Aqua Australis

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COUNCIL ENVIRONMENTAL PLANS - LOCAL AGENDA 21

Under agreements with the South Australian Government, Local Governments are preparing Environmental strategies, "Local agenda 21". This is one of the outcomes of the conference on sustainable environment held in Rio de Janero in 1992, implementing the slogan "think globally, act locally".

BURNSIDE

Five working groups of the Committee, which included councillors, council staff and community representatives addressed the issues of: Air Quality, Buildings and Precincts, Flora and Fauna, Waste Minimisation and Water Quality. The policy relating to Water Quality recommended the following strategies regarding urban stormwater to Council.

Strategies for Water Quality

The Water Quality group recommends that Council:

* Recognise and apply the Environmental Protection Authority (EPA)'s "Code of Practice for Stormwater Pollution Control by Local Government to Council operations and, further, that Council promote the range of EPA Codes for Stormwater Pollution Control to the community, as they become available.

* Examine requirements under the Building Code of Australia in order to remove legislative impediments to reducing stormwater run-off to street water tables.

Promote the use of:

* appropriately maintained rainwater tanks to collect roof runoff for domestic use

* underground tanks to collect the overflow from rainwater tanks and surface flow for garden use.

* stormwater retention and detention areas in landscape design for all types of land use.

* permeable surfaces to increase the amount of rainwater soaking into the ground.

In this issue:

Investigate:

* the installation of trash racks and silt traps on existing drains.

* slowing down the speed of stormwater removal from the City of Burnside

* the construction of wetlands along existing creek and drainage systems.

* the feasibility of aquifer recharge projects by identifying potential sites and monitoring water quality increasing the use of bores for irrigating reserves.

* Instruct Engineering Services to address water quality issues in the provision of all future drainage infrastructure.

* Ensure that, by the Year 2000, the City of Burnside does not allow sewage to overflow

into waterways, as now occurs in the Waterfall Gully area.

* Increase the use of local native vegetation in its parks and reserves to reduce its water requirements and hence costs.

* Promote to residents the advantage of reduced water bills, which can be gained by using local native vegetation in domestic gardens.

* Develop community information programs about land management practices which will help improve the quality of surface runoff from private properties.

* Re-vegetate natural waterways to prevent erosion and to enhance local flora and fauna.

* Collect existing water quality data from agencies, such as Eastern Metropolitan Region Health Authority and the Engineering and Water Supply Department, and from programs such as that currently being run by Waterwatch.

* Undertake water quality monitoring to establish base-line data on the quality of run-off where this is not available from other sources.

* Follow up particular problems revealed by testing and undertake water quality monitoring to identify pollutant sources.

Currently, Engineering Services is investigating potential wetland and aquifer recharge sites. Also, action plans, to identify how Enviroplan strategies can be implemented by each Council department, are being drawn up.

The Enviroplan report to Council recommends that a full-time environment officer be appointed by Council and that the Burnside Environment Advisory Committee continue to meet. This is considered necessary to ensure that the considerable enthusiasm and community support, which developing a local environment policy has generated, is maintained and that the process of implementing Enviroplan recommendations continues.

The Enviroplan was launched in July, with Environment Displays and Activities and a guide to Council's Parks and Gardens.

For further information please contact:
Christina Shepherd
Enviroplan Project Officer
City of Burnside Ph (08) 366 4226

MARION

PROMOTION OF SUSTAINABLE WATER MANAGEMENT IN MARION

To promote the better management and conservation of water resources, the City of Marion has recently formed a Water Resources Working party comprising local Councillors, community representative and staff.

The Working party will be investigating and promoting sustainable water management techniques over the coming months, specifically in relation to land next to the Filed River which has recently been re-zoned, through authorisation to the Worthing Mine and Environs Plan Amendment Report. The aim is to assist in identifying water management techniques for developers and building contractors during the early construction phases of development in the area.

The City of Marion is keen to promote ecologically sustainable water management as part of any future housing developments. Any ideas or contributions relating to the improved management of water resources are welcomed.

Contact the Environmental Officer for the City of Marion Ph 375 6661 for further information

Denise LeBlond Ph (08) 375 6661/fax (08) 375 6699

HYDROLOGICAL SOCIETY PHILANTHROPY

Because of our healthy balance sheet, the Committee has examined ways of using our funds to promote the cause of hydrology in the broadest sense. One such avenue chosen has been to become an "Organisation Sponsor" for the International Association of Hydrogeologists (IAH), whereby professionals from underdeveloped countries in our region (Fiji, Solomons, Tonga, Vanuatu, Papua New Guinea, Laos, Vietnam) are sponsored to join the IAH. For only $ 200/year, the Hydrogeological Society will sponsor four such people. When we know who 'our' members are, we hope to establish personal contact and send newsletters and assist with technical advice etc. Who knows what benefits may 'flow' on from these contacts? - joint projects, aid programs etc ....

Steve Barnett Tel ...fax (08) 274 1239
Past President

NEW JOINT EDITORS OF NEWSLETTER

After setting the standard for the Hydsoc newsletter Vince Kotwicki has had to relinquish the post of editor to take up a position in Oman for 3 years.

The responsibility has been taken over by Bart van der Wel DENR and David Walker

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$50 $50 $50 $50 $50 $50 $50 $50 $50 $50 $50 $50

The committee has decided to support the newsletter in the form of a $50 prize for the best contribution to each newsletter. This might be in the form of a paper submitted, or a letter to the editor, or a piece of news.

The committee will judge the contributions and winners will be announced in the following newsletter.

$50 $50 $50 $50 $50 $50 $50 $50 $50 $50 $50 $50

MINES AND ENERGY SA (MESA) GROUNDWATER AND ENVIRONMENTAL SERVICES DIVISION STRATEGIC PLAN 1995-98

The responsibility of the Division is to identify and assess the quality of groundwater resources and the constraints on their development, and to facilitate the development and management of these resources by providing cost-effective groundwater-related services to government, industry and the public.

There are three main initiatives that are going to be developed over the next three years which reflect the requirement of sustainable use of waster supplies for economic development and the use of innovative technology to encourage the recycling of stormwater to increase water-use efficiency whilst minimising environmental impacts.

* Great Artesian Basin - this resource is crucial to the development in the Far North of South Australia. A comprehensive data base is being established and a computer model will be developed to determine potential impacts of withdrawals for future developments. Monitoring of current withdrawals (eg Olympic Dam borefields) is continuing as is the rehabilitation program to repair uncontrolled flowing bores.

* Aquifer storage and Recovery (ASR) - this innovative technique has been pioneered by MESA in conjunction with Local Government, private developers and research groups. So far it is being used in metropolitan area for the re-use of stormwater. However, there are other circumstances where the ASR technique may be beneficial. MESA is currently investigating the feasibility of storing water from Lake Alexandrina in local aquifers for re-use when blue-green algae outbreaks render the lake water unusable. Clayton and Strathalbyn are two locations being tested. The potential for using ASR elsewhere in South Australia is going to be investigated and a report prepared on issues, optimum locations and marketing opportunities.

* Mount Lofty Ranges - groundwater resources are under increasing stress in the region (eg Piccadilly Valley, bottled spring water, irrigation). A comprehensive assessment of resources and usage is being initiated with a database and monitoring networks to be established. A groundwater quality sampling program has already been carried out in key catchments by AGSO.

Other important projects include an assessment of groundwater resources in the Far West and the Gawler Craton (northern Eyre peninsula) for potential mining developments, a review of the status of water supplies in Aboriginal Lands, and the development of a works program; and an assessment of the sustainable yield of the confined aquifer in the Southeast.

MESA has an ongoing commitment to investigate and monitor areas of intensive groundwater use and to provide technical advice to management committees. These areas include the South East, Mallee, Angas-Bremer, North Adelaide Plains and Southern vales. MESA also plans to ensure that the statewide Drillhole Data Base contains reliable and validated information.

CATCHMENT WATER MANAGEMENT BOARDS APPOINTED

PATAWALONGA CATCHMENT WATER MANAGEMENT BOARD	TORRENS CATCHMENT WATER MANAGEMENT BOARD	ENVIRONMENT PROTECTION AUTHORITY BOARD	SOUTH AUSTRALIAN WATER CORPORATION BOARD
Lyndon Parnell	Jay Hogan	Stephen Walsh QC 231 4200	James Porter c/- Piper Alderman solicitors
Rodney Hook	Peter Cooper	Ray Dougherty	Sandra McPhee c/- Qantas
Robert McLennan	Paul Harvey	Jennifer Cashmore	RogerCook c/- Colliers Jardine Pacific, Hong Kong
John Argue	Wendy Greiner	Tim Gamon	Brenda Shanahan c/- Mercer Pty Ltd
Colin Haines	Chris Coulter	Anita Aspinall	Ted Phipps Chief Executive Officer, South Australian Water Corporation
Brian Nadilo	Rosemary Craddock	Rob Thomas Executive Director EPA 204 2001	
Chris Tually	Valerie Bonython		
Jane Lomax-Smith	David Packer		
Susie Herzberg	Robert Angove		

Meetings of the boards are advertised in the press and interested members of the public are welcome to attend.

The Rise of Confined Aquifer Pressures in the Murray Basin

S.R. Barnett, Mines and Energy South Australia

Widespread rises in regional water tables in response to clearance of native vegetation have been well documented throughout the Murray Basin. In South Australia, rises have been monitored in two areas (Fig. 1). The most dramatic have occurred on the low lying Coastal Plain on the southwest margin of the Murray Basin where the depth to the water table is generally less than 40 m and the rainfall recorded is from 400-500 mm/year. Consistent rises of 10-15 cm/year have been monitored, even though the rainfall has been below average for the nine years preceding 1992. In the Riverland area, where the depth to the watertable is similarly less than 40 m, more gradual rises of 1-2 cm/year have been measured which may be due to the lower rainfall of about 250 mm/year and/or the presence of Blanchetown Clay.

Coincident with these watertable rises have been other changes. In some areas of the Coastal Plain, the salinity of the unconfined aquifer has risen by 700 mg/L, in other areas, it has decreased by 330 mg/L - trends which will make an interesting contribution to the current study on the potential salinization of the unconfined aquifer by the downward salt flux. (see papers by Leaney and Love, this volume)

Of more immediate interest however, is the rising trend in the underlying confined aquifer water levels in areas (Fig. 2) where watertables are also rising. One might expect that the rising trends would be caused by downward leakage from the overlying watertable aquifers. Figure 2 shows however, that these rises are occurring in areas of upward leakage from the confined aquifers.

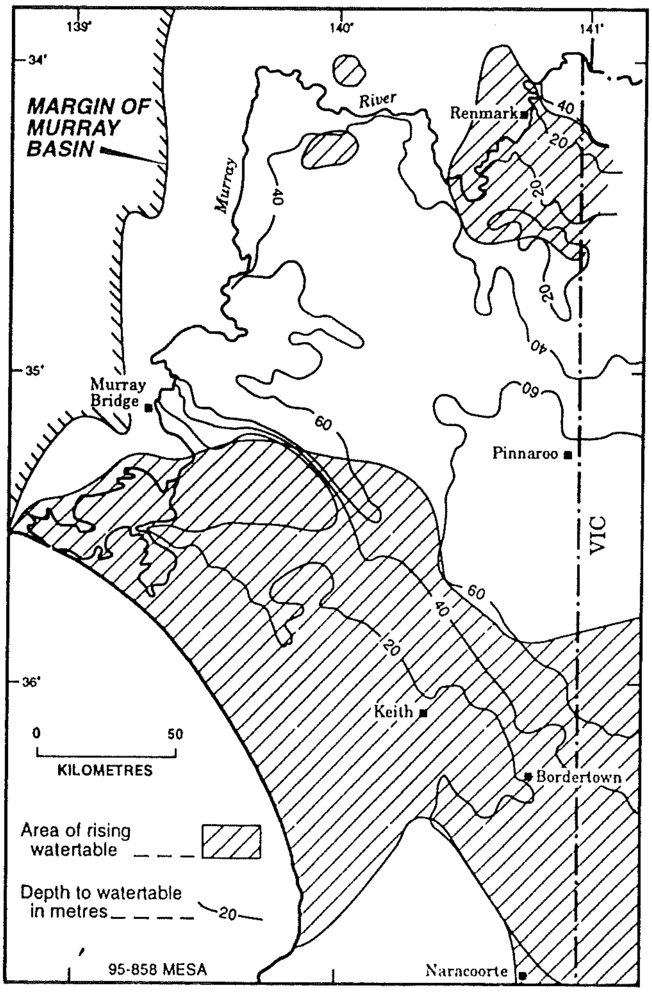

Figure 1: Areas of rising watertable

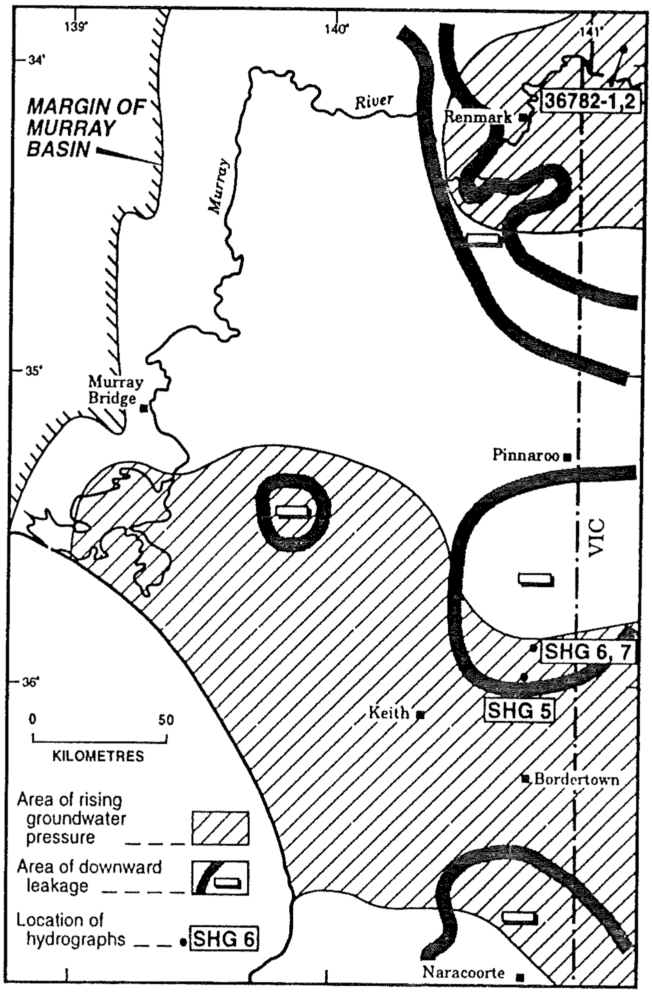

Figure 2: Areas of rising confined aquifer pressures

Another possible cause could be the rapid transmission downgradient of pressure increases due to increased recharge in the recharge areas. This is an unlikely cause because the type of response and the magnitude of response vary greatly throughout the area and are not uniform as one would expect for a confined aquifer with one main recharge area in southwest Victoria.

It is proposed that the rising pressures in the confined aquifers are caused by the increased load in the overlying unconfined aquifer (due to increased recharge and storage) which compresses the elastic confined aquifer and increases the hydrostatic pressure.

Overseas studies have shown that confined aquifers can act as giant weighing lysimeters. In Canada, van der Kamp and Maathuis (1991) postulated that annual head fluctuations in the deep confined aquifers reflect changes in the mechanical load on the formations caused by seasonal changes of the soil moisture, snow and storage at the water table. In New Zealand, Bardsley and Campbell (1994) took the aquifer lysimeter concept further and suggested that it could be used for water balance studies on a local scale.

Figure 3 shows paired hydrographs from adjacent observation wells completed in different aquifers in different parts of the basin as shown in Figure 2. Holes SHG 5 (unconfined Murray Gp Lst), SHG 6 (confined Renmark Gp) and SHG 7 (semi-confined Murray Gp Lst) all show very similar rising trends. Although the head difference (density corrected) is - 1.5 m which indicates downward leakage, the actual flux would be only be 0.2 mm/year (assuming a Kv of 10^{-6} m/day for the Ettrick Formation).

Holes 36782-1 (unconfined Pliocene Sands) and 36782-2 (confined Murray Group limestone) also show very similar trends. Here, the head difference is + 4.7 m, indicating upward leakage with a calculated flux of 4 mm/year (assuming 10^{-5} m/day for Kv of the Bookpurnong Beds).

These hydrographs are just some examples of the coincident rising trends in two different unconfined/confined aquifer systems which give strong support to the mechanism of hydrostatic loading as the cause.

The ramifications are not too disastrous at the moment. The head difference between the two aquifers remains relatively constant and therefore actual flows between the aquifers will not change dramatically. The increase in confined pressures relative to ground level would make any deep drainage less efficient in the future. In localised areas where the watertable is held constant but is surrounded by regional watertable rises, (by drainage systems in irrigation areas or by evaporative discharge in salinized areas), the upward discharge from the confined aquifers will be enhanced because of the regional increase in confined aquifer pressures.

Bardsley, W.E. and Campbell, D.I., 1994. A new method for measuring near surface moisture budgets in hydrological systems. Journal of Hydrology, 154: 245-254.

van der Kamp, G. and Moathius, H., 1991. Annual fluctuations of groundwater levels as a result of loading by surface moisture. Journal of Hydrology, 127: 137-152.

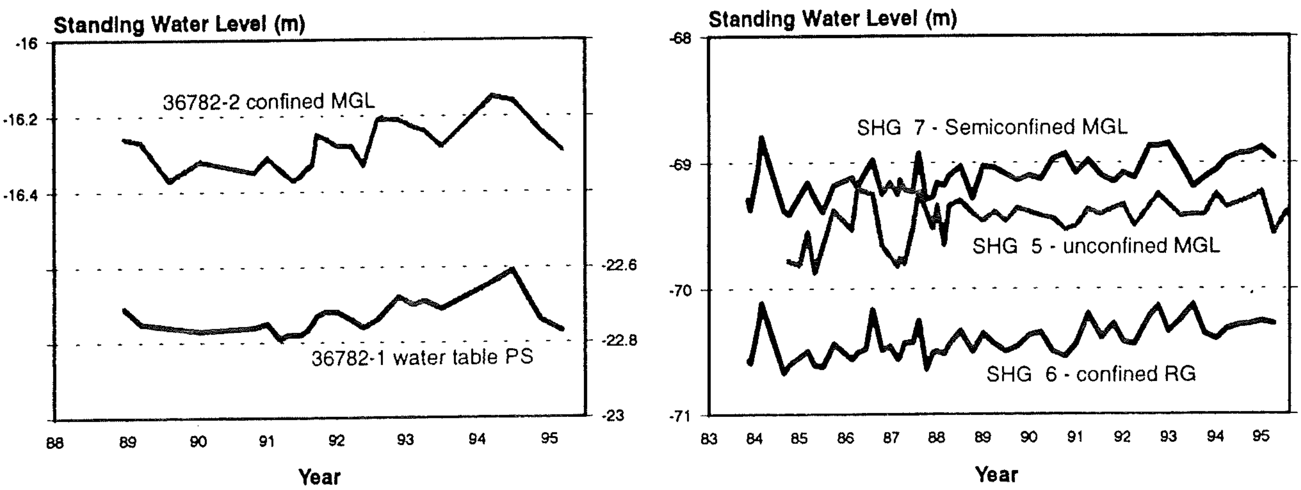

Figure 3 Hydrographs from Observations Wells

Assessment of Salt Load Impacts on the River Murray Due to Irrigation Development in the Eastern Riverland District of South Australia

N.C. Watkins and V.G. Waclawik
Mines and Energy South Australia

INTRODUCTION

The eastern Riverland district is located between Overland Corner and the South Australian -Victorian border (figure 1). The district contains 20 801 ha of irrigated land, planted mainly to vines, citrus and vegetables. The annual diversion volume for this area is in excess of 205 000 ML.

In the past the potential for mobilisation of salt to the River Murray due to the use of river water for irrigation in a saline groundwater regime has not been used as a criterion for irrigation management. The River Murray Water Resources Commission (RMWRC) has undertaken to formulate a strategy to monitor and control irrigation transfers with the aim of controlling salt loads to the river. To facilitate this, RMWRC has developed a policy that requires the best use of the limited water resources available for the least impact. This involves best practice on-farm irrigation management and stringent monitoring of water allocations and transfers.

A finite difference, single-layer computer model of the eastern Riverland is currently being used to model various scenarios of increased irrigation up to the year 2045. The objective of the study has been to optimise the location of potential irrigation sites to provide the most effective control of irrigation induced salt loads to the river and floodplain. This will allow water resources managers to strategically plan future irrigation at sustainable levels within the eastern Riverland, thus avoiding environmental degradation and economic losses.

The assessment of salt load impacts of existing major new irrigation developments has been achieved with the groundwater model described in this paper.

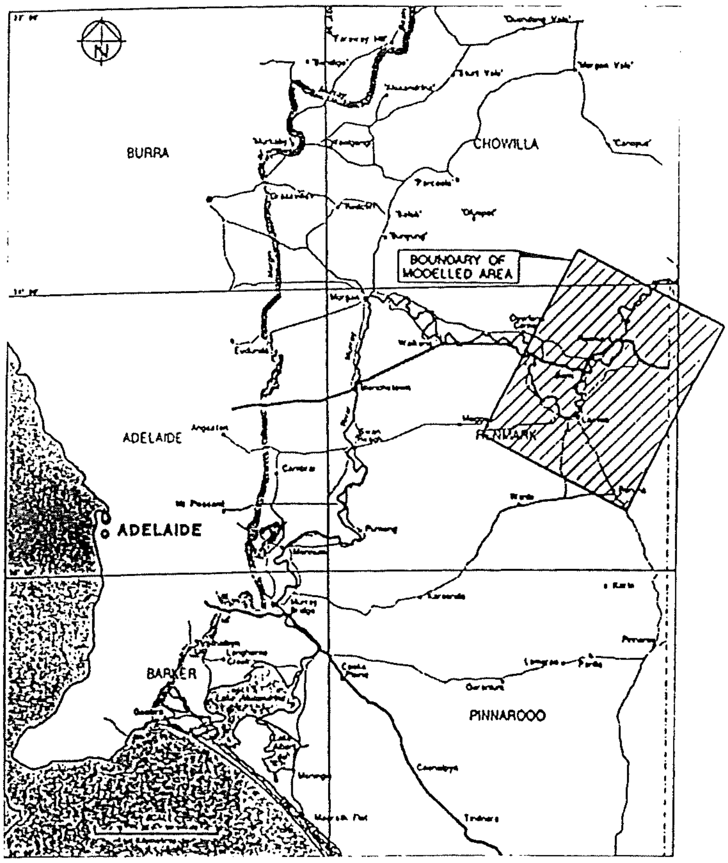

Figure 1: Location Plan

REGIONAL HYDROGEOLOGICAL SETTING

Surface Mallee sand deposits (Woorinen Sands) are ubiquitous in the eastern Riverland district. The sands are underlain by variable thicknesses of Blanchetown Clay, depending on surface elevations. Irrigation drainage percolates through these layers and recharges the unconfined Loxton Sands aquifer which comprises two units; an upper medium to coarse grained unit and a lower fine grained, silty unit. Significant watertable mounding has occurred

within the Loxton Sands aquifer due to irrigation development (figure 2). The Bookpurnong Beds aquitard, which comprises sandy marls and fine silty sands directly underlies the Loxton Sands aquifer and separates it hydraulically from the confined Murray Group limestone aquifer. The river valley is infilled with medium to coarse alluvial sand deposits of the Monoman Formation which are in direct hydraulic contact with the River Murray.

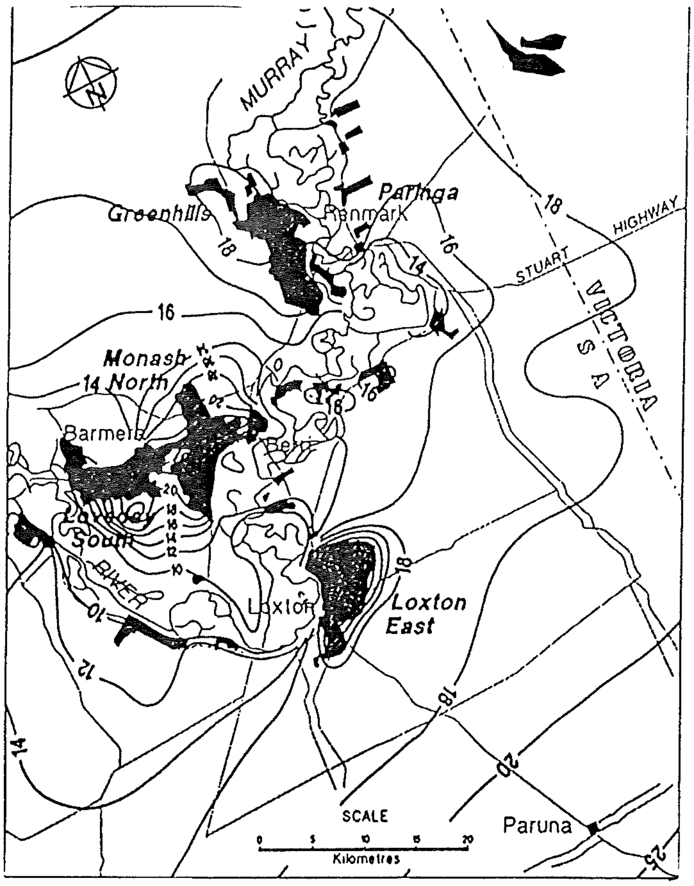

Figure 2: Current Water Table Contours, Observed

A list of hydraulic parameters adopted for the model are shown in table 1.

Monoman Formation:	k = 10 m/day
	$s_y = 0.15$
Woorinen Sands:	$\theta_1 = 0.14$
Blanchetown Clay:	$\theta_1 = 0.35$
Loxton Sands:	k = 2 m/day
	$s_y = 0.15$
	$\theta_1 = 0.07$

Note: θ_0 assumed to be 0.05 for all layers.

Table 1: Adopted Hydraulic Parameters

COMPUTER MODEL

General Description

The model (EASTMOD) was constructed using MODELCAD386, a computer aided design groundwater preprocessing package, and simulated using MODFLOW, a groundwater modelling program developed by the United States Geological Survey. It is a finite difference, single layer, regional groundwater model which simulates groundwater levels and flow within the Loxton Sands aquifer. The geographical extent of the model is shown in figure 1. It is 90 km long by 70 km wide and comprises 1189 square and rectangular elements forming an irregular grid with a minimum cell size of 400 ha. The model grid was designed irregularly in order to provide higher resolution within the areas of interest. General head boundaries were used at the edges of the model.

River levels were set using constant head cells and varied according to major historical changes in river levels. Pre-locking river levels were assigned by assuming lock lower pool elevations represented the average annual river level before locking. A gradient was calculated between these points and each river cell assigned the appropriate elevation.

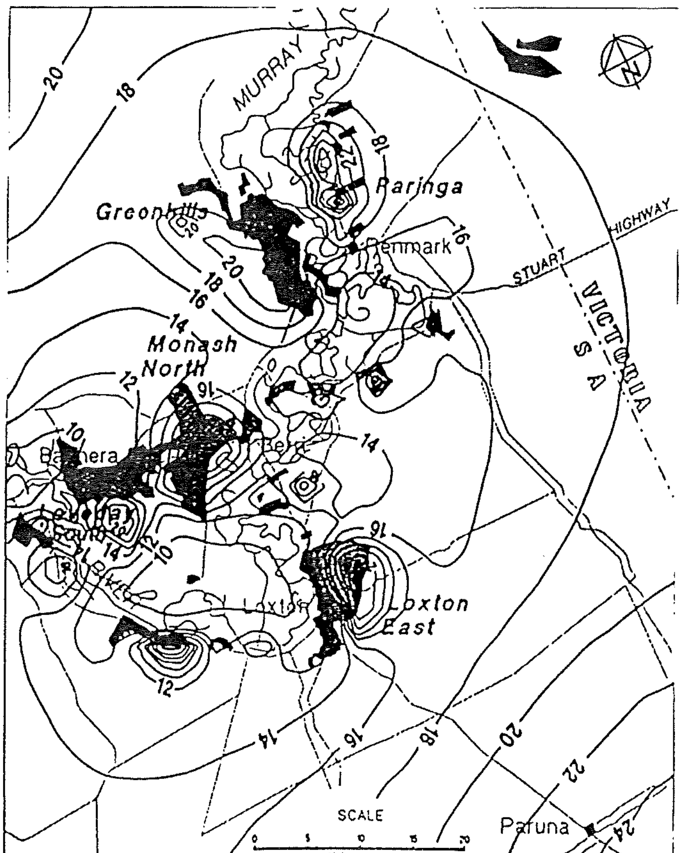

Figure 3: Current Water Table Contours, Modelled

Floodplain Storage

Floodplains of the River Murray store salt which is returned to the river as high salt loads during flood

recessions. EASTMOD was not constructed to take account of these short term events. Floodplain processes have been ignored and the floodplain has been included as part of the river. Any reference to induced salt load in this paper therefore refers to induced salt loads to both the floodplain and the river.

Effects of Development

The development of irrigation areas in the Riverland has generally been ad hoc with many private irrigation areas beginning on a small scale early in the 1900's but failing, only to be restarted later as Government Irrigation Areas. The increases in size of irrigated areas is reflected in the increases in drainage accession volumes until the introduction of drains (figure 4). The drains remove water from the system leaving a fixed volume that passes through the root zone. Prior to drain installation, the available applied volume data is poor and hence a curve is assumed for application and accession volumes. In EASTMOD, a worst case scenario has been modelled by using the highest accession volume available for any given area (figure 4). Data on historical and current drainage accession rates were adopted from Smith & Watkins, 1993.

Generation of Starting Heads for Pre-development Scenario

The model was initially run to steady state to achieve a set of starting heads which replicated groundwater gradients before locks were installed and irrigation developments occurred. The watertable contours produced by this method closely approximate the trends of the current observed contours without the groundwater mounds.

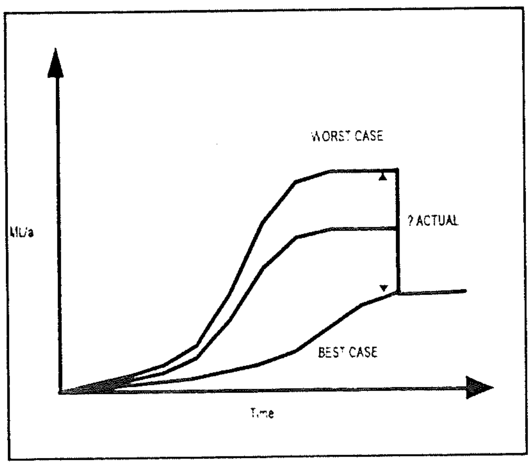

Figure 4: Diagrammatic Representation of Assumed Growth in Drainage Accession Volumes

Transient Calibration

The starting heads generated with the steady state model were then used in a transient calibration model that takes into account the development of irrigation in the region, the building of locks and the construction of Comprehensive Drainage Schemes (CDS's).

MODELCAD386 does not allow the input of different recharge rates at different times for a given area. In order to replicate the process of changing conditions such as the building of locks, the growth in irrigation developments and the installation of CDS's, seven different models were constructed to model the changes and connected in series by using the final head distribution of the preceding model as the starting heads for the active model.

Recharge wells were used to model irrigation drainage accessions. Where accession rates were not known a rate of 200 mm/a was assumed.

An infiltration time, or time before drainage accessions reach the water table and salt loads begin to impact on the river, was calculated for each irrigation area by the following formula (Cook et al, 1993);

$$t_i = \frac{\Delta b.(\theta_1 - \theta_0)}{DF}$$

where;

t_i = infiltration time through any layer (years)
Δb = unsaturated thickness of the layer (m)
θ_1 = moisture content above the pressure front
θ_0 = moisture content below the pressure front
DF = drainage flux (m/year)

EASTMOD was developed with the best available data for hydraulic conductivity (k), and hence transmissivity (T), as well as specific yield (s_y). Model sensitivity runs for combinations of k and s_y were carried out to obtain the best calibration to current groundwater levels.

The model was validated against groundwater level maps of the Murray-Darling Basin (Barnett, 1991 and 1993, RWC, 1991). The modelled groundwater levels on figure 3 compare well with the observed data shown on figure 2. It is concluded that the model represents the hydrogeology of the eastern Riverland sufficiently well to use it as a predictive tool.

Predictive Modelling

The aim of this work is to use the model to predict future groundwater level conditions and induced salt loads to the river and floodplain assuming the two scenarios of maintaining current irrigation or further expansion of irrigation in the region.

A baseline scenario was run maintaining irrigation areas at current sizes and accessions for a period of 50 years. Irrigation areas of 1000 ha were then added at proposed new development sites and their impacts compared to the baseline scenario. A final scenario was run which included all of the proposed sites to model the total impact. A comparison of the induced salt loads shows the relative impacts of 1000 ha of irrigation at these sites (figure 5). The flat curves, which have the least impact, are associated with irrigation areas situated behind major groundwater mounds.

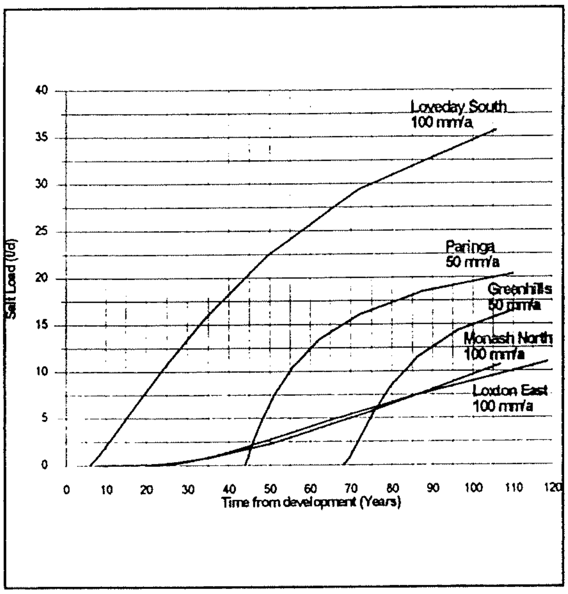

Figure 5: Salt Load Impacts of New Irrigation Developments

CONCLUSIONS

A regional groundwater model has been developed for the eastern Riverland district which effectively simulates current groundwater levels and flows in the Loxton Sands aquifer. The model has been used to quantify the salt load impacts of currently proposed irrigation developments in the district on the River Murray. It has shown that irrigation induced salt loads can be minimised by locating future irrigation developments away from the river behind existing groundwater mounds.

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RUNOFF ROUTING MODELS UNDER SCRUTINY

Investigations into runoff routing models in use in Australia is being carried out by David Kemp of the Department of Transport.

The primary aim of the investigation was the derivation of parameter values for ungauged catchments in South Australia for use with the RAFTS model. The RAFTS model has been in use in Australia for many years, having its origins in the Regional Stormwater Drainage Model, developed in the 1970s. The investigation related the RAFTS model parameters to the widely calibrated RORB model. It revealed that there was a direct relationship between the two models, but it also revealed that the RAFTS model has a fundamental problem in that a model using more than one node (the normal structure) is internally inconsistent and needs a storage modification factor, dependent on the number of nodes to give the correct total storage in the catchment.

The investigation was then extended to review the structures of the three most commonly used runoff routing programs in Australia, RORB, RAFTS and WBNM which all have their origins in the 1960s and 1970s. Although these models have been in general use since then and subject to calibration on a range of catchments a comprehensive review of the structure of the models has not been undertaken, although various limitations have been recognised. The investigation reviewed the structure of these models, revealed their weaknesses and proposed a new model that is both simple and internally consistent and has the potential to model adequately a wide range of catchments, including mixed urban and rural catchments.

Further information regarding the work can be sought from David on 343 2534/fax 343 2747.

L FOR LITRE

Why do we use a *capital* L as a symbol for litre?

Metric Conversion still seems fresh to me. I remember well that the symbol for litre was a lower case "l". This was in accordance with a strict convention applied to all the symbols for metric units.

In this convention, upper case or capital letters were used only for units named after a person e.g. Pa (Pascal), N (Newton), A (Ampere), Hz (Hertz).

Capitals were also used for big multiplier prefixes; 10^6=M (mega), and above: 10^9=G (giga), 10^{12}=T (tera).

Lower case letters were used for all other units e.g. m (metre), s (second) and so on, as well as for all the minor multiplier prefixes kilo (k) and below (h, da, d, c, m, m, n, p, f and a). Although not all these are recommended for use, I'm sure you will know what they symbolise.

Now litres, not being named after anyone, fitted happily into this convention with the lower case symbol "l".

The Highways Department at the time - in its issue of "Metric Conversion Training - Typing and Writing Using Metric Units" - instructed as follows:

> "In Australia, the script letter "*l*" has been adopted as the symbol for litres. If a typewriter keyboard has not a script "*l*" the word "litres" should be typed in full. The normal letter "l" should not be used to avoid confusion with the figure one (1). Either the normal "l" or the script "*l*" may be used with prefixes, e.g. millilitre = ml or m*l*."

Australian Standard 1686-1974 Metric Units for use in Water Supply, Sewerage and Drainage (including Pumping) was happy to specify "l" as a symbol for litre, with the proviso that "where confusion may arise, the unit should be spelt out in full".

You can appreciate the importance here of observing normal convention with fonts and serifs. The stupid affectation, currently seen on TV advertisements, of writing telephone numbers using (instead of the digit 1) the capital letter "I" with serifs grates like hell and it can be safely assumed that lettering fonts sans serif, where 1, I and l appear identically would satisfy the Standard's case for confusion and require "litre" to be written out in full.

AS 1947-1976 Metric Units for use in Mechanical Engineering and Related Fields included the note:

> "The symbol for litre is 'l'. Where additional clarity is required, the word litre may be used as a symbol, e.g. litre/s instead of l/s. Multiples and submultiples of the litre should always use the symbol l, e.g. ml/s not mlitre/s nor millilitre/s."

In the United States of America, a paper by R Ernest Leffel in the ASCE journal (p 11875, Jan 1976) "Civil Engineering Calculations Using SI

Units" shows that the accepted symbol there for litre was also a lower case "l".

AS 1155-1974 Metric Units for use in the Construction Industry also specified a lower case "l" with the proviso: "Where limitations of typescript can lead to confusion the word "litre" should be used. Otherwise, usage of the symbol 'l' is recommended".

What happened then?

Why does everyone now use a capital "L"? Were the scribings of an obscure Monsieur Litre discovered somewhere? Or was the neat convention of capitals sacrificed to convenience and the foibles of fonts?

I can tell you that in June 1979, Amendment no. 1 to AS 1155-1974 required the symbol "l" and its proviso to be deleted and replaced with an upper case "L". However, the other Australian Standards quoted here were not similarly amended.

Why not? Are we (other than those in the construction industry) in error if we use an "L" for litre? The Macquarie dictionary is happy with "L".

I don't know the answers. I admit it's not as important an issue as say the French nuclear testing, but perhaps someone in the know can help me by writing in our next issue.

David Kernich Tel 343 2094/fax 343 2747

DOG POLLUTION

"That indefatigable and unsavoury engine of pollution, the dog"

(John Sparrow British lawyer and academic 1975)

The are many things ailing the Patawalonga and the River Torrens Lake. The most obvious is litter, but sediment, heavy metal contamination, nutrients and micro-organisms are also pollutants of concern. Some of these render water bodies a risk for swimmers. Domestic animals (such as dogs, horses and chickens) have been implicated as the main source of bacteria in urban areas. Excrement also adds to excessive plant nutrients, which encourage unwanted growth of algae.

In Sydney, the contribution to the bacterial load in stormwater from dogs has been put at 5 % to 50 %, with the higher proportions from the denser urban areas (The ARK Dog Poo report 1994). In Adelaide, the figure may be even higher, as we do not have the same number of overflows from sewers as Sydney.

Some doggy facts:

* one gram of dog faeces contains 23 million faecal coliform bacteria (median value);
* fresh faeces from only a few hundred dogs could render the Patawalonga or River Torrens Lake unswimmable;
* the Patawalonga and Torrens catchments have 35 000 dogs each (imagine if there were 35 000 small children about without toilet facilities);
* in metropolitan Adelaide there are 7 humans for each dog or 10 dogs for every 26 dwellings (1 to 4 dogs to the hectare in the built up area).

Dogs can be trained to defecate in the garden before a walk or the waste scooped up and put into the toilet or buried in the garden. When it only takes so few dogs to contaminate our waterways and there are so many dogs, it would seem an uphill task.

Bart van der Wel
PROJECTS ENGINEER WATER RESOURCES GROUP
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

NEXT YEARS PROGRAM

The provisional program is out for next year. The speakers have not all been contacted yet, so there may be some changes but the dates will probably be close to the mark.

Date	Speaker and Details
15/2/96	Water Supply in Country Towns B van der Wel & G McIntosh
18/4/96	CFCs for Groundwater Dating P Cook & A Love
16/5/96 or 17/5/96	River Discharge Related to the El Nino Southern Oscillations Simpson To be held in Berri
22/8/96	Catchment Management A Ockenden
17/10/96	Neural Network Night G Dandy, T Daniell & J Pannell
5/12/96	Coopers Brewery - Water Being Put to Good Use

MEETINGS OF INTEREST TO HYDROLOGISTS

First national conference on stream management in Australia. 19-23 February 1996. Cooperative Research Centre for Catchment Hydrology, Monash University. Details Office of Continuing Education, Monash University Fax (03) 9905 1343; E-mail: maureen.kemp@adm.monash.edu.au

WaterTECH
Conference promoting technology, science and business in the water industry.
Sydney Convention & Exhibition Centre, Darling Harbour, Sydndy, 27&28 May 1996. Enquiries to (02) 413 1288

The AWWA has set up a number of special interest groups. The Environment and Catchment Management group has set provisional dates for its meetings for next year.

Date	Speaker and Details
20/3/96	Paddocks and Barker Inlet Wetlands visit. 4:00pm - 6:30pm
5/6/96	Torrens Catchment Group - an Interactive Session
4/9/96	Contaminated Sites - Mile End Railyard
20/11/96	Newhaven - Field Trip

Final details will be provided as soon as possible. Further information about the group can be obtained from David Walker Ph 303 4319 or Cathryn Hamilton Ph 204 1953

NATIONAL PARKS FOUNDATION TO SUPPORT STUDY ON IMPACT OF STREAM REGULATION ON RIPARIAN VEGETATION

The National Parks Foundation may wish to pursue. This is to study the environmental and aesthetic/tourism impacts of water flows in rivers and creeks on the health of Conservation and Recreation Parks in the Mount Lofty Ranges.

Many of the conservation parks in the Mount Lofty Ranges are downstream of reservoirs (for example Para Wirra, Warren, Port Gawler and Onkaparinga Parks). These dams have reduced the water flowing downstream probably to the detriment of the natural ecology. Farm dams in many areas have also reduced flows in the rivers flowing through Parks (for example Marne, Onkaparinga) or areas which should be parks (for example Tookyerta Creek).

Studies by the Engineering and Water Supply Department have shown that farm dams significantly reduce flow, particularly in dry years. In the Barossa Valley, flows have been reduced by 20% (up to 70 % in dry years) and in the Marne River by 20% (35 % in dry years) as a result of the proliferation of farm dams. There have also been increases in the salinity of the water.

Flow reduction is manifested in high levels of nutrients in some streams. For example, in the Onkaparinga Recreation Park, the nutrients accumulate at the head of the estuary because the reduced and less frequent flows can not flush them out. Nutrients are the foodstuffs of plants and could cause algal blooms. The large amounts of filamentous algae growing in the waterholes of the Onkaparinga Gorge now could also possibly be due to nutrient concentration.

Flows in streams are also essential to regenerate several species of vegetation which rely on flooding, such as River Red Gum.

Clean permanent water in the waterholes and their fringing native vegetation is one of the main tourist/bushwalker attractions of these parks.

Many South Australian water supply reservoirs and the River Murray Locks were built without consideration of the environmental impacts. The original environmental condition of the rivers is therefore unknown. However, in the case of the River Murray, management of flow releases is being revised to accommodate environmental considerations and similar action should be taken in the Mount Lofty Ranges.

The Department of Environment and Natural Resources in conjunction with the Engineering and Water Supply Department is investigating the impacts of reservoirs in the Mount Lofty Ranges on the environment. However, it would seem that this proposal does not have high priority. Furthermore, there is no environmental management of farm dams. Given the current government's pre-occupation with encouraging irrigation, particularly grapes, decisions could be made which are detrimental to the environment. An independent base study would therefore appear essential.

A project be undertaken or funded by the National Parks Foundation in conjunction with a suitable organisation such as the Nature Conservation Society or the Field Naturalists' Society or a University Department.

The Foundation seeks persons or an organisation which can carry out a study to investigate the impact of environmental flows on river health in conservation parks to form a basis for negotiation with the Engineering and Water Supply Department and the South Australian Water Resources Council (in conjunction with the Department of Agriculture and the National Farmers Federation or similar bodies).

References:

* Good RK (1992). The impact of development on streamflow in the Marne River. Engineering and Water Supply Department EWS Lib Ref 92/23.
* Engineering and Water Supply Department (1991). Integrated management of farm dams in the Barossa Valley EWS Lib ref 91/7.

Bart van der Wel

LETTERS TO THE EDITOR

Oh Dear! The Business of Hydrology, as reported on page 8 of No 1 Vol 1 Aqua Australis.

Are things so bad in South Australia? Has El Niño bitten so hard? Land so degraded there is now no infiltration? Hydrological modellers swelling the ranks of the unemployed and a dimension of uncertainty gone forever! The death of mud! I refer of course to your 'water balance' equation. The water that so many of use spend so much of our time trying to get a handle on and that is normally held within a catchment for later release has seemingly been forgotten. A little "loss" lost somewhere perhaps?

Like other AA readers my heart rate increases at the thought of 'messing' it with hydrology. But Editor, you've removed a great chunk of joy! Central Australia without Ayers Rock, strawberries and cream without strawberries!

Were you perhaps merely aiming to provoke discussion (have I taken the bait?) or was the full equation too long to fit within the confines of the column block?

Or ..... is this Hydrology of the future?

Mike Catwood
Blackburn Vic 3130

WILD RIVERS

Wild rivers, in the sense of undisturbed, are important and irreplaceable systems where biological and hydrological systems continue without major interference.

Commonwealth, state and territory governments have initiated a number of programs dealing with river conservation and catchment management. To date these have focussed on heavily utilised water resources, and much less emphasis has been placed on identifying and caring for those rivers which remain undisturbed.

The Wild Rivers Project has been established to identify and provide guidelines for the management of our remaining wild rivers. It is a cooperative venture between Commonwealth and state water management and conservation agencies. The project is managed by the Australian Heritage Commission under the guidance of the Wild Rivers Committee, comprising representatives from government agencies, landowners, indigenous peoples, the scientists and conservation groups.

Australian National University will develop a computerised database with information on catchment naturalness and barriers to natural river flow, to be verified against state and other data and by pilot studies. The catchments will be classified according to terrain and climate, and a "wildness index developed". Scheduled for completion October 1995, but is currently behind schedule.

Concurrently, nationally agreed guidelines for the management of wild rivers are being developed in consultation with interested parties. Scheduled for completion July 1995.

The final phase of the project is encouragement of community adoption through posters, videos, photographic competitions, a Wild Rivers handbook, workshops and conferences.

In South Australia the Rivers most likely to be considered include the tributaries to Lake Eyre and the other salt lakes and the rivers emanating from the Flinders/Gammon Ranges National Parks. Whilst several of the less arid streams pass through conservation parks, they are heavily regulated upstream.

Details Australian Heritage Commission Ph (06) 271 2111 Fax (06) 273 2395.

IN THE NEXT ISSUE

Research - who is doing what?
A short report about current research in the universities, government, industry and the community.

Please submit material that you think will be of interest.

Contributions

Any material can be submitted to either of the editors. Contributions on disc would be appreciated in any format - plain text is fine.

Papers must be in camera ready format - 2 columns, 20mm margins top, left and right, 40mm margin bottom. See paper in this issue for guidance.

Aqua Australis is prepared using Microsoft Word Version 6

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