Hydrological Newsletter
The Hydrological Society of South Australia No 75, April 1994

Living in harmony

PATAWALONGA WATER QUALITY IMPROVEMENT

Bart van der Wel

"All your better deeds
shall be in water writ..."
Francis Beaumont 1584-1616

WITH THE PROMISE OF $ 4 MILLION TO "CLEANUP" THE Patawalonga, water quality improvement in metropolitan Adelaide has taken a high profile. This amount is insufficient for works to significantly improve water quality, so thought has to be given to the benefits of harnessing stormwater and cleaning it up simultaneously.

The Engineering and Water Supply Department has been assessing scope for water quality improvement in the Sturt River for many years. In the late 50's it was decided not to use the then-proposed Sturt River Flood control dam for water supply due to poor quality of the water. Concerted water quality monitoring began in 1971. In 1987 a trash abatement committee was formed on which the Glenelg Council was the only local government representative. In December 1993, elected representatives from all the Councils in the Patawalonga catchment agreed to set up a catchment management board in accordance with recommendations of the Joint State and Local Government Task Group on Stormwater management. Councils in other catchments are following suit.

Community groups in the Sturt River catchment had, several months earlier, banded together under the auspices of the Australian Conservation Foundation.

Elsewhere interest in water quality improvement abated because there was a perceived conflict between "user-pays" and "community service obligations". Under "rationalist" economic thinking, not only were the benefits of harnessing the stormwater not recognised, but the natural environment and leisure are not regarded as valuable capital assets to be protected against attrition.

The community recognises that water upstream of the Patawalonga and in the basin are of equal importance, and that the pollutants are not only "trash" but also heavy metals, sediment, organic matter and micro-organisms. Pollution abatement measures which have been tried include: trash rack on Sturt River (1971 abandoned due to continuous cleaning required); floating boom (1988), permanent racks (mooted in 1989 and 1992), experimental wire baskets (1993) (Keswick Creek at Morphett Road and Adelaide parklands), and community education through tagged litter program (KESAB 1992). An experiment using tides to flush the Patawalonga with sea-water (1988) was unsuccessful in replacing water in the upper reaches of the basin. This, and a scheme to pump seawater into the basin, would only move the pollution to the sea.

Various works have contributed to the pollution: the Patawalonga catchment was rapidly converted from market gardening to urban after World War 2. Installation of kerb and gutter eliminated roadside detention basins. Artificial drainage accelerated flows, reduced sedimentation and reduced uptake of contaminants by in-stream vegetation. Construction of an outlet directly to sea for the Torrens River in the 1930s and filling at the airport in the 40s eliminated natural purification through swamps to the Port River. The building of the Patawalonga barrages in the 1950s created an impoundment which acts as a settling basin (and this reduces pollution of the sea).

Monitoring of water quality has shown that one of the pollutants which most exceed guideline values is lead. The predominant source is domestic vehicle exhausts: comparison with other catchments shows residential areas as the worst generators. There would appear to be a substantial store of lead in the catchments. Cars also generate zinc (from tyres) and copper (from brakes). Sediment quality indicates that the predominant source of zinc is again residential areas.

In the Sturt River, contamination is shown by chromium and cadmium, possibly from industries. Known spills of chemicals are generally controlled by emergency action.

Suspended matter is also of concern, due to its visual impact, the safety in swimmable waters, and as a carrier for heavy metals and micro-organisms. Bare soil areas, such as overgrazing of hobby farms and building sites are obvious sources. However, overall, the export of suspended matter appears to be roughly in balance with atmospheric dustfall.

For nitrogen and phosphorus, plant nutrients promoting algal growth, the biggest single source is Heathfield Sewage Treatment Works. Other land based sources are postulated as fertilisers, animal excrement, overflows of septic tanks and vegetation decay. Nevertheless, the input from the atmosphere is considerable. The replacement of native vegetation with deciduous trees has replaced a continuous load of organic matter with a concentrated seasonal load.

The concentration of pollutants is highly variable, varying by three orders of magnitude at any location. Hydrologists, expert in dealing with the variability of stream flow, are well placed to assess the variability in water quality. As yet, however, water quality guidelines are largely based on absolute values without regard for natural variability.

Water quality monitoring in the Patawalonga catchment is continuing, in order to assess pollutant loads from various land uses. These can then be used to ascertain the most effective pollution control methods, using computer packages such as CMSS or AQUALM. Meanwhile, adoption of best available technology to control pollution is being encouraged.

The harnessing of stormwater can have many benefits. Wetlands provide an amenity which enhances land values (studies in Canberra justify the cost by this benefit alone), diverse recreational facilities, a substitute for mains water for irrigation and industrial use, groundwater recharge, restoration of wildfowl habitat and improved safety over the existing concrete drains. These benefits can offset the cost of the pollution control facility.

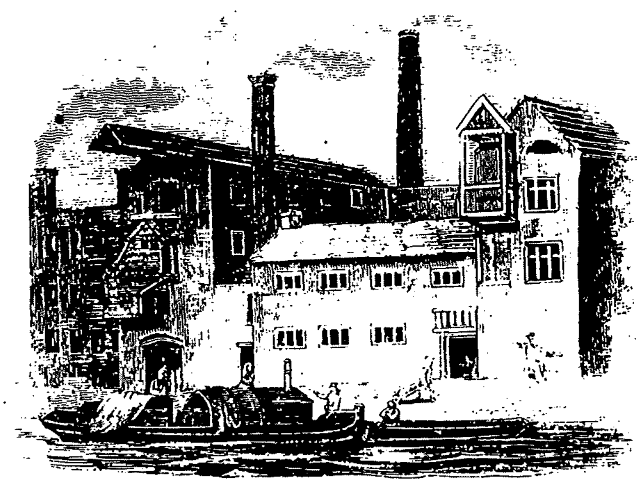
CONCLUSIONS

Steps are being taken in pollution control to manage the whole of the Patawalonga catchment. Nevertheless, an even broader approach is needed, epitomised by the slogan "think global, act local".

Air pollution is a substantial source of some pollutants, and knows no catchment boundaries.

Pollution is everybody's responsibility. Household activities are a large source of pollution, particularly motor transport. Social changes are necessary to reduce addiction to the car. On a national basis, tax laws can be amended to discourage inclusion of cars in salary packages. The proposed development of Adelaide as a multi-nodal city and urban consolidation will make public transport more efficient and reduce travel requirements.

There are many benefits to be gained from stormwater management, to which pollution control is an added bonus. A change in economic thinking is required. The natural environment and leisure must be regarded as a capital asset requiring protection, not as goods which have no value until exploited, for the sake of harmonious living.



the MYTH REPORT

Trevor Daniell

As of October 1993 the MYTH report was distributed with copies going to individuals in Unis, CSIRO, Water authorities etc. The Myth committee sent a number to people in various groups and asked them to pass copies on. A list of those who have been sent bundles follows. If you can't get a copy from any of these people, let me know and I will see if I can get more copies. (Ph 3035451, Fax 3034359 email trevord@crackle.aelmg.adelaide.edu.au)

Those People in South Australia that received copies en masse were:

Adelaide Uni	Trevor Daniell
CSIRO	Peter Dillon
USA	John Argue.

Who and what is MYTH?.

A group of university academics, researchers and CSIRO scientists came together for what is now known (somewhat facetiously) as MYTH *(Meeting of Young Turks in Hydrology).* It was essentially a meeting to question what was happening to hydrological sciences and practices in Australia and how could improvements be made in terms of both research and education. The people who were part of this first meeting were:

Rob Vertessy and Cathy Wilson (CSIRO-CRCCH- Cooperative Research Centre for Catchment Hydrology)
Francis Chiew and Rodger Grayson (University of Melbourne)

Garry Willgoose	(University of Newcastle)
Trevor Daniell	(University of Adelaide)
Roger Hadgraft	(Monash University)
Murugesu Sivapalan	(University of Western Australia)
Gunter Bloeschl	(Technical University of Vienna) Visiting Fellow at ANU
Rory Nathan	(Rural Water Corporation/CRCCH)(absent member- was there in spirit)

The initial Meeting dealt with many issues including:

- Professional Organisations and Communications
- Research Funding
- Education
- Data Collection

It was a feeling of the meeting that as more and more studies are becoming interdisciplinary that hydrologists need to become more conversant with a whole bag of processes and tools that are contained within the environmental debate.

The discussions ranged around the development of a journal in Hydrology for Australia to the development of another Society. It was resolved that if a network was set up then the interest in the process of communication outside normal conferences could be gauged.

An EMail Network has been set up and it is open to anybody wishing to join it for the purpose of airing their views, seeking help or generally keeping in touch with what people are doing.

The network can be joined by sending the following message:

sub hydrology Fred Bloggs(actual name)
to
listserv@eng.monash.edu.au

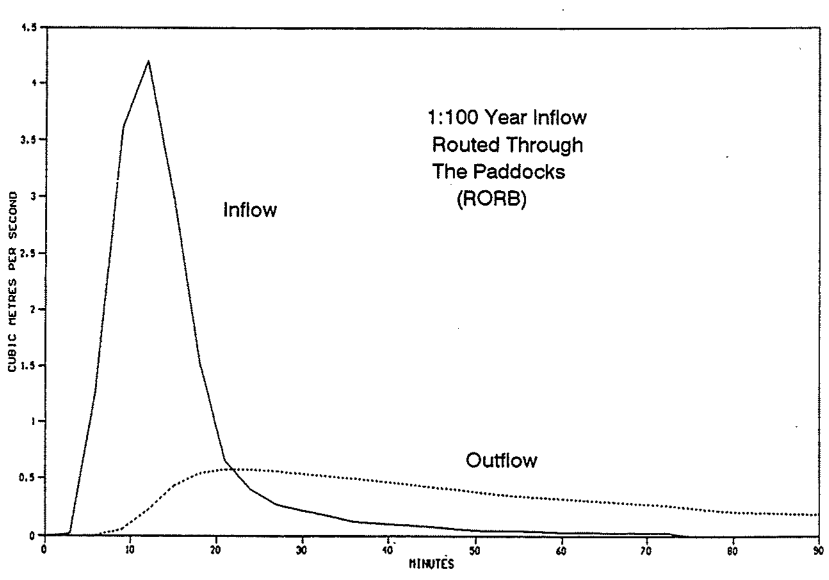
A group of the MYTH participants will be organising a meeting at the forthcoming Water *Down Under* Conference:

- to encourage presentation of latest research work
- to encourage active involvement of research students from all disciplines of hydrology
- hopefully it will be cheap and kept low key

Get yourself a copy of the MYTH report, become a voice inwhere hydrology is heading in Australia and tell the network members.

The Paddocks

Graeme Tomlinson



IT HAS BEEN KNOWN FOR SOME TIME that artificial wetlands are useful for stormwater management and, if the numbers appearing around us on the urban landscape is anything to go by, their current popularity is at an all time high.

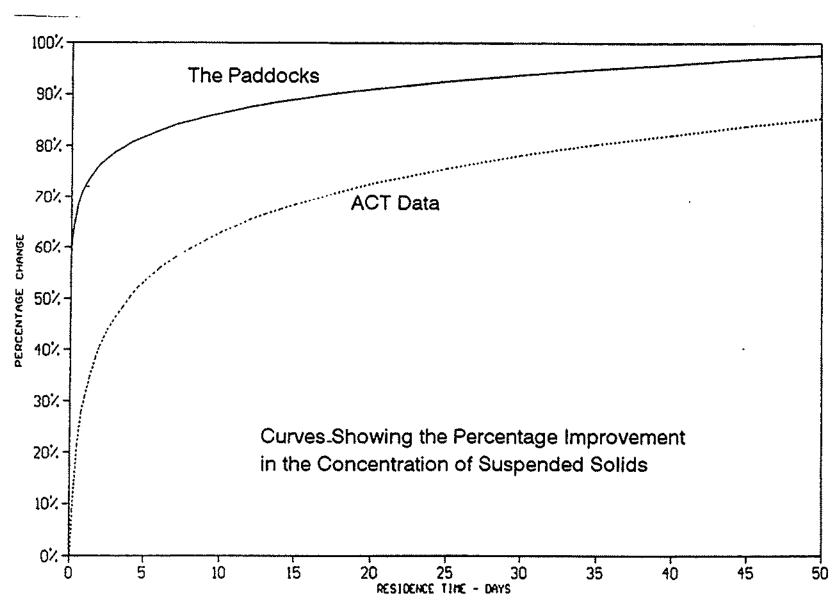
Traditionally, stormwater management has been from the perspective of waste disposal. Seen only as an undesirable product of urban development and a potential cause of flooding and health problems, stormwater has been dealt with by same hard edged engineering that caused it. But while conventional drainage may solve the problems of one community, it too often simply passes those problems downstream. This is only too evident in the history of The Patawalonga.

Artificial wetlands can be designed to not only provide the levels of protection we have come to expect, but also to provide us with a wealth of additional benefits. With reduced levels of contamination, stormwater from wetlands could be a viable alternative to mains water for local irrigation, industry, aquifer recharge or even a secondary domestic supply. Landscaped thoughtfully, artificial wetlands can also provide the very real community benefits of both active and passive recreation. Lastly but not least, artificial wetlands can minimise the impacts downstream by effectively addressing the problems at their source.

Artificial wetland design is therefore not simply a drainage exercise but one of maximising all of the possible community benefits. However, up until now, there have been very few studies carried out in Australia to provide suitable design criteria.

There is some data available from overseas studies but it is not known how relevant it is to Australian conditions. Water hyacinth, for example, although widely used in wetlands in USA for nutrient reduction, is extremely difficult to control in Australia and is capable of causing considerable environmental damage.

Studies of wetlands in ACT have provided valuable (and widely used) criteria for Australian design. Australia however, is a big country with extremes of climate. In Adelaide, for instance, the evaporation is about four times the rainfall which makes it difficult to prevent small wetlands from drying out. In Canberra, with more rain and less evaporation, the problem is less of a concern. It is therefore advisable to confirm any design criteria with local knowledge and experience wherever possible.



In 1990, the EWS commenced a study of a small established artificial wetland at *The Paddocks.*

The Paddocks is a community sport and recreation complex in urban Adelaide. The City of Salisbury redesigned the site in the early 1970's making use of stormwater to create artificial wetlands which are principal features of the complex as well as providing flood control for nearby residents.

The hydrology of one of the wetlands was monitored over a 2 year period: automatic recorders were installed to measure rainfall over the catchment area and flows into and out of the wetland. In addition, water samples from the inflow and outflow were analysed for a range of contaminants including heavy metals, nutrients, dissolved and suspended matter.

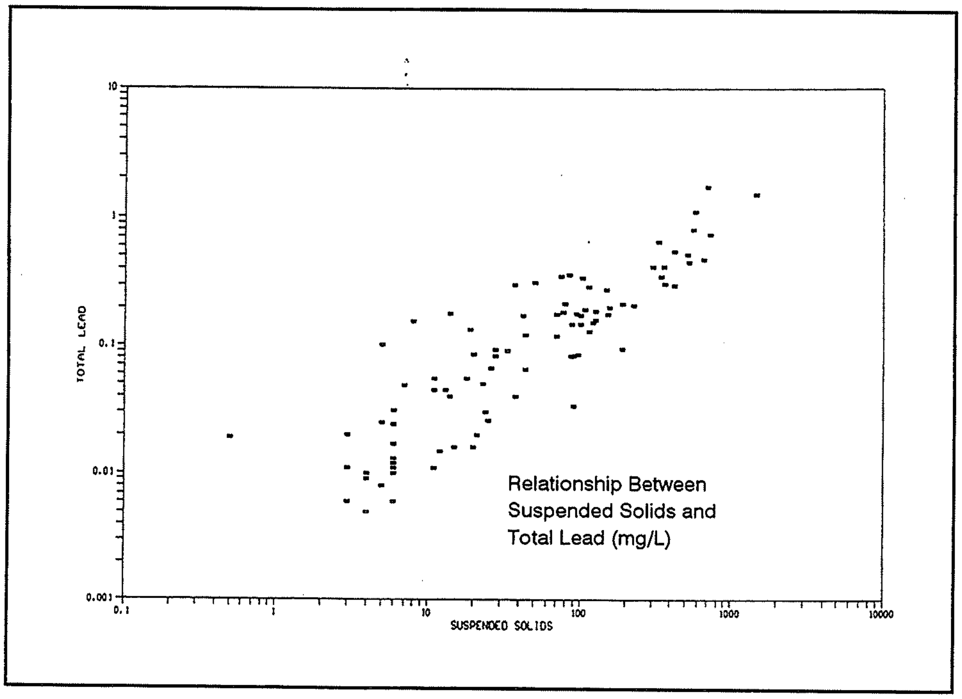
The investigated wetland is sustained with runoff from a 60 ha residential area. The stormwater is collected by a fully piped drainage system and, on reaching *The Paddocks*, is directed along an open channel which has been landscaped to give it a natural appearance. The channel leads the water onto the swale, a broad, level area of grass and then into a pond. Outflow from the pond is controlled by a small broad crested weir.

Grass on the upstream part of the swale is mown but on the area adjacent to the pond it is allowed to grow naturally. Water from the channel spreads out evenly and flows very slowly through the grass. The study indicates that the swale is the key to the effectiveness of this wetland: it provides temporary storage for floods, the low velocities promote sedimentation, the grass filters the water and prevents coarse litter from reaching the pond and the diffuse inflow helps to mix the water in the pond. With a kind of symbiosis, the grass itself is sustained by the periodic inundations and nutrients extracted from the sediment. This has created a very attractive area in the wetland which remains lush and green even through the height of summer.

The observed flow data showed the wetland to be an effective flood mitigator. Routing an estimated 1:100 year inflow hydrograph through the wetland with RORB, gave an outflow peak some 86% less than the inflow.

Although water quality was not an original design objective, it was felt that the wetland was likely to provide some improvement. From the range of water quality parameters monitored there were some quite significant reductions in the levels of concentration. It was alos shown that sedimentation was the principal mechanism for the improvements. Many of the contaminants, particularly metals and nutrients, are associated with suspended matter and are removed from the water as this matter settles out; conversely, the wetland has very little effect on dissolved compounds. The close relationship between the concentrations of lead and suspended solids is illustrated below.

Curves were derived for a number of parameters which show the relationship water quality improvement and the time taken for water to pass through the wetland (residence time). These curves indicate that suspended solids and phosphorus are removed more effectively from stormwater at



The Paddocks than from wetlands in the ACT; this probably reflects the effectiveness of the swale. The curves in the adjacent figure show the rate of improvement in the level of suspended solids at *The Paddocks* and compared with that for the ACT.

As most of the Adelaide's rainfall occurs during winter, summer irrigation of parks and gardens is a necessary part of living here. But as Adelaide has very few usable sources of surface water, mains water is typically used. There is however, a significant volume of urban stormwater generated which some estimates say is equivalent to the amount of mains water consumed. Up until now, however, the common perception has been that stormwater has no resource value. Artificial wetlands could be the key to turning this perception around.

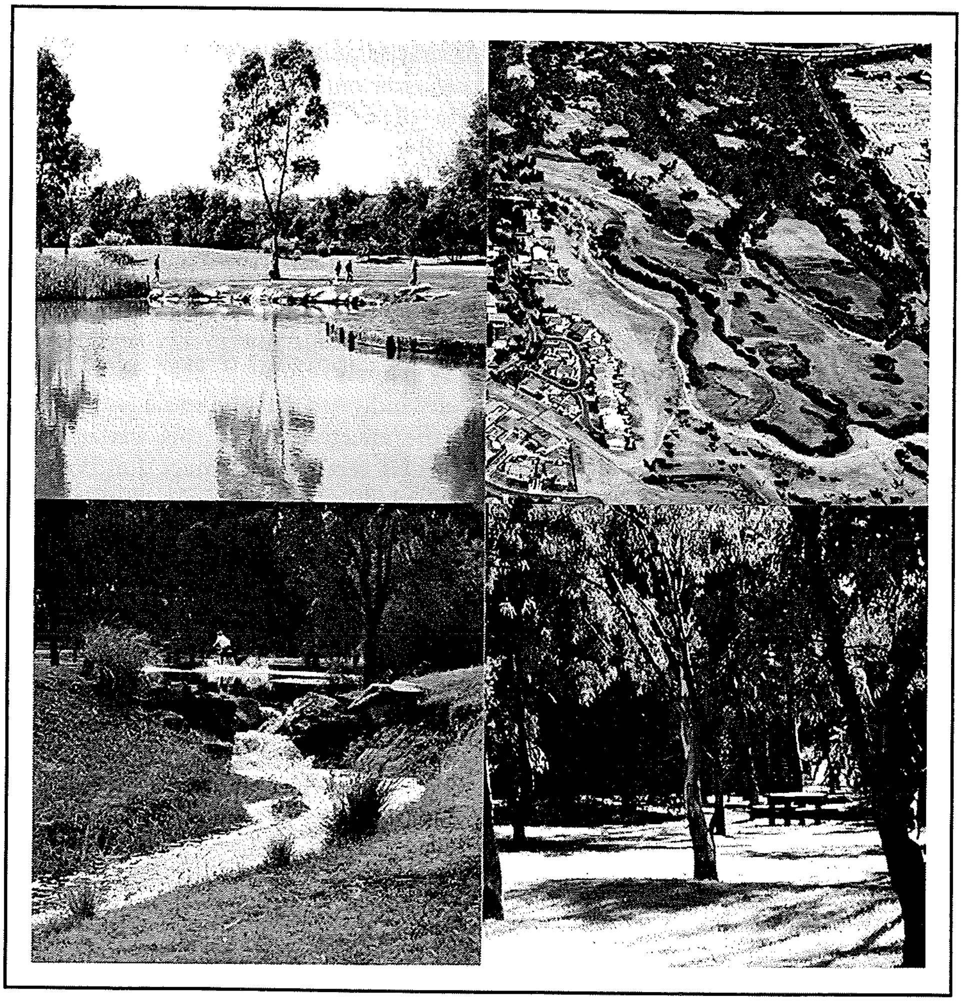
Using a balance of the measured data, the various losses from *The Paddocks* wetland were evaluated. A model could then be constructed to simulate the water balance and be used to estimate daily outflow from the measured inflow. The model could also be used to provide a daily estimate of the residence time of the water in the pond. Using this model, the water harvest potential was investigated.

Guided by residence time as an indicator of water quality, surplus water could be hypothetically pumped into an aquifer and retrieved to top up the pond when it began to dry out. The model indicated that sufficient good quality water could be harvested from the wetland to prevent the pond drying out and to supply about one third of the irrigation water for the surrounding parkland.

While this study has answered some questions it has also raised some others. Following on from this study, the City of Salisbury is currently modelling *The Paddocks* catchment rainfall and runoff and the University of Adelaide is investigating the effectiveness of the floating fern *Azolla* to remove contaminants from the water.

Wetlands however, are only one part of a total catchment strategy: tackling some of the contamination problems at their sources and distributing flood control measures throughout the whole catchment where possible, will allow wetlands to function effectively and help to make stormwater a very real alternative community water resource.

Full details of *The Paddocks* study are contained in Engineering and Water Supply Department Report 93/11.



Rehabilitation of uncontrolled wells in the Great Artesian Basin

David Lock

Rehabilitation carried out by SADME continued during 1993 on the uncontrolled flowing wells in the SA section of the Great Artesian Basin. The program, funded jointly by the State and Federal governments, commenced in SA in 1977 and is now nearing completion.

The following table shows operations completed in 1993, work completed since commencement of the program and that remaining to be completed.

	1993	since 1977	remaining
Plugged flowing seismic and mineral exploration holes	-	48	
Rehabilitate existing wells	2	75	11
Drill new wells	4	21	
Plug all wells	6	27	2
Totals	12	171	13

One of the wells plugged during 1993 was Coward Bore at Coward Springs. This well was drilled in 1886 and became uncontrollable several years later. An attempt was made to plug the well in 1967 by drilling a new well in the close vicinity and the original well whose exact location beneath the wetland was not known. Cement was pumped down into the new well but unfortunately did not stop the flow. A further attempt was made last year using the same well but this time with more sophisticated techniques and ultimately, with success. Controlled flow was re-established to maintain a water supply to the wetlands generated since the late 1890's.

Most wells are rehabilitated by installing non corrosive casing cemented into place with headworks attached for fitment of pipelines by pastoralists. Well which cannot be rehabilitated are plugged with cement and a replacement well drilled.

Pressure and flow testing of rehabilitated wells is undertaken by Department of Mines and Energy on a bi-annual basis to enable the effects of the rehabilitation to be monitored. Pressure in the basin will increase as a result of the water saved by rehabilitating uncontrolled wells and the recently initiated programs of rehabilitation by Queensland and NSW will eventually increase pressure in SA.

Australian Rainfall and Runoff
Extreme Flood Estimation

Chapter 13 of *Australian Rainfall and Runoff* is about to be revised. A small group has been put together to carry out this task including Rory Nathan, Erwin Weinmann, Jim Irish, Bill Weeks and Trevor Daniell. If you have had any problems using this Chapter, could you please let me or Rory Nathan know so your problems are addressed in the rewrite of this Chapter.

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EDITOR'S NOTES

Readers are encouraged to submit short articles on their findings to be considered for future issues of *Hydrological Newsletter*. Concise illustrations summarising results are requested. The publication schedule is:

Issue	Items due	Publication
Autumn	15 Mar	April
Winter	15 Jun	July
Spring	15 Sep	October
Summer	15 Nov	December

IT IS ALL IN THE NAME

A Martian would have a hard enough time finding out where to obtain the best information on water let alone trying to find out who is in charge of the stuff in South Australia. Not so long ago the best bet would have been the Engineering and Water Supply Department. But not any more. With the recent transfer of the Water Resources Group to the Department of Environment and Natural Resources, the EWS has been left with the purely operational functioning of its pipeware. From now on, the South Australian water resources perspective is likely to broaden in scope, rise in stature and develop an environmental flavour. This seems to be a move in the right direction.

However, while the *environment* is a universal darling, the term *natural resources* is too vague. Virtually everything could be classified as a natural resource; even us! Yes, whether we like it or not, we are nature! As it is better to call a spade a spade, it would be more appropriate to replace *natural resources* with *water resources.*

One could argue that the Department of *Water Resources and Environment* would sound even better in our dry State, but as *environment* is probably the more marketable and saleable item, so let it be - for the time being anyway. And as far as the fashionable focus on *land* is concerned, there is plenty of land on Mars, but little water and even less life...

This leads one to propose a modification to the popular conception that the earth bears fruit:

IT IS NOT EARTH *BUT WATER* THAT BEARS FRUIT .

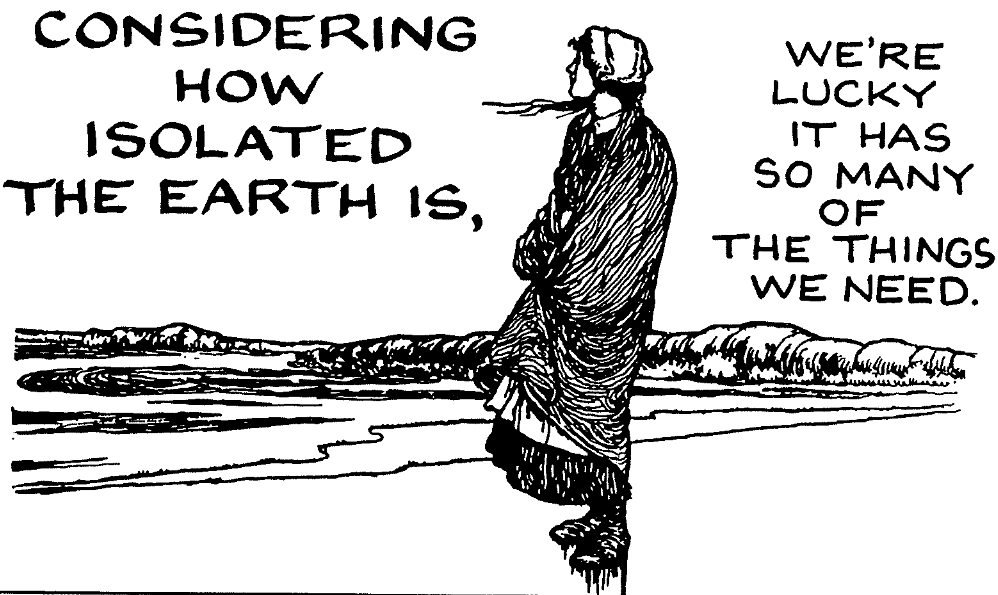
Earth, or *land*, is in a well established position. To some cultures it is the *Fatherland* and to others, the *Motherland*; people are prepared to die for it and countless millions already have. Is this a fascination with *static*, a familiar, linear perception of life? Is this a way of fixing our existence in an everchanging world? Water is *dynamic*, water is in a state of constant flux, water is everywhere; water flows through our bodies but its molecules do not belong to any specific person.

It is a fine peace of poetry that *Man was invented by water as a means of inexpensive transport from place to place.*

Looking at water authorities around Australia, one can find names which are inherently poor, like *Power and Water Authority.* To rank mere machinery above the medium of life displays both arrogance as well as a lack of imagination. One can only be glad that a similar idea for our State got left by the wayside.

Let us, however, not dwell on such atrocities; it is far more pleasant to concentrate on good examples, when they can be found: one gets encouraged by the stout *Department of Water Resources* (NSW), authoritative *Water Authority of WA* and that marvel of succulent brevity (and briefly putting aside our parochial differences), *Melbourne Water;* but the Prize of Prizes must go to the CSIRO's *Department of Water and Land.* **Someone, at last, has got their priorities absolutely correct!**

Vincent Kotwicki



Flood Warning and the Weather Bureau

Chris Wright

IT IS ALMOST SIX YEARS SINCE THE BUREAU of Meteorology set up a Hydrology Section in South Australia (June 1988), more because of a national initiative than for the particular reason that floods were seen as hazardous to this state. The section consists of an Engineer and a Technical Officer, regarded as the minimum viable unit.

Despite the apparent lack of floods here, the task has been both challenging and interesting. Perhaps the most obvious place to start was the River Murray, however, floods on this river had always been predicted and handled by the Engineering and Water Supply Department. The Bureau was not required to provide any service.

That left the catchments in the Mount Lofty Ranges and the Hutt river at Clare, with a history of flood damage since settlement, and for which flood mitigation measures had provided at best, only a partial solution.

The development of the first flood warning system in the state had begun several years before, I think on the initiative of Ian Laing whom many of us remember with great respect and affection. A rainfall-runoff model had been developed by B.C. Tonkin and Associates to study the effects of operation of the gates on the Little Para Dam. The model was based on RORB, and used three pluviometers within the catchment to define the storm temporal distribution. While it had been used for study purposes and some trials had been carried out to determine its usefulness for flood prediction, we never actually used it.

Having studied the records and looked at what was available, our first move was to set up peak height relationships between adjacent gauging stations on the North Para River. Despite a slight hiccough due to the rating table at Turretfield having changed during the recording period, the peak height relationships from Penrice to Yaldara and from Yaldara to Turretfield produced quite good results. For predicting flood flows to Gawler, one simply added the hydrographs from Turretfield on the North Para and South East Gawler on the South Para, and lagged them by three hours to get predicted maximum discharge at Gawler Junction. When coupled with information on the average time of travel for floods moving down the catchment, the result was a reasonable (if not particularly advanced) flood prediction method. In the floods of 1992 and into 1993, this simple model was the basis of all predictions and warnings. This was despite the fact that we had developed unit hydrograph models for both Penrice and Yaldara, and had developed reasonable confidence in them. We found that the practical problems of running a flood warning desk, in times of flood, with the pressures of collecting rainfall and water level information, assessing the data, deciding which catchments were most likely to flood, answering calls from emergency services, local councils and private citizens, precluded any but the simplest computations. The situation was complicated by the fact that most of the data collection was taking place on a computer network which is not DOS based, while the unitgraph models were available only on DOS based PCs, and the data had to be transferred manually.

It may shock the specialist hydrologists and meteorologists in our state, that we were not more sophisticated in our attempts to predict floods. After all there are now many rainfall-runoff models which have the ability to process huge amounts of data very quickly. Furthermore, with the strong interest in use of radar for rainfall measurement, it should be possible to predict floods before the rain has even landed. Also with improvements in weather forecasting methods, it should be possible to predict the rain before it has rained so to speak. However, in the world of practical hydrology, and I suspect in other worlds too, the best solution in the short term was the simple one, and the method described briefly above provided satisfactory estimates of peak discharge at Gawler. The main shortcoming of our flood prediction and warning was our inability to estimate flood volumes. Consequently although we predicted peak discharges quite accurately, we were far less successful in estimating the places and extent of breakouts of flood water. We could give indications of the likely areas of inundation, however channel storage and temporary mitigation works on the Gawler river had major effects on the breakout behaviour of the river.

In order to predict floods it is obvious that one needs plenty of information from the catchment, primarily the rainfall and runoff that is occurring. The Gawler catchment was well supplied with gauging stations thanks to a major program of construction by the E&WS Department in the 70's and early 80's. With improvements in technology during that period, the quality and reliability of the monitoring equipment has progressed in leaps and bounds. The Metropolitan Telemetry System, developed by the E&WS primarily for monitoring and controlling the tanks pumps and valves throughout the water supply and sewage treatment system, was extended to cover a network of Hydrographic stations round Metropolitan Adelaide. Within the last few months this system has been completed and now provides data from more than 50 rainfall and water level stations. The Bureau is able to access this information whenever required.

Simultaneously with this development, the Bureau has been encouraging local councils with perceived flood problems to purchase and install automatic catchment monitoring systems, known as ALERT. These ALERT systems use radio telemetry to communicate to a central base Station, where a PC computer operates continuously, stores all rainfall and water level data and issues alarms in case of flood. There are now some twenty ALERT stations, and the number is expected to approach 100 within the next three years. The network will cover the upper reaches of the River Torrens, the Gawler and the Onkaparinga, the South Eastern Suburbs of Adelaide, the Dry Creek and Little Para Catchments, and the Hutt River at Clare.

In addition to their primary function as monitors of potential floods, the network is already showing benefits in terms of a much improved data base on which to base catchment models for design purposes. Recent work on the Gawler and Onkaparinga catchments in particular has shown much greater accuracy and reliability in the hydrologic models and their performance. The availability of a large number of pluviometer records within each catchment has permitted much more accurate description of the storm temporal and spatial distribution.

Over the next few years, undoubtedly the current drive for installation of more gauging stations will slow. However this will be followed at least within the Bureau, by rapid development and adoption of the modelling techniques which are already used for flood forecasting along the east coast of this continent. Despite the fact that floods are the reason for our existence in this state, I cannot in conscience wish that we experience plenty over the next few years. However, it is also true that our data base will be rapidly expanding over the next few years. With the benefit of whatever major events take place over the next few years, we will be more confident and capable of fulfilling our role, which is to avoid loss of life in our community and to minimise damage to property.

LETTERS TO THE EDITOR

The Editor, Hydrological Newsletter

The question posed on page 1 of issue No 74 (*River Murray in flood*, by Andrew Jessup) about the probability of the last five floods of the River Murray is no more than mental arithmetic (or at worst a 'back of an envelope problem'). The overall ARI is simply the product of the individual ARI's, so the recurrence interval of those *particular* five flood magnitudes is 11x7x3x9x6 = 12 474 years. Obviously we are not likely to repeat exactly those magnitudes, so the real question is "What is the probability of the smallest of those five floods being exceeded five times in a row"? In this case the ARI is 3^5 or >243 years, AEP = 0.004, ie, on the face of it, we are likely to have to wait for more than two and a half centuries to see a comparable set of floods. However, basic probability theory doesn't work for several reasons:

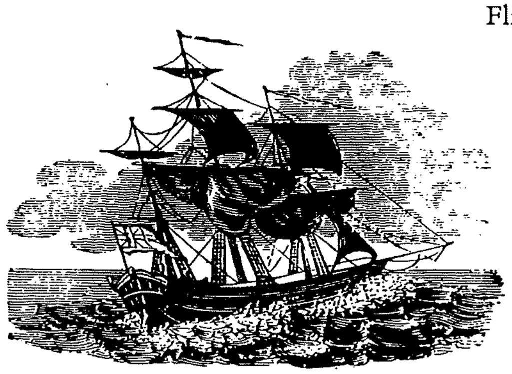
1) The data set does not extend for more than a century, so we are on a 'sticky wicket' in talking about an ARI of 243 years. There has been enormous change in land use and river control just in this century. Therefore the underlaying assumption of a stationary data set is false.

2) When we are dealing with very long ARI's, we probably have to take climatic change into account, ie. still less stationarity of the data set.

3) There is carry over, if not of channel storage, then at least of groundwater storage, from one year to another. Therefore, since runoff is influenced by antecedent catchment conditions, the assumption of *independent* annual flood peaks is also invalid.

In short, a true answer "does not compute". It is easy to calculate numbers, but *meaningful* numbers are something else. The next step up from trivial (and dubious) probability theory is serious catchment modelling, which is many orders of magnitude more complex, and even then, hard probability figures are almost impossible to estimate. So pick any impressive sound ARI you like, it is probably as good as anything that can be computed objectively!

Gordon Stanger
School of Earth Sciences
Flinders University



Call for Papers and Posters

INTERNATIONAL WATER SUPPLY ASSOCIATION

INTERNATIONAL SPECIALIST CONFERENCE ON "DESALINATION AND WATER REUSE"

1-2 DECEMBER 1994

**MURDOCH UNIVERSITY
PERTH, WESTERN AUSTRALIA**

Sponsored by:

International Association of Water Quality

International Desalination Association

Australian Water and Wastewater Association

Organised by:

**Australian Water and Wastewater Association
W.A. Branch
The Remote Area Developments Group
Institute for Environemental Science
Murdoch University**

IMPORTANT DATES

Submission of Abstract	15 April 1994
Acceptance of the paper	30 June 1994
Submission of papers	15 Sept. 1994

FOR FURTHER INFORMATION

Please contact:

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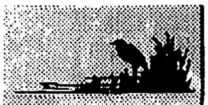
Mississippi River Model



HEC is working with HQ, WES, and five division offices (NCD, ORD, MRD, LMVD, and SWD) to develop an integrated numerical hydraulic model of the Mississippi River mainstem. Presently, the Corps does not have such a model implemented for the Mississippi River that can be used to rapidly predict and analyze system-wide impacts of various alternate actions on stages and flows during large floods (such as those experienced during the summer of 1993) or droughts. During such extreme hydrologic events intensive coordination among the five divisions is required to effectively manage and evaluate the performance of Corps' Mississippi River projects. Quick, accurate, and effective communication of the status of the system and results of Corps' forecasts to other parties during such events is critical. Investigation of past events has identified the following needs that such a model could, and should, satisfy:

1) Improve and facilitate the coordination, communication, and sharing of data and forecasts among water control activities along the mainstem Mississippi River during all hydrologic conditions. This can be accomplished with a uniform and consistent channel/floodplain routing model and a shared data management/display system.

2) Assess impacts of levee breaching and floodway operations on local and downstream areas.

3) Support emergency management activities through timely prediction of stage and rate of rise.

4) Display areal extent of flooding potential for various predicted weather scenarios and levee failures.

5) Identify navigation hazards.

6) Provide real-time flood damage assessment.

To satisfy these needs, a four-phased approach has been identified. First, a UNET model of the system from the Gulf upstream to Chicago on the Illinois River will be developed from existing data sources. (UNET is a one-dimensional unsteady flow model widely used throughout the Corps.) UNET models of major portions of the area exist. The suitability of UNET's levee failure-storage cell computations for this system will be evaluated. With additional data acquisition the model will be extended to Minneapolis on the Mississippi and Kansas City on the Missouri. It is expected that each division will operate the section of the model within its geographical jurisdiction. HEC-DSS will be used to provide forecast information to downstream divisions. Changes to UNET may be required to enhance its operation as a real-time forecasting tool. Second, the capabilities and accuracy of the model will be improved by refinement of the data and interfacing with advanced hydrodynamic modeling techniques such as two-dimensional flow in the floodplains where necessary. Third, additional capabilities for data acquisition and display and communication of results using GIS and digital terrain models will be pursued. Fourth, model maintenance, support, and technology transfer will be provided concurrently with the other phases. *(Gee)*

New Urban-Hydrology Research Effort

Many of the Corps flood-control investigations are now being conducted in urban areas, where the watershed response to precipitation is affected by the many features of the urban landscape. These features include impervious areas, altered drainage patterns, improved channels, and detention storage. Several simulation models exist to analyze urban runoff problems; but, often several models are required for a complete analysis. Each of the models has some limitations for simulating urban runoff. The lack of knowledge about these limitations, as well as the lack of an appropriate methodology, make current hydrologic investigations in urban areas more expensive and/or less accurate than necessary.

The work will be carried out in three areas: 1) the surface system, 2) the underground storm-drain system, and 3) the interaction between these two systems.

The limitations of existing simulation models used by the Corps in each of these areas will be identified. The needs of the field offices for different urban studies will be summarized. Close coordination will be maintained with other agencies (mainly EPA). An urban hydrologic investigation methodology will be developed for best application of existing models. Strengths and limitation of the models will be highlighted. Where deficiencies in the needed simulation capability are noted, recommendations for new capability will be made. New capability and applications guidance will be developed as deemed necessary by the Corps field offices. HEC plans to conduct a seminar later this fiscal year to assess the state of urban hydrology practices. *(Feldman)*

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Flinders Institute for Atmospheric and Marine Sciences

Seminars, Semester 1 1994

Unless indicated otherwise, seminars are held on Fridays at 4pm in the Tele Lecture Thea the ground floor of the Information Science and Technology Building.

15 April: Beth Curran, Bureau of Meteorology, Adelaide
Maximal Temperatures in Coastal Localities

29 April: Dr. John You, FIAMS
A Time-Dependent Barrier Layer Model

13 May: Dr. Michael English, Wilfed Laurier University (Canada)
Dr. Sherry Schiff, Waterloo University (Canada)
Title to be announced

27 May: Dr. Neville Clark, FIAMS
Eddy Correlation Measurements of Trace Gases

10 June: Prof Matthias Tomczak, FIAMS
Hemispheric Conjugate Atmospheric Variations and Variations of North Atlantic "Deep Water Formation"

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Newsletter items, cartoons, 'Quotable quotes', personal anecdotes relevant to the role of the Society or its members would be greatly appreciated. So put pen to paper, (finger to keyboard) and look through your filing cabinets and dig out those interesting or humourous articles and send them in to:

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