on groundwater. This should involve a range of government agencies, community groups, research institutes, consultants and industrial and rural bodies in investigations. For example, departments of agriculture/primary industries could integrate fertiliser and pesticide trials with leachate and groundwater quality measurements.

3. A charter (national management program) be developed for the protection and sustainable use of groundwater, for communities and industries that are wholly dependent on groundwater. Specifically targeted groups should include Aboriginal and Torres Strait Islander communities, isolated towns and communities, the rural livestock industry and the outback tourism industry.
4. A program be established to identify principles of appropriate monitoring of groundwater quality to determine man's impact and to facilitate prevention, rather than remediation, of groundwater pollution problems. Target groups should include industrial and rural associations and community groups, e.g. Landcare groups, investing in groundwater quality monitoring. Monitoring should take account of land uses so that base-line data will provide meaningful indications of the impacts of land use and future land use change, on groundwater quality.
5. Performance criteria be established to assess the application of the Guidelines for Groundwater Protection progressively with the implementation of monitoring within each State and Territory, using agreed to, and coordinated standards (see Note 1).
6. Funding and organisational arrangements be identified to undertake these groundwater protection and monitoring programs using existing organisations and programs in the States, the Territories, and the Commonwealth (see Note 2).
7. The Australian Geological Survey Organisation be co-opted as the lead agency to coordinate national groundwater quality assessment activities. It should be funded to collaborate with all appropriate State, Territory and Commonwealth bodies, research organisations and the Commonwealth Environmental Protection Agency (CEPA), in order to implement such a national assessment program and identify and coordinate appropriate national standards for groundwater sampling protocols, databases, and data exchange.

#### *Notes*

##### *1. Performance criteria*

Performance criteria will require that:

- (a) all States and Territories have groundwater assessment programs and timetables for monitoring of potable aquifers, and aquifers that affect valued surface water resources, and have mapped the beneficial use classes for major groundwater systems;
- (b) mean concentrations of groundwater contaminants (e.g. nitrate, bacteria) trend downwards or do not increase, by the year 2003, in all aquifers with designated beneficial uses, in accordance with ecologically sustainable development principles.
- (c) all potentially contaminating activities, for all groundwater-derived water supplies serving more than 1000 people (bores or groundwater-fed surface water bodies) have at least one observation bore to assess the level of contamination.
- (d) all States and Territories have established procedures to determine whether remediation of aquifers is required at identified pollution sites.

(e) a monitoring network be established to assess long-term trends in pristine groundwater quality for a wide range of chemical and biological parameters.

(f) the Australian Geological Survey Organisation be commissioned to develop, in partnership with State, Territory and Commonwealth agencies, research organisations and CEPA, all elements of a National Groundwater Quality Monitoring Program with the objectives of:

- . assessing the effectiveness of groundwater protection policies;
- . reducing the cost of sustaining the quality of groundwater and preventing unnecessary degradation;
- . improving the quality of degraded potable groundwater; and
- . optimising cost-effectiveness of groundwater protection measures through a combination of education, regulation, economic incentives, and assistance.

## *2. Funding sources*

Potential funding sources will need to be identified and should include:

- (a) funding from the Commonwealth and State agencies;
- (b) an environmental levy on organic chemical, pesticide, and fertiliser manufacturers and distributors;
- (c) an environmental levy on waste disposal (landfills, sewage, stormwater).

Environmental levy should be used for:

- (a) the National Groundwater Quality Monitoring Program;
- (b) clean-up of aquifers to minimum standards for defunct industries;
- (c) education program to highlight controls over land uses that impact on groundwater;
- (d) technical training programs for groundwater remediation personnel;
- (e) groundwater quality research targeted to problems identified by the monitoring program.

**John Bauld, Peter Dillon, Graham Henderson, Gerry Jacobson, Libbie Lau,  
Geoff Smith, Alan Wade**

Members of the Organising Committee for 'Aquifers at Risk'

## HYDROLOGICAL RESEARCH IN QUEENSLAND

The Department of Primary Industries, through its Water Resources program, is involved in many substantial projects in groundwater research in Queensland. These projects vary from overall small catchment analysis and site specific pollution monitoring projects, through to a regional analysis of the groundwater resources of Cape York Peninsula and the determination of the recharge zones of the Great Artesian Basin.

These projects are initiated from various sources including requests from other government departments for information and from public enquiries and concerns, as well as feedback and requests from other technical bodies. These include universities and consulting organisations.

The most significant current project is the investigation of the groundwater resources of Cape York Peninsula funded by the Cape York Peninsula Land Use Strategy (CYPLUS) program. The project will identify and correlate the major groundwater yielding stratigraphic units, determine their average and local transmissivities, regional potentiometric surfaces, flow directions and recharge areas.

A major drilling program has been conducted to fill in some of the knowledge gaps through the central peninsula area. Additionally, during this current field season, a census covering most of the significant boreholes will be conducted. This will identify flow rates and histories, water usage, current water qualities and likely potential uses. Additionally, data loggers that have been installed on the boreholes drilled during this program will be downloaded. This will provide data on seasonal variations of groundwater levels.

This information combined will help to provide a comprehensive understanding of the hydrological characteristics of the peninsula. However, for much of the peninsula useable data for this project is sparse and this will necessitate the final analysis to be presented with an indication of reliability and useability.

A long term investigation is being undertaken to monitor recharge behaviour in the presumed intake areas of the Great Artesian Basin. Work began late 1990 when three holes were drilled in the Roma/Injune area to assess recharge response of the Gubberamunda, Mooga and Hutton Sandstones in the Surat Basin. In March 1992, a further seven holes were drilled in the Tambo area to assess recharge behaviour of the Hooray, Adori and Hutton Sandstones in the Eromanga Basin. These 10 bores have been equipped with downhole pressure transducers, automatic rain gauges and data loggers. Data recorded on these loggers will assist in the understanding of the response of groundwater levels to rainfall events.

Further drilling will be undertaken this year along the eastern edge of the Eromanga Basin between Jericho and Torrens Creek to assess the recharge potential of the Hooray, Hutton and Ronlow Sandstones. The information gained from these bore holes will help to define recharge behaviour along the eastern edge of the Great Artesian Basin.

These projects are an example of the twenty or so current projects being undertaken in groundwater research. The knowledge gained from these projects will help achieve better management decisions for the sustainable use and development of this natural resource.

## NOTES FROM QUEENSLAND

The 1992 Christmas function was held at the Oxley Wharf Restaurant, on the Brisbane River on 9th December, from 5.30 p.m. with an attendance of 20. A good night was had by all.

At the March meeting, Ken Collerson presented an interesting talk on "Strontium Isotope Geochemistry of the Great Artesian Basin". Ken is the Professor of Geology at Queensland University, and has been involved in isotope work for many years.

The Water Resources' Regional Hydrologists were in Brisbane for their annual conference and most of them attended this meeting, being an opportunity for others to meet them.

The AGM of the Queensland Branch will be held at the next meeting on 11th May 1993.

## **WESTERN AUSTRALIAN BRANCH MEETINGS**

- 16 November 1992**      **Sara Cody: University of WA**  
The use of geoelectrical techniques for monitoring  
groundwater leachate plumes from landfill sites
- Jason Pepper: Curtin University of Technology**  
The hydrogeology in the vicinity of the Pinjarra  
Alumina refinery, with emphasis on the groundwater  
of the superficial formations
- 22 February 1993**      **Roger Schulz: Chemistry Centre WA**  
Cyanide in groundwater
- 5 May 1993**              **Tony Laws and Sara Cody: GSWA**  
Hydrogeological map of the Dumbleyung Land  
Conservation District

For the first time, at the November meeting, presentations were given by graduating students. An enjoyable end of year dinner was held after the meeting.

## NEW SOUTH WALES

### CAREER MOVES

**Nik Kontos** has moved from the EPA Contaminated Lands Branch to join Coffey and Partners, Sydney.

**John Rayner** formerly Earth and Environmental Sciences has recently joined forces with CSIRO.

**Terri Bulman** has moved to the Australian Defence Industries.

**David Walte** has left ANSTO to head the Dept. of Water Engineering at the University of NSW.

### DEPARTMENT WATER RESOURCES (DWR)

Principal Hydrogeologist, **John Ross** is spending four weeks in the Malaysian State of Sabah advising the State Government on groundwater resource issues.

The drought in the north west of NSW continues unabated. Some surface water supplies are severely depleted (eg. Copeton Dam on the Gwydir River is 4% of capacity). Groundwater usage has increased as a result of reduced surface water allocations. This is causing short term water level declines in some areas and concern to water users who have shallow bores. Poaching of groundwater has been reported and property surveys are being undertaken to catch illegal users.

Pesticide studies in the Namoi Valley have recorded low levels of the herbicide 'Atrazine' in 4% of groundwaters sampled. The levels found ranged from the detection limit of 0.1 mg/L to greater than 3.0 mg/L. The cartoon opposite is the humorous side of an otherwise serious groundwater and surface water contamination problem.

A groundwater vulnerability mapping study in the Tamworth region was completed by CSIRO (Perth) in a joint venture with DWR. Nitrate values were used to validate the "DRASTIC mapping technique to Australian conditions.

The new head of the Sydney Water Board, **Mr. Paul Broad** has indicated his willingness to work with the DWR. It is still unclear whether the Board will be corporatised like the Hunter Water Board, Mr. Broad's last assignment.

### ENVIRONMENTAL PROTECTION AGENCY (EPA)

The EPA has a new Groundwater Unit which is headed by **Dr. Greg Muir**. Greg is presently working on a 'State of the Environment Report', the first such report to provide a reliable set of data on the condition of major aquifers around the State. This will provide a snapshot or benchmark from which change can be measured. Ongoing measurements will provide trend data and a measure of effectiveness of groundwater protection policy.

The next stage in the Environmental Survey of the ICI site at Botany is due to start shortly. All groundwater work is being undertaken by consultants. The EPA and DWR are not involved in the tender selection process but sit on a technical review committee and have community liaison responsibilities.

## GROUNDWATER IN THE NEWS

### CSIRO highlights water table contamination

By FRAZEA PEARCE

**TAMWORTH** — A two-year CSIRO water pollution study has found high levels of cancer-causing nitrates in the Peel Valley ground water system.

The CSIRO program coordinator Chris Barber said from Perth last week the readings were taken from 160 private bores in the underground water table in the upper Peel Valley.

"The levels (nitrates) are certainly high in some ground water associated with agriculture development such as poultry industries, pigeries and feedlots," Mr Barber said of his report's findings.

But local health and water authorities have downplayed the findings.

Tamworth City Council health services manager Brian Wake said Tamworth's town water was in the clear.

# GROUND WATER ALARM

"A total chemical analysis is done on a regular basis on the town's water supply," he explained. He said Tamworth

draws its water from the Peel River and council was not associated with reticulated water supplies drawn from underground

Parry Shire Council health officers said he

# Water Borefield plan looks doomed

and over a wider area than was previously predicted. This means a supplementary borefield would have \$15,000 for extra water studies and supply.

Mr Sandy Reid, to abandon the project will be considered by the council's works committee on Thursday.

The collapse of the borefield project comes on top of Ballinger's rock-solid opposition to the Ballinger River water scheme, growing opposition to a Nyabada-based water source and court action to nullify the outfall.

However, the council and the FWD had spent \$322,000 to confirm the obvious, without even having a lease to guarantee access to the site, an land owned by Bonville Beach Hardware which was now in receivership, leaving the chances the company would accept the borefield on its land, he said. Mr Gillis said the council had been badly advised, and it was time to consider alternatives. He had calculated the FWD was wrong to claim that water for Galla supply enough water for Galla and he believed wastewater could be treated water could be the

## Water supply worries council

**NARRABRI** — The shire council will hold a meeting with other councils and water authorities in the Namoi Valley to discuss the area's dwindling underground water supply.

Director of corporate services Tony Magner said council had become deeply concerned about the dry period and wanted to try to find a solution to the problem.

"We want to talk to other local government authorities and councils to work out possible courses of action to ensure the water reserves are not damaged," Mr Magner said.

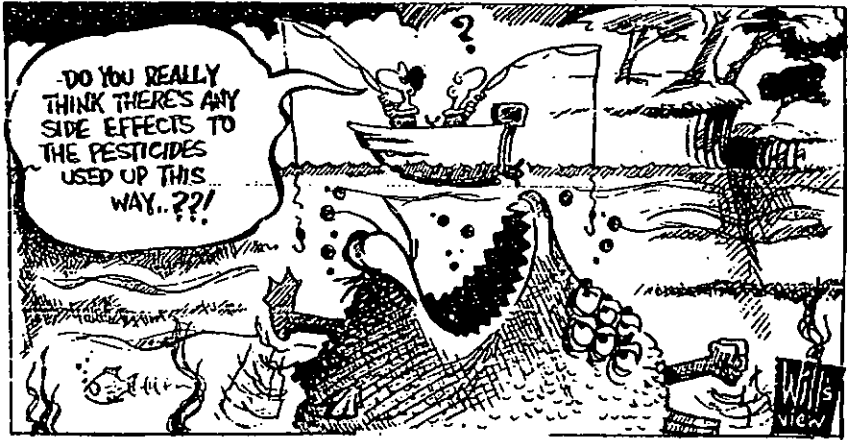
"We are worried about the time it will take to replenish the underground water once it dries up."

Mr Magner said council hoped "some sort of management plan could be drawn up at the meeting to cater for future dry spells and to establish the best course of action to take now."

The yet-to-be scheduled meeting will incorporate delegates from councils from Gunnedah to Quirindi and out to Moree and Wilcannia.

By ICHK

The mechanical prop has been killed. This is the Harbour and to extend cover of water in the system. The new field new loc...





## VICTORIAN BRANCH ACTIVITIES

### 1993 Committee (elected 9/2/93)

President	:	John Brumley
Hon. Secretary	:	Greg Hoxley
State Liaison Member	:	Rick Evans
Committee Members	:	Steven Hancock, Joe Duran, Anthony Lane, Charles Lawrence, John Nolan

### Meetings

December 1992	-	David Ife - Groundwater issues in Arabia
February 1993	-	John Nolan - Australian Newsprint Mills Wastewater Disposal Plan

### Committee Activities

#### 1. Education Survey

A national education survey is proposed to be undertaken by the Victorian Branch. It is planned to send the questionnaire out to Tertiary Institutions in May 1993, with the intention that replies will be received by September 1993.

#### 2. IAH Award

The new committee is considering a proposal that there be an IAH Award for the best thesis submitted for post-graduate studies at a Victorian Tertiary Institution. The proposal is that the award be on the basis of merit only and not necessarily awarded each year.

### Victorian Activities

Groundwater activities across Victoria continue to focus on principally two major areas: Government agencies involved in salinity, and consultants working on pollution. This newsletter edition will focus on the activities of a few consultants in Victoria. Many consultants are involved in groundwater and soil contamination and rehabilitation. Site investigations for petrol stations continue at a great pace, with substantial work involved in assessing liabilities for land purchases, the so called "due diligence" investigation.

AGC-Woodward-Clyde have been investigating a groundwater supply option for snow making at Mount Bulla. Geological mapping has shown the geological environment to be complicated

by faulting, metamorphism and intrusion with a masking cap of alluvium and volcanics. In the Melbourne suburbs, a new bore water supply for Williamstown Council involves conjunctive use of groundwater and surface water for an ornamental lake and adjacent irrigation development.

Coffey Partners projects have included mine dewatering programs at Nagambie and Heathcote, dewatering projects for construction programs and a range of groundwater related environmental projects. There has been considerable success in the application of geophysical survey methods to environmental problems. Of particular interest is the new GRC-2 radiowave technology using low frequency electromagnetic methods which allow operation in areas where interference from surrounding metals or power lines would make conventional EM systems inoperable. The technique has been used successfully to delineate subsurface hydrocarbons, voids and variable ground conductivity conditions. The company has also been active in exploring reinjection techniques for liquid waste disposal and have been involved in extensive field trials and computer modelling of potential reinjection of saline waters in central Victoria.

## **STATUS OF GROUNDWATER IN THE PERTH BASIN**

Systematic groundwater exploration in the Perth Basin by the Geological Survey over the last thirty years has defined the broad outline of the magnitude, quality, and distribution of the groundwater resources. However, the reconnaissance groundwater assessment program was abruptly curtailed in 1990, and is now proceeding at a much reduced level. A program of carbon-14 dating, utilizing bores drilled for resource assessment is currently being extended throughout the basin.

The Perth Basin contains thick and extensive Quaternary and Mesozoic aquifers, and lies in the reliable medium to high rainfall area of the south west of the state. Fresh groundwater extends to depths of 3000 m, and the major aquifer, the Yarragadee Formation, includes some 1500m of sandstone. The basin is certainly the most important groundwater resource in Western Australia. From a national perspective there are four times the number of bores of any other groundwater province, and on 1984 figures abstraction is comparable with the Murray Basin, which covers six times the area.

Utilization of the deep groundwater resources commenced in the 1890s after successful drilling around Perth and country centres. 'Artesian' bores were then Perth's major source of water until the completion of the Canning Dam in 1940. Large scale development of the shallow groundwater for metropolitan water supply began in the early 1970s from the Gnangara Mound, and an estimated one in four households within the urban area also have their own bore for garden watering. The interest in shallow groundwater, following the 1977 drought, prompted the Perth Urban Water Balance Study, which looked at water quality, sources of recharge and modelled various demand and rainfall scenarios. Commissioned by the Metropolitan Water Authority and carried out in collaboration with the Centre for Water Research and the Geological Survey, the study brought together data for the most developed part of the basin and has stimulated a number of lines of further research.

Controls on groundwater abstraction began in 1914, but originally applied only to artesian bores. Since 1975 licensing of all bores has been extended progressively to cover the greater part of the basin. Virtually all abstraction in excess of 1500 kL/a is now licensed, and the total abstraction for all purposes is now estimated to be about 300 GL/a. This compares with the current estimates of 1400 GL/a for groundwater recharge and about 1 million GL storage of fresh to marginal groundwater. While allocations are presently made on the basis of the reconnaissance assessment, in the future monitoring of water levels will be the crucial determinant of abstraction quantities, with sustainability as the ultimate aim of management.

A major constraint on the utilization of the unconfined groundwater resources on the coastal plain is the need to maintain the ecosystems of shallow wetlands. Minimum water levels have been set by the EPA, such that augmentation from bores in the vicinity of public supply borefields is sometimes necessary. The interaction between lakes, wetlands and unconfined aquifers, and nutrient leaching from irrigated horticulture and urban parks and gardens is being studied in detail by CSIRO Division of Water Resources in Perth.

In the early stages of industrial development the sandy soils of the coastal plain seemed ideal for the easy disposal of waste from a variety of industries. This has resulted in a number of groundwater contamination plumes, which have also locally affected water quality in wetlands.

Legislative protection for groundwater quality began in the 1970s with effluent licensing and progressively tighter controls on waste disposal practices. In the Metropolitan Area some 700 inferred and proven potential point sources of pollution have been identified, mostly from light industry. Recent studies by CSIRO have also indicated that groundwater contamination by hydrocarbons may occur at a fifth of Perth's 600 service station sites. A database is now available on all the identified potential point sources throughout the Perth Basin; future surveys will be aimed at determining 'proven' status, and the extent of contamination.

Studies have been carried out around some of the 100 former landfills to determine the concentration and extent of contamination plumes, and detailed research on the processes undergone by leachate and other contaminant plumes is being done by CSIRO and Murdoch University. This will provide the data for appropriate and rational management.

A major challenge for government is coordination of the waste disposal activities of the various state and local government authorities, and the setting up of a register of contaminated land.

For a rapidly expanding city such as Perth, studies of the effect of urbanisation on groundwater quality are essential if past mistakes are to be avoided. Suburbs built during the 1950s and 1960s are mostly unsewered, without thought of the impact on groundwater. The fate of nitrogen and phosphorus from septic tanks, and the impact of other sources such as storm water sumps has been studied in detail. GSWA is currently carrying out comparative studies of water quality in old and new urban areas.

A basin wide survey of shallow groundwater quality is underway, aimed at defining whether problems exist with agricultural pesticide and fertiliser residues. To assist landuse planning and groundwater protection, a groundwater vulnerability map of the basin is being drafted. Integration of hydrogeological information for the Perth area and the basin as a whole are being prepared as GSWA Bulletins.

Western Australia is fortunate that its population and industry has access to the large groundwater resources of the Perth basin. It is doubly fortunate that the major groundwater catchment areas have been identified before being compromised by development.

The major challenge for the future is to ensure appropriate landuse strategies throughout the basin, and to resist the pressures to urbanise groundwater catchment areas.

W.A. Branch

## UNSW GROUNDWATER CENTRE

### GROUNDWATER TEACHING AND RESEARCH EXPANDS AT UNSW

An active programme of groundwater teaching and research commenced at the University of New South Wales (UNSW) in 1987 when the Federal Government and State Government made grants to UNSW for the creation of the Centre for Groundwater Management and Hydrogeology. Federal funding ceased in June 1993 and at this time a number of staff opted to leave UNSW.

The UNSW programme of teaching and research has continued, and the Centre has been reorganised as a joint enterprise between the Faculties of Engineering and Applied Science. A management committee has been formed to oversee the affairs of the Centre. The Directorship of the Centre will rotate between the two Faculties on a two year basis. Dr Ian Acworth, of the School of Civil Engineering was appointed Director of the new Centre in March 1993.

The Centre is financed by the two Faculties which provide operating funds and employ the staff. The staff members are permanent employees of UNSW. The Centre laboratories and equipment are based in The Department of Applied Geology and at The Water Research Laboratory (WRL) in Manly Vale.

#### STAFFING

There are two full time members of staff carrying out teaching and research in groundwater, Dr Ian Acworth and Dr Jerzy Jankowski. A third full time staff member is to be appointed shortly. Other UNSW staff associated with the Centre and with research interests in groundwater include:

Professor Robin Fell - Mine tailings and waste disposal sites  
Professor Grant Hocking - Contaminant transport  
Professor David Waite - Transport of reactive solutes  
Visiting Professor Colin Dudgeon - Mine dewatering  
Associate Professor Ron Cox - Surface and groundwater modelling  
Associate Professor Geoff Taylor - Remote sensing  
Dr David Cohen - Geochemical processes  
Dr Gareth Swarbrick - Infiltration to waste dumps  
Dr Rene Schneider - Microbiological processes  
Dr Tam Tran - Geochemical processes in mining  
Dr S Valliappan - Modelling contaminant transport  
Mr Rolf Beck - Analytical chemistry

Many of these staff are involved in joint research on groundwater related projects and supervise student projects.

#### TRAINING

The popular MAppSci course in Groundwater Management and Hydrogeology has been substantially revised and updated. The course has been renamed Groundwater Studies (8021), and the degree is awarded after successful completion of 30 credits comprising the five core subjects in Session I and one or two session II subjects combined with a 9 credit (GEOL-9124 Groundwater Project) or a 12 credit (GEOL-9144 Groundwater Research Project) subject.

##### Session I Subjects

GEOL 9010 Groundwater Environments  
GEOL 9051 Hydrogeochemistry  
CIVL 9880 Groundwater Modelling  
CIVL 9875 Hydrological Processes  
CIVL 9861 Environmental + Engineering  
Geophysics<sup>1</sup>

##### Session II Subjects

GEOL 9012 Contaminant Hydrogeology  
GEOL 9052 Advanced Hydrochemistry  
CIVL 9799 Environmental Geomechanics  
KCME 1110 GIS in Applied Geology  
GEOL-9100 Remote Sensing of Groundwater  
Resources

NOTE 1: Environmental and Engineering Geophysics is offered subject to approval by Faculty.

A feature of several of the Session II subjects is that they can be taken as week long short courses, thus making Session II part-time attendance possible and reducing the strain on student finances. The short courses are available for casual registration to serve as extension training for those already in employment. They are timetabled in the first half of the Session, leaving the remainder of the year for completion of project work.

In addition to the graduate and undergraduate training, there are currently three PhD students completing their theses at the Centre and numerous others in the general areas of groundwater resources and groundwater contamination supervised by UNSW staff.

### SHORT COURSES

Contaminant Hydrogeology is being offered as a short course in the period 2nd to 7th August. Advanced Hydrogeochemistry is being offered as a short course two weeks later in the period 16th to 22nd August, 1993. These courses will be for a restricted number of students and will be run at these times annually.

### MAJOR RESEARCH INTERESTS

Programmes for which LWRRDC contributed funds include the following:

- The NASA airborne radar will fly over salinity catchments being studied by the Centre in September/October this year. The Centre obtained GEOSCAN imagery of these catchments in January this year and is currently working on interpretation of the data using ER-Mapper software installed on SUN workstation systems.
- The Centre has constructed a research facility at East Lakes in Sydney. The East Lakes Experimental Site consists of 815 mini-piezometers in an area (7m by 11m) of saturated sand. The hydraulic gradient at the site is approximately 0.007 so that contaminant transport can be studied within a convenient time scale. The Centre has purchased pumping and field sampling equipment as part of this ongoing project.
- Centre staff have carried out considerable field work in the area of dryland salinity, particularly in the Southern Tablelands around Yass but also at Wagga and on the Tragowel Plains. This work has led to a model of dryland salinity occurrence which is gaining acceptance. The Centre will play an important part in the proposed work on the Liverpool Plains.

Staff associated with the Centre are playing key roles in Stage II of the CRC for Waste Management and Pollution Control Integrated Mapping Technologies (IMT) project which has recently been awarded. This project will see the construction of a world class research facility at WRL for the development of geophysical techniques for the mapping of dense non-aqueous phase liquids (DNAPL). The IMT project involves personnel from ADI, BHP Engineering and BHP Research, ICI, ANSTO, CSIRO, and the Water Board. Geophysical field work will begin in June this year to be followed by cone probing and the extraction of core material from an industrial site in Sydney.

A detailed investigation project is nearing completion at WRL to investigate the geophysical properties of Botany Sand contaminated with light non-aqueous phase liquids (LNAPL's).

### CONSULTANCY

Staff associated with the Groundwater Centre undertake consulting work for a wide range of private and public clients through *UNISEARCH*, the commercial arm of UNSW. Enquiries regarding consulting services should be directed to:

Dr Ron Cox, Associate Professor in Civil Engineering  
Director of The Water Research Laboratory

Tel: 0-61-2-949-4488

Fax: 0-61-2-949-4188

### **FUTURE DIRECTIONS**

A major objective of the Centre work will be to establish the graduate course in Groundwater Studies as an internationally recognised course. This objective is obtainable with applications already for 1994 from the USA, South Africa and Zambia. Two strands for the course are to be developed; groundwater resources and groundwater contamination.

A programme of short courses is being organised with both regular subjects and special courses with invited lecturers.

We are planning to implement the most recent AIRSAR (airborne radar) interpretation packages and to develop further the GIS and remote sensing work. Professor David Waite's recent appointment to UNSW will further strengthen the capability in hydrogeochemistry and the development of research programmes in the transport of reactive solutes. We will further develop existing programmes in modelling and salinity studies.

Finally, the Centre will act as a focus for groundwater related research at UNSW and will act to develop the synergy between the several related Departments and to provide an effective contact point for outside organisations.

### **FURTHER INFORMATION**

Details about any of the Courses or research work at the UNSW Groundwater Centre should be sent to:

Dr Ian Acworth  
Director  
UNSW Groundwater Centre

Tel: 0-61-2-949-4488      Fax: 0-61-2-949-4188  
email [acworth@manly.civeng.unsw.edu.au](mailto:acworth@manly.civeng.unsw.edu.au))

## UNITED NATIONS GROUNDWATER SOFTWARE

This seems to be an on-going story, and here is the latest chapter. There is an updated version on its way around Australia, to all people who obtained the original version. I do not know where it is now - its progress is dependent on whether people on the mailing list act promptly or not. If anyone wants to short circuit this, please send me 3 disks with a stamp for return postage, and I'll copy the new version and send it.

For the benefit of new readers or members, the UN groundwater software package was developed by UN and is being made freely available. They are not sending copies to all and sundry, but sent me a copy on the understanding that I would make it available to colleagues in Australia. Hence the arrangement with IAH, which is providing the facilities for printing copies for distribution at cost, on request. The package has modules for salinity diagrams, pumping test analysis, hydrographs, bore logs, cross sections and flow models.

I have also received a copy of a workbook, which can be used to work through the various modules in the package, using the sample data sets, and copies can be made available.

We have not quite been covering costs of copying and posting the package so far. New charges will be as follows:

1. Manual, disks and postage	\$30
2. Manual, workbook, disks and postage	\$40
3. Workbook only, and postage	\$20

Please send cheque payable to IAH, to Don Woolley or John Ross, at Dept of Water Resources, PO Box 3720 Parramatta NSW 2124, if you want to obtain a copy. Also, please feel free to copy disks/manuals and pass on to colleagues.

Don Woolley



## **APPOINTMENT & GENERAL INTEREST ARTICLE**

*Anthony Lane has recently joined D J Douglas & Partners as Manager Environmental Services, Victoria and Tasmania.*

*Australian owned and based, D J Douglas & Partners operates a wide range of geotechnical and environmental consulting services, and has 30 years experience associated with building, civil engineering and mining activity, with special services also in petroleum exploration and resource development, in all parts of Australia and overseas. Committed to the highest standards in technology, innovative cost effective procedures for data collection, and reliable service, D J Douglas put high priority on completing projects on time and within budget.*

*Mr Lane is a hydrogeologist and previously headed the Water & Waste Management Group for Dames & Moore in Melbourne. Prior to this he was a Director of Australian Hydrogeologists International, providing consulting services in environmental assessments, groundwater resources, mine dewatering and waste management skills.*

*With Mr Lane's 17 years experience, D J Douglas now provide total services in contamination assessment and remediation advice and options. This integrated service for environmental investigations includes assessment of contamination, liaison with regulatory authorities, specialised drilling and sampling equipment, field and laboratory analyses, evaluation of clean-up options and supervision of clean-ups. Routine environment monitoring services are also provided to industry and mining clients.*

*Technically advanced, D J Douglas has more than \$1.5 million worth of specialist equipment incorporating laboratories, drilling and sampling plant computer facilities and environmental testing. One of the company's recent developments is a conductivity cone penetrometer that measures electrical conductivity, allowing a quick and economical method to obtain a continuous profile of the conductivity of the ground with depth. In combination with the cone penetrometer test, the subsurface profile in terms of soil type, porosity, water content and composition, can be assessed, which is particularly useful in groundwater and pollution investigation work. These unique capabilities in field data collection are utilised for both geotechnical and environmental projects.*

*D J Douglas & Partners aim to satisfy their client's needs by enforcing the highest quality standards in regard to technology and its application, accuracy and presentation, and commitment to a "Quality Policy" on all projects undertaken by the company.*

*Mr Lane's appointment significantly strengthens the company's capability to service clients in Victoria and Tasmania, especially in the field of environmental services.*