NEWSLETTER OF THE COOPERATIVE RESEARCH CENTRE FOR CATCHMENT HYDROLOGY

CATCHWORD

NO 96 JULY 2001

A NOTE FROM THE DIRECTOR

Professor
Russell Mein

Inside...

ARE WE 'ENGAGED'?

Perhaps the most notable feature of the CRC (Cooperative Research Centre) model is the direct linking of research users and research providers. The aim of this 'connection' is to target research to more closely match perceived industry needs, to involve industry in the conduct of the research, and to facilitate the uptake of successful research outputs by users. The CRC for Catchment Hydrology has embraced this objective using the level of adoption of Centre products by land and water managers as its prime performance measure.

The 'products' we envisage are many and varied, falling mostly in the category of new knowledge and new tools (eg software) for better land and water management. It goes without saying that success in developing knowledge and tools does not it itself lead to 'adoption'; a good deal of effective communication is required at many stages in the research and development process to ensure our work is well targeted and put into practice..

Effective communication is vital to the success of a CRC, and ours is no exception. Research teams can't operate without it, especially if multi-sites and/or disciplines are involved. At the wider level, close links are needed to our Parties, so that they can monitor, and maximise the benefit from, their considerable investment in the Centre. Two-way communication or interaction with the ultimate users of our research outputs is necessary to identify users needs and expedite the adoption of new knowledge and tools. Overall we have a variety of stakeholders to consider in the CRC, and face quite a communication challenge to 'engage' them.

How are we doing? We recently engaged an external consultant (Econnect Communications Ltd) to assess the effectiveness of the communication activities of the CRC. We wanted independent answers to the questions:

1. What are the most effective communication activities for a Centre like ours?
2. Which of these is the CRC doing?
3. How well are we doing them?
4. What would make the CRC more effective?

We also wanted a quantitative benchmark against which we could make adjustments and measure their effect.

The review team canvassed three classes of stakeholder (internal, external, and major investor), and consulted with communication specialists from comparable organisations. Generally speaking, a good proportion and number of people responded to the survey questionnaires, so we were confident that representative findings were achieved.

The questions asked of stakeholders related to their perceptions of the CRC in relation to four categories of communication (awareness raising, information exchange, dialogue, and involvement/action), these being seen as the steps generally needed for 'adoption'. The data were further classified to relate responses to the CRC's activity areas, and to stakeholder organisation type.

How did we do? Pretty well overall, but (as always) there is room for improvement and we will strive to do that. The Executive Summary of the Report can be found on the web at:

http://www.catchment.crc.org.au/commreview.shtml

For me a satisfying statistic was that about 15% of external stakeholders were using 'most of' the information generated by the CRC, about 55% 'to some extent', 25% 'to a small extent', and 5% 'not at all'. Given the relatively broad field covered by the CRC, that's a good take-up rate. More to the point, a high proportion of consultants (SMEs) were represented in the stakeholder groups and were relatively stronger users, as were policy making bodies.

We'd welcome comment from those interested in our communications review, and feedback from stakeholders. We want to stay engaged!

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CRC PUBLICATIONS LIST

Copies of the Publications List are available on request from the Centre Office on 03 9905 2704 or can be downloaded from the CRC website at

www.catchment.crc.org.au

All prices listed include GST, postage and handling.

The Centre's products can be ordered through the Centre Office.

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PROGRAM 1
PREDICTING CATCHMENT BEHAVIOUR
Program Leader
ROB VERTESSY

PROGRAM 5
CLIMATE VARIABILITY
Program Leader
TOM McMAHON

Joint Program Report by Francis Chiew, Andrew Western and Harald Richter

Intermediate or Mesoscale Soil Moisture Monitoring Network For The Murrumbidgee Catchment

Joint CRC Program Work

We are in the final stages of setting up a soil moisture and temperature monitoring network in the Murrumbidgee Catchment. This is part of joint work between Project 5.1: 'Modelling and forecasting hydroclimate variables in space and time' and Project 1.2: 'Scaling procedures to support process-based modelling at large scales'. Project 5.1 has a range of objectives including improving medium range forecasting of rainfall and other climate variables (i.e. forecasting 12 hours to several days ahead). Project 1.2 aims to develop improved methods for representing sub-grid variability in large-scale models.

Improving numerical prediction models

One of the primary forecasting tools used by the Bureau of Meteorology for medium range forecasting is their limited area numerical weather prediction (NWP) model. This work aims to improve the implementation of the land surface scheme (LSS) used in that model. The NWP model operates over an area covering all of continental Australia and extending well into the Southern, Indian and Pacific Oceans, and north to the equator. It has a grid size of 12.5km and a time step of 5 minutes. It is run twice a day and forecasts up to one week in advance, although the forecasts are most reliable for the first couple of days. Describing the surface hydrologic and energy transfer processes accurately over the continent at these time and space scales is a major challenge. Previous case studies by Graham Mills and Beth Ebert indicate that the NWP predictions of rainfall are sensitive to the initialisation of soil moisture, but at present we do not have a good idea of how well the soil moisture field is initialised.

Describing soil moisture and temperature – Land surface scheme

The LSS currently treats each 12.5km grid cell as being spatially uniform and it describes the vertical variation of soil moisture and soil temperature using the following four layers: 0-7cm, 7-30cm, 30-100cm, 100-250cm. The LSS interacts with the atmospheric component of the NWP model via the land-atmosphere moisture and energy fluxes, and soil moisture influences the partitioning between the latent and sensible heat fluxes. To initialise the soil moisture field, the LSS is run off-line and is forced by observed data. The quality of this soil moisture initialisation is currently untested against soil moisture data. To test the soil moisture and soil temperature predictions of the LSS and to evaluate its overall performance within the NWP framework, a major intermediate or meso-scale monitoring exercise is being undertaken across the whole Murrumbidgee catchment.

Selecting monitoring sites

In the first week of June, Francis Chiew, Harald Richter, Rodger Young and Andrew Western visited the Murrumbidgee and selected eighteen monitoring sites. The week began with a discussion of the Richmond-Fremantle football match in the car on the way to Wagga Wagga on Sunday night. Then we were up bright and early and flew around the middle Murrumbidgee, starting over Kyeamba Creek and Adelong Creek, our candidate catchments for more intensive monitoring, and then over the Cotter River, Cootamundra and Narrandra to gain a more general feeling of the landscape. Then we started driving! First around Kyeamba Creek and Adelong Creek, then to Canberra (to send Francis home), Cooma, back to Canberra and then Melbourne via a variety of towns including Balranald.

Monitoring site locations

The core of the monitoring network consists of eighteen sites, with two groups of five in Kyeamba and Adelong Creeks and eight other sites associated with Bureau of Meteorology meteorological stations. *Figure 1.1* shows a map of the locations of the monitoring sites. Adelong and Kyeamba Creeks were selected for more detailed study because they have catchment areas approximately equal to the grid cell size (150km^2) of the NWP model and using gauged catchments will enable testing of the overall water balance predicted by the LSS. The other eight sites were chosen to get good coverage over the Murrumbidgee, which is a big enough area to be significant in the overall NWP model (about 600 grid cells). These sites are located at or near Bureau of Meteorology meteorological stations to maximise the usefulness of the routinely collected weather data for the project.

Rainfall and soil data to be monitored

Each station will monitor rainfall as well as soil

moisture, soil temperature and soil suction in the 0-7cm, 0-30cm, 30-60cm, and 60-90cm layers. The stations will be telemetered using mobile phone technology and data will be downloaded and checked weekly from Melbourne. The monitoring equipment has been purchased and we are planning to install it in August and September 2001. Field calibration of the soil moisture sensors is planned for each site. Initially the sites will be monitored for a period of 18 months but there is the possibility of this project being incorporated into GEWEX (see November 2000 *Catchword*), in which case the monitoring would continue.

Figure 1.1 The location of planned soil moisture monitoring sites across the Murrumbidgee.

What will the future bring?

Further work

In addition to the continuous monitoring, we have some intensive campaigns planned. Because we want to assess the performance of the LSS over areas comparable to the model grid scale but we only have point monitoring, we need to deal with the issue of spatial variability and the representativeness of the monitoring sites. To assess this at the eight sites associated with Bureau of Meteorology stations, we plan to measure soil moisture in the 0-30cm layer using the University of Melbourne 'Green Machine'. This will be done on pairs of 10km long transects running north-south and east-west through the monitoring stations. Moisture will be measured every 500m along the transect on two to three occasions. In Adelong Creek and Kyeamba Creek we are planning to use a slightly different approach where we stratify the landscape on the basis of topography, soils, and vegetation and sample from each landscape component. This will be done two to three times and, in addition, we will try to monitor the variations in moisture for several days just before and following rainfall events.

As well as providing information on spatial variability to assist in interpreting the continuous point data, the intensive sampling will provide a basis for assessing the importance of any effect of spatial variability on the LSS, hence the involvement of Project 1.2.

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MELBOURNE TECHNICAL SEMINAR

Environmental Data Management in Europe - Good News and Bad News

by

Dr. Ralf Denzer

International Federation for Information Processing Working Group 5.11: 'Computers and Environment'

Friday 31 Aug 2001

11:45am for a
12:00 noon start

Tea/Coffee on arrival

Lecture Theatre C1
Engineering Block C
Department of Civil and Environmental Engineering
The University Of Melbourne,
Parkville, Victoria

(Please note: parking is not available on university grounds)

For further information visit www.catchment.crc.org.au/events or contact David Perry on 03 9905 9600

THE THIRD AUSTRALIAN STREAM MANAGEMENT CONFERENCE - THE VALUE OF HEALTHY STREAMS

27-29 August 2001

Hilton Hotel
Elizabeth Street
Brisbane

The Third Australian Stream Management Conference will be held during 27 - 29 August 2001 in conjunction with the 2001 River Symposium (29-31 August) and associated with the Third Australian Fishways Technical Workshop (30-31 August).

In support of the 'Value of Healthy Streams' theme, the Conference is centred on four key areas:

· Ecosystem services
· Hydrological connectivity
· Bio-physical integration
· Tools and techniques

DETAILS OF CONFERENCE ACCOMMODATION AND COSTS NOW ON-LINE at www.catchment.crc.org.au/streamconference

Book your accommodation NOW to ensure a room - please quote the conference name when booking.

PROGRAM 2
LAND-USE IMPACTS ON RIVERS

Program Leader
PETER HAIRSINE

Report by Mat Gilfedder

Project 2.3: Predicting the effects of land-use changes on catchment water yield and salinity

Salt delivery to streams

A major part of Project 2.3 is Task 6: Salt delivery to streams. This is concerned with the impact of land-use changes on salt loads and stream salinity. Linkages between surface hydrology and salt delivery to streams will be developed as part of this work in particular, the remobilisation and delivery of salts to streams in local to intermediate groundwater flow systems.

Task 6 is an add-on component to CRC Project 2.3, funded by the Murray-Darling Basin Commission. It is managed through the MDBC Catchment Categorisation Project led by Glen Walker.

This task involves four main activities aimed at helping to link changes in land-use, through groundwater flow systems, to stream salt loads. This article briefly describes each of these activities

Landscape Disaggregation

A first step in this process is to have a sensible way of breaking up the landscape into units with consistent topographical and hydrogeological processes leading to dryland salinity. What this means is knowing where different groundwater flow systems occur, and being able to put them on a map. This then provides the structure for predicting responses to land-use change. This work is being carried out in the Catchment Categorisation project.

Yield Response

The work of Lu Zhang and others has led to an ability to predict the difference in long-term mean annual catchment yield between forested and grassed catchments for a given rainfall.

This technique will be used to predict the effects of land-use change on catchment yield. However, the method provides results for equilibrium conditions. It may be reasonable to assume that the effects of land-use change will express themselves fairly rapidly for surface runoff. However, there may be long time-lags for such changes to pass through groundwater systems. These time-lags are very important, since groundwater discharge is a significant component of stream salt load. Thus, temporal prediction of how catchment yield and salt load will be affected by land-use change will need to consider groundwater response times.

Groundwater Response

A focus of the work on 'Salt delivery to streams' (Task 6) is the prediction of groundwater system response to recharge changes. This work is developing ways of predicting the timing of the response of a particular groundwater system to changes in recharge. A dimensionless similarity parameter (G) has been derived, which is a way of combining groundwater system attributes into a single factor. The G parameter can be visualised as the ratio of the total catchment recharge to its mean discharge capacity. The aim is to use G as part of a method for predicting variation in response times between different groundwater flow systems using available data.

Connection to Streams

In the final stage of this task the different connections between groundwater systems and streams will be investigated. This work will determine under what conditions most of the salt load is making its way into streams (e.g. high flows, low flows). Gauged data and flow-salinity relationships will be analysed as part of an approach to categorise broad types of connection. Examples of categories may include deeply incised streams with high baseflow components, and small upland systems where surface runoff is more important. This work will also include modelling work, investigating the behaviour of different connections.

Summary

This project aims to provide linkages between surface hydrology and stream salt load. It will provide greater confidence in catchment scale predictions of stream salt load, using available data. We are trying to provide realistic answers to questions about the magnitude and location of land-use change needed to manage stream salt loads, and the length of time it will take for this change to occur.

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Report by Bofu Yu

Project 2.2: Managing pollutant delivery from dryland upland catchment

Key climate data requirements for runoff, sediment and pollutant predictions

One of the primary objectives of Project 2.2 is to develop and test algorithms and models to predict runoff, sediment and sediment-related pollutants from upland catchments. It is widely documented that at the hillslope scale, runoff rate (as distinct from runoff amount) is absolutely crucial to predicting sediment and pollutant concentrations. Runoff rate is important because commonly used predictors, such as velocity, shear stress and stream power, are all related to runoff rate rather than runoff amount.

It follows that data on observed or stochastically generated rainfall intensities at sub-daily time scales are essential to drive models for predicting sediment and pollutant generation from upland catchments.

In this brief note, we report the considerable effort within Project 2.2 to quality-control historical climate data for six sites in NSW for model validation and to prepare parameter values for a stochastic weather generator for 42 sites around Australia.

Climate data requirements

We have identified the following seven variables as key climate data requirements:

- Daily rain (mm)
- Rain duration (h)
- Peak rain intensity (mm/h)
- Time to peak intensity (h)
- Maximum daily temperature (°C)
- Minimum daily temperature (°C)
- Daily solar radiation (MJ/m^2)

Analysis of historical weather data

Historical weather data were analysed to prepare these seven daily variables on a continuous basis for about 40 years for each of the six sites in NSW, namely Inverell, Gunnedah, Wellington, Cowra, Wagga Wagga and Scone. For rainfall data, we compared daily readings of the rain gauge and digitised pluviometer charts, and then compared the on-site daily data with those from nearby sites. Missing pluviograph data and incorrect dates have been a recurring problem for all sites. We had to re-align

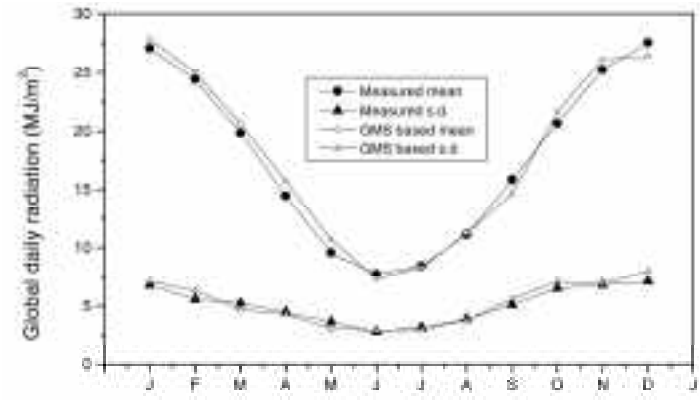

Figure 2.1 A comparison of radiation statistics between GMS based estimates and ground measurements for Wagga Wagga

Figure 2.2 CLIGEN validation sites in Australia for runoff, sediment and pollutant prediction

CANBERRA TECHNICAL SEMINAR

Linking nitrogen cycling and export with variable source area dynamics in forested and urbanising catchments

by

Prof. Larry Band

Department of Geography
University of North Carolina

30 July 2001

10:45am for a
11:00am start

Tea/Coffee and biscuits on arrival

Conference Room, C.S. Christian Laboratory
CSIRO Land and Water
Black Mountain Laboratory
Canberra (Clunies Ross Street, Acton)

For further information visit www.catchment.crc.org.au/events or contact Tanya Jacobson on 02 6246 5746

NEW EVAPOTRANSPIRATION AND RAINFALL MAPS FOR AUSTRALIA

Where to get them!

The CRC for Catchment Hydrology and the Bureau of Meteorology have recently completed a project to produce national maps of evapotranspiration for Australia.

The map set is now available for $33 plus postage and packaging.

They can be purchased from:

1. **Publications Section, 9th floor, 150 Lonsdale St Melbourne. tel: 03 9669 4000 (main switch) and ask for Publications**

OR

2. **Bureau Regional Offices (all capital cities) Contact details for each Regional Office are available at http://www.bom.gov.au/inside/contacts.shtml**

Information about the climate atlas map sets and the digital map data sets can also be obtained from: National Climate Centre Ph: 03 9669 4072 Email: webclim@bom.gov.au

Technical queries about the evapotranspiration modelling can be referred to Dr Francis Chiew at The University of Melbourne email f.chiew@civag.unimelb.edu.au

Any technical queries about the mapping should be referred to Graham de Hoedt tel 03 9669 4714 email: g.dehoedt@bom.gov.au

some of the daily or pluviograph data and patch up about 2 to 7% of the missing pluviograph data for these sites. For daily temperatures, historical data were reasonably complete with only about 2-3% missing. Missing values since 1957 were patched up with data from the Data Drill developed by the Queensland Centre for Climate Applications. Solar radiation data were not widely available, and they had to be generated stochastically. The mean and standard deviation of daily solar radiation for each of the sites was estimated using visible spectrum data from geo-stationary meteorological satellites (GMS) (http://www.bom.gov. au/sat/GMS/paper1GMS.shtml). For Wagga Wagga, where ground measurements of global radiation were available, Fig. 2.1 shows that GMS based estimates fit ground measurements quite well. The historical weather data for these six sites will play an important role in testing the algorithms and models for runoff, sediment and pollutant models.

Generating weather variables

To meet climate data requirements for applying the prediction models to large areas, we intend to develop the capacity to generate the above-mentioned weather variables for sites without comprehensive weather data. We have carefully selected 42 sites with four to five sites in each of the major climatic zones in Australia (Fig. 2.2). We have also prepared all the necessary input parameter values for these sites so that a climate data generating model (CLIGEN) can be tested. CLIGEN can stochastically generate a comprehensive range of daily weather variables including those mentioned above (Nicks et al., 1995; see also http://horizon.nserl.purdue.edu/Cligen/). Recent work has shown that CLIGEN can be used to generate the required climate input to predict runoff and soil loss when compared with using historical climate data (Yu, 2000).

Features of climate generating model - CLIGEN

In comparison to some of the more recent models for generating sub-daily rainfall intensities, the algorithm in CLIGEN is rather unsophisticated. What is unique about CLIGEN, however, are the range of variables generated, and simple statistics as model parameters. More importantly, there is also a vast parameter database so that CLIGEN can be readily used and tested. The more complicated models, some of which have been developed here in Australia, are rarely calibrated and tested for more than half a dozen sites, and use of the models beyond the original developers is even rarer still.

Simulating sub-daily rainfall – a challenge

Continuous daily weather data since 1957 are readily available for any location around Australia. Daily rainfall, maximum and minimum temperature, solar radiation, evaporation and vapour pressure can be extracted easily through the Data Drill (http://www.dnr.qld.gov.au/silo/datadrill_frameset.html). These spatially interpolated data sets capture much of the climate variability across the continent. Given that daily climate data no longer constrain the applicability of prediction models anywhere in Australia, one is understandably led to argue that the real challenge is to develop the capacity to simulate sub-daily rainfall intensities for a range of climate environments so that models to predict runoff, sediment and sediment-related pollutants can used widely.

What is reported here are the activities within Project 2.2 that attempt to meet this challenge.

Reference:

Nicks, A.D., Lane, L.J., and Gander, G.A. (1995). Weather generator. In 'USDA-Water Erosion Prediction Project: Hillslope Profile and Watershed Model Documentation'. NSERL Report No. 10. (Eds DC Flanagan and MA Nearing)

Yu, B. (2000) Improvement and evaluation of CLIGEN for storm generation. Transactions of the ASAE 42, 301-307.

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PROGRAM 3
SUSTAINABLE WATER ALLOCATION

Program Leader
JOHN TISDELL

Report by John Tisdell

Irrigator and community attitudes to water reform: A comparison of the Fitzroy and Goulburn Broken catchments

Background

The first phase of CRC Project 3.2: 'Enhancement of the water market reform process – a socio-economic analysis of guidelines and procedures for trading in mature water markets' is to gather information on the nature of water markets and to provide input into water policy development to enhance water trading in the Fitzroy and Goulburn Broken catchments. While these catchments have quite different climates, hydrology, farming practices and social characteristics, water managers in both catchments have to meet national water reform policy objectives. The analysis in this project aims to provide comparative insights into general opinions and expectations of irrigators across these catchments.

Attitudes to water reform

The study found that respondents in the Fitzroy and Goulburn Broken catchments are generally supportive of water reform, but the community at large has been poorly informed in the reform process. Within the reform agenda, opinions and attitudes were sought on issues of water pricing, the definition of water rights, and the notion of trading such rights. Overall, there is indifference among respondents to full cost pricing. The mean and distribution of responses, however, differ significantly between catchments with Fitzroy respondents less supportive of full cost pricing than Goulburn Broken respondents.

Breaking the link between water rights and land

The results of the survey suggest that there is overall agreement that the nexus or link between land and water should be broken and water rights be traded as chattels separate to land. Issues in the definition of the water right itself include the status of water for the environment, the rights to on-farm runoff, and the rights to sleeper and dozer licences. Overall, setting aside water for the environment prior to allocating it for irrigation use is supported, and is stronger among Fitzroy respondents than Goulburn Broken respondents. Respondents from both catchments reject licensing on-farm runoff and are indifferent to the notion of extinguishing sleeper and dozer licences.

Definition of water rights

Changes to the definition of rights to water include issues of security and certainty of supply. The results suggest that irrigators overall believe that water entitlements will be more secure and have higher reliability following the reform process. Comparing catchment respondents, Goulburn Broken irrigators indicated more support of the notion that the water reform process will lead to more secure and reliable water supply than Fitzroy irrigators did.

Views on water reform objectives and community values

The reform objectives of maximising the income generated from available water supplies, ensuring an equitable and fair distribution of water, meeting environmental flow requirements, and accounting for local economic and social impacts are likely to either be in conflict or not achievable simultaneously. Maximising the return from water, measured in terms of aggregate farm income, is the most commonly used measure of the Council of Australian Governments (COAG) water reform success. Setting priorities for this objective appears to be at odds with the opinions of catchment communities. The results of this study suggest that the catchment communities consider social justice objectives more important than maximising aggregate farm income. In the Fitzroy catchment (see catchment report) the irrigators, who have self-interest in maximising farm income, ranked social justice and environmental objectives statistically higher than maximising farm income.

Market size – number of traders

The number of buyers and sellers in the market will in part depend in part on who is allowed to trade. Constraints on such rights may be spatial, sectoral or use related. On the whole, there is strong support for free trade within and between sectors. This includes trade between irrigators, local towns and communities and local shires, but not with individuals or companies who do not intend to use the water. Respondents in the Fitzroy catchment are generally less supportive of trade, be it between irrigators or between irrigators and towns for non-domestic use, than Goulburn Broken respondents, but more supportive of allowing local councils to buy water for recreational use.

NEW WATER ALLOCATION RESEARCH REPORTS

Two new reports from the Sustainable Water Allocation Program are now available.

IRRIGATOR AND COMMUNITY ATTITUDES TO WATER ALLOCATION AND TRADING IN THE GOULBURN BROKEN CATCHMENT

by
John Tisdell
John Ward
Tony Grudzinski
Geoff Earl

Report 01/3

IRRIGATOR AND COMMUNITY ATTITUDES TO WATER ALLOCATION AND TRADING IN THE FITZROY CATCHMENT

by
John Tisdell
John Ward
Tony Grudzinski

Report 01/2

These reports describe the results and findings of a survey of irrigator's and community members attitudes to COAG reforms in the Goulburn Broken and Fitzroy catchments respectively.

The cost of $27.50 includes postage and handling and GST in Australia.

For further information contact Virginia Verrelli on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

WATER SENSITIVE URBAN DESIGN

WATER SENSITIVE ROAD DESIGN - DESIGN OPTIONS FOR IMPROVING STORMWATER QUALITY OF ROAD RUNOFF

by

Tony Wong
Peter Breen
Sara Lloyd

Report 00/1

This joint publication with the CRC for Freshwater Ecology investigates opportunities for incorporating stormwater quality improvement measures into road design practices for protecting aquatic ecosystems.

Copies of the report are available from the Centre Office for $27.50 (includes postage and GST).

Please phone Virginia Verrelli on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

Temporary versus permanent water markets

Overall there is agreement that in the future water would become a chattel and be traded, but rejection of the notion that a farm's water entitlement would no longer be an inherent asset in farming. This suggests that the current emphasis on the temporary, rather than the permanent, water market will continue. Irrigators generally discriminate between high security and general security water and expect to pay more for high security water in the future - Goulburn Broken irrigators being more supportive of the notion than Fitzroy irrigators. This price differential suggests that there may in fact be a split market for different security levels in the future.

Goulburn Broken and Fitzroy irrigators see a surplus of water, as opposed to the opportunity value of water, as the main reason why others sell water in the permanent market. This result questions, beyond redistributing surplus water, whether the permanent market is yet to result in real structural change in the crop mix of individual farmers. Furthermore, if the water offered for sale has not been used for some years, the entitlement to that water may have been deemed a 'sleeper'. Re-activation of sleeper licences could jeopardise the security of supply of all water users.

Future significance of water trading

There is overall agreement that trade will become significant in the future and have a significant influence on agriculture and improve farm income. There is also overall agreement that trade is likely to be limited, occur within a region, impact on the water supply of farmers in other regions, significantly impact on the environmental health of rivers, and be dominated by a few large players.

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PROGRAM 4
URBAN STORMWATER QUALITY

Program Leader
TONY WONG

Report by Tim Fletcher, Lucy Peljo and Jodie Fielding

Grass Swales for Stormwater Pollution Control

The Stormwater Treatment Train

It is widely accepted that best practice management of urban stormwater involves an integrated range of structural and non-structural approaches. Within the range of structural approaches, the need for a 'treatment-train' approach is also acknowledged.

The idea of a treatment train is to tailor the stormwater quality improvement device to the catchment and stormwater pollutant characteristics. Ideally, in areas of new development ("greenfields"), the sequence of treatment measures is designed to ensure that the majority of pollutants are removed at or near source. This approach, which is an integral component of Water Sensitive Urban Design, integrates stormwater treatment facilities into the broader landscape design, in such a way as to provide amenity, recreational and aesthetic benefits.

The Role of Swales

Vegetated swales are becoming a common feature of Water Sensitive Urban Design developments. In simple terms, a vegetated swale is a strip of grass (or rushes etc) acting as a shallow drain to receive runoff from adjacent impervious areas (e.g. roads). The swale acts to remove pollutants (particularly particulate pollutants), and to attenuate flows.

Lack of Performance Data

Despite their increasing popularity, there is very little information available about the performance of vegetated swales, particularly in Australia.

The CRC for Catchment Hydrology's new Model for Urban Stormwater Improvement Conceptualisation (MUSIC) allows users to assess the performance of alternative stormwater treatment strategies (refer to *Catchword* No. 92, March 2001). MUSIC models the performance of vegetated swales, as part of its Unified Stormwater Treatment Module. Calibration of this model has been conducted using data from an extensive worldwide literature review, and in particular, detailed experiments conducted at the University of Texas (Walsh, Barrett et al. 1997; Barrett, Walsh et al. 1998). There is a need, therefore, to refine the application of this model, using data from Australian conditions.

Industry Collaboration

Brisbane City Council operates an extensive monitoring

Figure 4.1.Constant-head tank and inlet weir.

Figure 2. Swale during simulated flow event.

program on the performance of stormwater treatment measures throughout the Brisbane area. They are also a 'test-site' for the new MUSIC software, and are therefore keen to incorporate local performance data into its application in Brisbane. Brisbane City Council teamed up with CRC researchers to design an experiment which could improve the prediction of swale performance, and improve the future design of vegetated swales in Brisbane.

Experimental Design

The experiments were undertaken on a recently-constructed grass swale at the Pinjarra Hills Estate, 15 km south-west of Brisbane. A constant-head tank, discharging through a v-notch weir (*Figure 4.1*), was used to achieve steady-state flows, ranging from 2L/s up to 15L/s. The experiments were undertaken over a 65 m long stretch of the swale (*Figure 4.2*). Inflows to the swale were dosed with a synthetic mix of pollutants, matched to typical stormwater characteristics in the Brisbane area (Total suspended solids (TSS) = 150 mg/L, Total nitrogen (TN) = 2mg/L, and Total phosphous (TP) = 0.3mg/L). Water quality samples were taken at the inlet, outlet and three points along the swale.

Results

Figures 4.3 and *4.4* show the results for total suspended solids at four sites along the length of the grass swale, for flows of 2 L/s and 15 L/s respectively. *Figure 4.5* shows total phosphorus concentration over the length of the swale, for the 15L/s flow. The concentrations shown are 'event mean concentrations', being the average concentration during the 'dosing period' at each sampling station.

The results showed substantial reductions in pollutant concentration over the length of the grass swale. Reductions in the concentration of pollutants over the full length of swale monitored (65 m) were as follows:

Total suspended solids

- 73% to 95% for TSS: The highest removal occurred at 2 L/s, but decreased with increasing flow (refer to *Figures 4.3* and *4.4*). Since TSS removal is largely a result of physical processes (sedimentation and filtration), velocity and detention time are critical factors. Design of swales must therefore consider the design flow-range, in order to ensure optimum performance.

Total nitrogen

- 27% to 44% for TN: No relationship was observed between the percentage removal and the flow rate. This suggests that the mechanisms of nitrogen removal are not dominated by physical processes (since much of the nitrogen is in the soluble form), but instead by biochemical processes. Further investigation into the behaviour of the various species of nitrogen is needed, to verify these findings.

VICTORIAN FLOOD CONFERENCE

The next Victorian Flood Management Conference is being held in Traralgon from 10–12 October 2001. The conference, which is held only once every two years, is being hosted by the West Gippsland Catchment Management Authority and Latrobe City Council.

The theme for the conference, Planning for the Inevitable, is intended to highlight the importance of planning to good floodplain management.

If you would like to be placed on the mailing list for conference information, please contact the Chairman of the conference organising committee, Wayne Gilmour, on telephone (03) 5175 7800 or email wayneg@wgcma.vic.gov.au

THIRD AUSTRALIAN STREAM MANAGEMENT CONFERENCE

All the updated details about the conference and how to register are available on-line at the Stream Management Conference home page

www.catchment.crc.org.au/streamconference

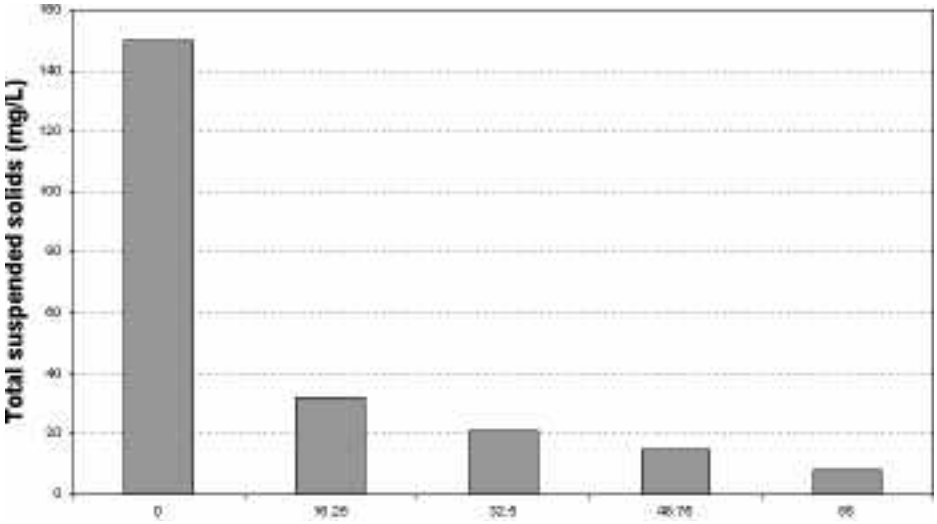

Figure 4.3 Reduction in TSS event mean concentration along length of swale, for 2L/s flow.

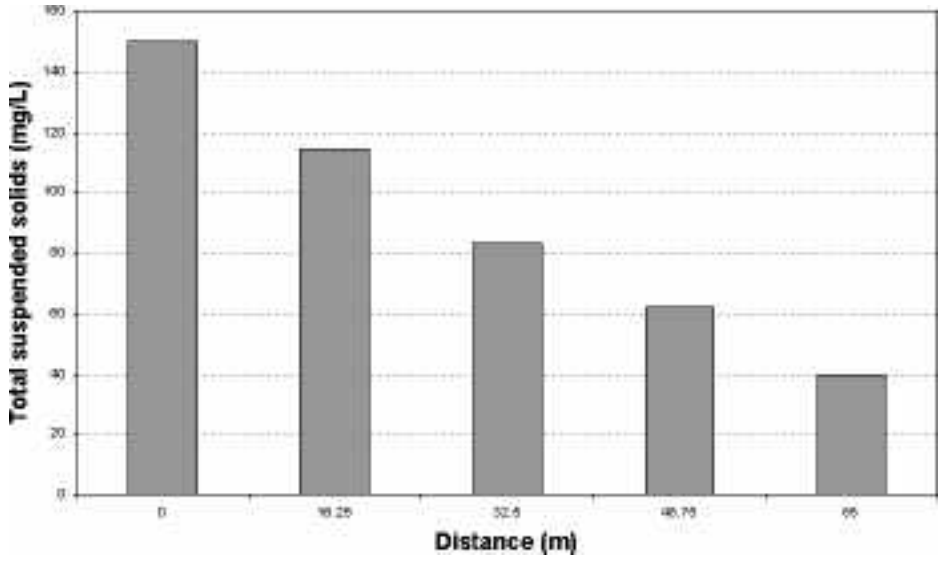

Figure 4.4 Reduction in TSS event mean concentration along length of swale, for 15L/s flow.

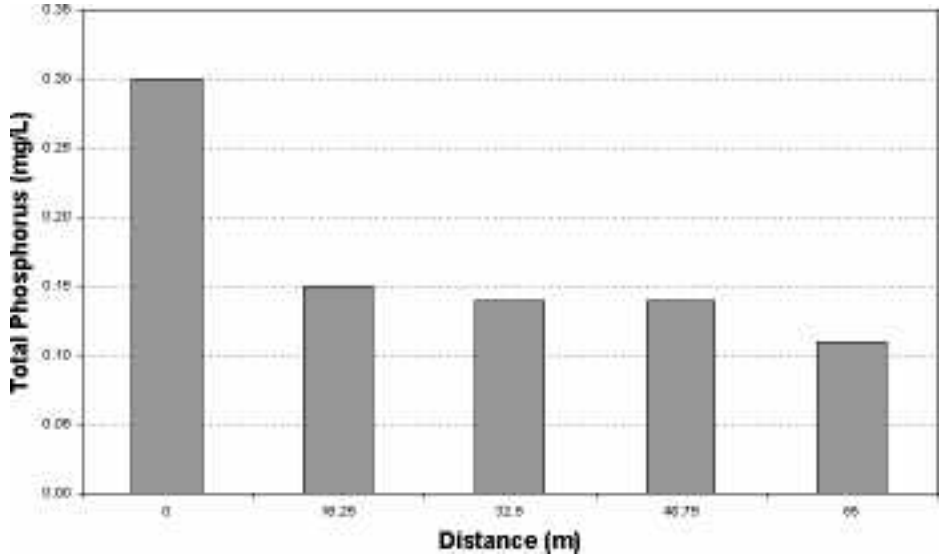

Figure 4.5 Reduction in TP event mean concentration along length of swale, for 15L/s flow.

Total phosphous

- 57% to 73% reduction for TP: Little relationship between removal and flow rates for TP was found, which may be a reflection of the fine particles to which the soluble phosphorus has attached. Changes in flow rate will not affect sedimentation of these fine particles as much as it would for coarser particles. Further investigation, centred on transformations between the various species of phosphorus, is required.

Implications and Future Investigations

The results of these experiments are very encouraging, and suggest that vegetated swales have great potential for stormwater quality improvement, particularly adjacent to roads and other linear impervious areas. Further investigations will study the impact of changing design parameters (vegetation type, density and height, detention time, hydraulic loading, slope and infiltration capacity) on pollutant removal performance. Future investigation will also attempt to understand the chemical processes occurring in the swale, such as the transformation between soluble and particulate forms of phosphorus and nitrogen. The aim of these investigations is to refine the design specifications for grass swales, and thus improve their performance.

Conclusions

These experiments have confirmed the effectiveness of swales in achieving at-source and in-transit removal of stormwater pollutants. Importantly, the experiments have provided some local Australian data on which the prediction of vegetated swales can be based. The CRC for Catchment Hydrology hopes to be able to calibrate models of all stormwater treatment measures - swales, buffer strips, infiltration systems, bio-filtration systems, wetlands, sediment basins and ponds, with local empirical data.

Such an achievement will not only improve our understanding of the role and behaviour of stormwater treatment measures, but also help to facilitate best practice in their design.

References:

Barrett, M. E., P. M. Walsh, J. F. M. Jr and R. J. Charbeneau (1998). "Performance of vegetative controls for treating highway runoff." Journal of Environmental Engineering 124(11): pp 1121-1128.

Walsh, P. M., M. E. Barrett, J. F. Malina and R. J. Charbeneau (1997). Use of vegetative controls for treatment of highway runoff. Austin, Texas, Center for Research in Water Resources, Bureau of Engineering Research, The University of Texas: 115pp.

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PROGRAM 6
RIVER RESTORATION

Program Leader
IAN RUTHERFURD

Report by Bob Keller and Lindsay White

Fishways Research and the Third Australian Technical Workshop on Fishways

Fishways Project

Within the river restoration program, there are two projects covering fishways – Project 6.5: 'Hydraulics and performance of fishways in Australian streams' and Project 6.8: 'Research to improve the effectiveness of Australian fishway design'. The latter project is an associated project funded jointly by Agriculture, Fisheries and Forestry – Australia (AFFA) and the CRC.

New Postgraduates and their work

Since last reporting, two Master's students have joined the fishway program – Andrew Barton, enrolled for an MEngSc in the Department of Civil Engineering and Peter Kolotelo, enrolled for an MSc in the Department of Biological Sciences, also at Monash.

Andrew's work will centre around the use of a generic three-dimensional numerical model called FLUENT. The model will be used to provide a predictive capability for velocities and turbulence levels and their spatial variations within fishways. The model will be verified using laboratory and field data obtained from vertical slot fishways by Lindsay White over the last twelve months. The final outcome will be the ability to design a fishway to provide a given set of hydraulic characteristics, known to be those preferred by given fish species. That is where Peter comes in!

Little is currently known about the preferred hydraulic conditions for migrating Australian fish. Peter will be investigating stress levels in fish passing through fishways. The stress levels will be analysed by physiological studies of fish extracted below, within, and above fishways. Peter is currently refining the necessary experimental methods in the laboratory before commencing field investigations in August/September 2001.

We welcome both students to the project.

Technical Workshop on Fishways

An important activity for Project 6.8 is convening the Third Australian Technical Workshop on Fishways, to be held on the Sunshine Coast on 30 and 31 August 2001. This workshop is particularly timely within the context of the recent announcement to fund construction of fishways on all weirs between the Hume Dam and the sea.

NEW RIVER RESTORATION PROGRAM SHEET

Printed versions of the recently completed River Restoration Program Sheet are available from the Centre Office.

The brochure describes the rationale and key elements of the CRC's River Restoration Research led by Dr. Ian Rutherfurd.

Readers will find information on the Program's target problems, research objectives, expected outcomes and contact details for project leaders.

Copies are available by contacting Maeve or Jill at the Centre Office on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

THIRD AUSTRALIAN TECHNICAL WORKSHOP ON FISHWAYS

Novotel Twin Waters Resort
Maroochydore, Queensland

30-31 August 2001

The two day workshop follows the Stream Management Conference and River Festival.

The workshop theme is 'Innovations in biological and hydraulic research on fishways, and building linkages between the two'.

For further information visit
http://www.monash.edu.au/oce/fishways/

or contact

Irene Thavarajah
Conference Management Office
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The workshop will include 20 papers from Australian and New Zealand fishways specialists. The workshop features a short course to be presented by Dr. Chris Katopodis, an internationally known fishways expert from Canada. His course will include training material on Diverse Designs, Fish Speeds, Fishway Hydraulics, and Fish Screens.

Plenary addresses will be given by Dr. Katopodis (Visions of Future Fushway Research) and Dr. John Harris.

The papers accepted for presentation are grouped in the following sessions:

- The Management Perspective
- Monitoring and Research
- Fishway Innovations
- Site Specific Examples
- Future Directions

Four papers are being presented on work carried out within our program by CRC for Catchment Hydrology personnel as follows:

- Response of fish to hydraulic stimuli within Yarrawonga fish lock, (White and Keller)
- Findings of Australian and overseas surveys on fishways, (White, Katopodis, Keller, Harris, and Rutherfurd)
- Temporal patterns of fish passage through Torrumbarry Fishway, (White and Henderson)
- The Influence of Rock Ramp Fishways on the Hydraulic Characteristics of Weirs, (Haupt and Keller)

So, for those attending the Third Australian Stream Management Conference, why not spend a couple of days extra on the Sunshine Coast exploring one of the most interesting challenges in water resource management: allowing indigenous migratory fish to pass weirs.

Details on the workshop are available on the following website www.monash.edu.au/oce/fishways. The cost of attendance is subsidised by AFFA, so it is a bargain!

We hope to see as many CRC folk there as possible.

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Lindsay White
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PROGRAM 7
COMMUNICATION AND ADOPTION

Program Leader
DAVID PERRY

Report by Carolyn Young

The Murrumbidgee Focus Catchment

The CRC's Business Plan states that the major performance indicator for the CRC for Catchment Hydrology is the level of adoption of research outcomes. It describes the five focus catchments - the Fitzroy, Brisbane, Murrumbidgee, Goulburn Broken and Yarra catchments – as key targets for the focus and delivery of the CRC's research to demonstrate the integration of the research programs and to realise the holistic view of catchments desired by users.

Planning for the CRC – strategic issues

The CRC's research agenda resulted from intensive dialogue between research, management, policy and technical representatives in both land and water industry and research groups. This collaborative planning resulted in a successful application for a new CRC which included the focus catchment model. The process involved a high degree of strategic planning with CRC Parties taking a long-term view in an attempt to address future research needs. In contrast, many stakeholders of the CRC research in the focus catchment want their research needs met now or preferably yesterday! This adds to one of the challenges that all CRC's face when communicating their research and seeking adoption.

Planning for the Murrumbidgee – incorporating catchment issues

In planning for the focus catchment's role, there was limited direct communication between the CRC researchers and end-users in the Murrumbidgee - the research programs and projects were in an advanced planning stage by the time the Murrumbidgee Focus Catchment concept became a reality. Consequently, the first task from a focus catchment perspective was to ensure the CRC research teams were aware of the issues that Department of Land and Water Conservation (DLWC) staff were dealing with at the Murrumbidgee catchment level. Then we could collectively identify the research gaps and ensure that the CRC's research covered these gaps as much as possible. Addressing these has resulted in a reasonable match between the CRC's research and the priorities in the Murrumbidgee catchment.

Supporting the focus catchment model in the Murrumbidgee

To help make the focus catchment model work in the Murrumbidgee a number of initiatives were implemented:

- An email list of DLWC staff interested in the CRC's research was created to regularly communicate the CRC's activities to DLWC staff.
- Focus groups for each CRC Program have been established to enable discussion and quick feedback on research projects and their progress. The feedback is delivered directly to the Project Leader and the project review panel.
- For each CRC Program (and sometimes project), a list of key researchers, contacts and stakeholders in DLWC was compiled and passed on to the CRC Program Leader. These lists aim to encourage CRC researchers to contact DLWC staff and discuss their projects and associated communication strategies directly with potential end-users.
- DLWC staff have been directly involved in the CRC research. This should increase the likelihood of the CRC research meeting industry needs and reduce the time for adoption.

Examples of Success

Most of the CRC research projects align with the research needs of the Murrumbidgee and DLWC. An apt example is Project 2.1: 'Sediment movement, water quality and physical habitat in large river systems'. Project 2.1 is starting to produce results, which will help DLWC and the Catchment Management Board with targeting management actions to achieve the water quality (sediment and nutrient) targets.

Similarly, Sustainable Water Allocation Program Leader John Tisdell recently delivered a seminar to Murrumbidgee DLWC staff on his survey results, 'Irrigator and community attitudes to water reform in the Murrumbidgee catchment'. John's presentation was at an excellent time as the Department is currently assisting the Water Management Committees with developing Water Sharing Plans. These plans set out the water allocation and environmental flow rules.

Observations and suggestions for increased effectiveness

From a Focus Catchment Coordinator's point of view there are a number of actions that will result in a more effective Murrumbidgee focus catchment model:

- Increased integration between CRC Projects will make it easier for Focus Catchment Coordinators to communicate and market research activities and outcomes. Where the CRC research has linkages or overlaps with other research institutions, researchers should consider doing joint communication activities in the focus catchments to avoid overloading stakeholders with information.
- To date, the CRC's research communication to Murrumbidgee stakeholders has been largely opportunistic. The Communication and Adoption Plans that are being developed in conjunction with industry Parties should provide a more strategic and effective approach to communication.
- We are learning that many of the CRC's potential end-users are not based in the Murrumbidgee. In NSW, the Focus Catchment Coordinator has a larger statewide role in facilitating the CRC's research communication and adoption.
- In general the CRC project teams who regularly update and inform key stakeholders have experienced greater confidence and support from industry Parties.
- The commitments of DLWC staff, combined with the commitments of CRC staff, mean that effective communication can fall second place to more immediate work pressures. Therefore as communicators of research, we need to be succinct and targeted with our messages.

The focus catchment concept is still in its infancy and we are continuing to revise and improve the way in which we relate and communicate our research to stakeholders in the catchment and beyond. I look forward to reporting on more successes in my next update on the Murrumbidgee Focus Catchment and NSW.

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CRC COMMUNICATIONS REVIEW

Thank you to all those Catchword readers who participated in the recent review of the CRC's communication activities.

The executive summary of the review report is available online at http://www.catchment.crc.org.au /commreview.shtml

Further information about the communication review outcomes is available from David Perry tel. 03 9905 9600 or email david.perry@eng.monash.edu.au.

Over the next few weeks, the Communication Review subcommittee will review the reports recommendations and begin implementing the highest priorities.

The biggest river event in Australia since the Cretaceous!

Monday 27 - Wednesday 29 August 2001
Hilton Hotel, 190 Elizabeth Street, Brisbane, Queensland

THE CONFERENCE

The Conference is, from a scientific perspective, the nation's premier stream management event. Held every two years, the conference encourages scientists and practitioners to share their findings with a broad audience of researchers, educators, policy makers, regulators, advisors, community facilitators and stream users. The focus is on credible science and practical learnings from the fields of ecology, hydrology, geomorphology, water quality, sociology and economics.

THE THEME

The theme is **The Value of Healthy Streams**. How highly do we, as a society, value our stream systems? We, and future Australians, may be faced with massive costs to rehabilitate our streams if we want to reinstate some of the lost values. So how do we do things better? The conference will explore these questions through oral and poster presentations in four technical streams –

Ecosystem services – how do we quantify the values that healthy riverine ecosystems provide to humans (water quality, flood mitigation, sustainable fishery resources, stable bed and banks, etc) and to other ecosystems (on floodplains, in estuaries, etc)? This stream's keynote presenter is Dr Steve Cork of CSIRO Sustainable Ecosystems

Hydrological connectivity – how do we value the important linkages between the various hydrologic elements (streams, floodplains, estuaries and ground water) and what role do these connections play in regard to stream health? This stream's keynote presenter is Don Blackmore, Chief Executive of the Murray Darling Basin Commission

Bio-physical integration – how are the physical and biological aspects of stream systems inter-connected and how is the connection reflected in our planning and action? This stream's keynote presenter is Assoc. Prof. Martin Thoms of the University of Canberra

Tools and techniques – what are the latest developments in science that will assist us to better plan and manage our stream systems in a cost effective way? This stream's keynote presenter is Professor Sam Lake from Monash University, a community ecologist with an interest in freshwater systems.

International perspectives will be provided by Prof. Jim Salzman of American University, an expert in ecosystem services and Sandra Postel, a former White House environment adviser.

REGISTRATION FEES

	Regular	Discounted*
Full (3 days)	$480	$340
Daily (Monday or Tuesday)	$150	$115
Daily (Wednesday)	$220	$220

All registrations received after Monday 6th August will attract a $50 late fee.

Fees are payable at time of registration.

* Discounted registration fees apply to full-time students and members of volunteer-based organisations (such as Landcare and WaterWatch).

SOCIAL PROGRAM

Happy Hour – 6:30pm, Sunday 26th for delegates to pre-register and catch up with friends over a drink and finger food. The cost is included in the full registration fee – extra tickets $30 each.

Conference Dinner – 7:30pm, Monday 27th at the Hilton Hotel, including wine, food and entertainment. The dinner is not included in the registration fee. Cost is $85 per person.

River *prize* – 6:00pm, Wednesday 29th at the Brisbane City Hall to witness the awarding of prizes for outstanding international and national river management achievement. This function is free.

River *feast* - 7:30pm, Wednesday 29th, the famous "dinner on the bridge" with food, drinks and roving street theatre. The dinner is not included in the registration fee. Cost is $120 per person.

OPTIONAL TOURS

North Queensland Rivers Tour – 8:00am, Cairns Saturday 25th and returning to Brisbane on Sunday afternoon, will look at high-energy stream systems in the Wet and the Dry Tropics, such as Tully, Herbert and Burdekin - some real rivers! The tour will include coach, meals and twin-share motel accommodation on Saturday evening. It does not cover air travel to Cairns or return to Brisbane. Tour cost is $250.

Whitsunday Rivers Tour – 8:00am, Mackay Saturday 25th and returning to Brisbane on Sunday afternoon, will look at high-energy stream systems in the Whitsunday region, such as the Pioneer, Proserpine and Don. The tour will include coach, meals and twin-share motel accommodation on Saturday evening. It does not cover air travel to Mackay or return to Brisbane. Tour cost is $230.

Post-Conference Day Tours – 8:00am Brisbane CBD, Thursday 30th. Four tours are on offer, each costing $45 per person (including lunch and teas) –

- Sunshine Coast – to look at stream systems north of Brisbane along the Noosa – Caloundra (Sunshine) Coast, including hinterland streams such as the upper Mary.
- Brisbane Valley - to look at stream systems west of Brisbane in the upper Brisbane Valley.
- Darling Downs - to look at stream systems around Toowoomba, at the headwaters of the Murray Darling Basin.
- Gold Coast - to look at stream systems south of Brisbane, including Gold Coast hinterland streams such as the upper Logan.

REGISTER NOW

Delegates are urged to register as soon as possible because the number of registrations available is capped due to venue constraints. There will also be constraints on accommodation and air travel that week due to Brisbane hosting the 2001 Goodwill Games and the River*festival*.

Register either **on-line** (via **www.catchment.crc.org.au/streamconference**) or by fax or mail (contact the Convenor for a registration form or download one from the website).

ACCOMMODATION

A limited number of rooms have been tentatively reserved at several hotels in the Brisbane CBD for delegates. The price for these rooms range from $74 to $235 per night, which is significantly below market rates expected during that week. Book now!

ASSOCIATED EVENTS

River *symposium* (29 – 31 August, Hilton Hotel) – will address broad management issues, such as cultural connections, river frontage use, institutional arrangements and investment strategies. Links with the conference on Wednesday 29th. Visit www.riverfestival.com.au for details.

Third Australian Fishways Technical Workshop (30 - 31 August, Maroochydore) - will address issues related to the design and operation of fishways to provide fish passage over stream barriers such as weirs and barrages. Visit www.monash.edu.au/oce/fishways for details.

FURTHER DETAILS

For further information on the **conference program, travel, tours and accommodation** visit the conference web site at www.catchment.crc.org.au/streamconference or contact

John Amprimo *Conference Convenor*
Email: stream.conference@dnr.qld.gov.au
Phone: (07) 3224 7668 Fax: (07) 3224 8359

For further information on **how to register for the conference, tours and other events** contact

Rachel Taylor *Conference Registrar*
Email: conference@riverfestival.com.au
Phone: (07) 3846 7444 Fax: (07) 3846 7660
Mail: PO Box 5696, West End Qld 4101

CATCHMENT HYDROLOGY
Department of AGRICULTURE FISHERIES & FORESTRY - AUSTRALIA
Queensland Government Natural Resources and Mines
Natural Heritage Trust
RIVER BASIN MANAGEMENT SOCIETY INC
Environment Australia
Department of the Environment and Heritage

POSTGRADUATES AND THEIR PROJECTS

Our postgraduate for July is:

Dana Thomsen

I arrived in Australia at the beginning of 2000 with a degree in Biological Sciences from Auckland University, a Masters Degree in Environmental Sciences from Canterbury University, and the experience of growing up and working on a New Zealand farm.

My Master's thesis focused on wetland restoration in series to remediate wastewater and enhance wildlife and water quality values simultaneously. The development of scientific and management plans showed me that good science is not enough – a commitment to widespread critical understanding through education is required before science is utilised in a way that benefits the wider community. So to the summer heat of Brisbane I flew. There I worked as a research assistant compiling a web-based directory of all kinds of public participation and natural resource management resources. I then gained a scholarship from Griffith University and the CRC for Catchment Hydrology where I have been fortunate to combine my interest in environmental education with my background in water science.

My PhD project concerns community-based research. I am exploring this as a strategy that can improve catchment quality and empower local communities by developing the kind of social learning that accrues from active participation. This research is based upon two assumptions. The first is that actions detrimental to catchments are embedded in our current ways of life and social institutions. The second assumption, and the focus of this study, is that community-based research can empower communities to seek sustainable alternatives through local participation in science and decision making. Community-based research is viewed as facilitating mutual learning on behalf of the community and established research organisations. It does this by enabling a greater range of information and knowledge to be accessed and analysed, which, in turn, can lead to improved catchment quality.

Community-based research involves people as citizen scientists. A citizen scientist is someone who actively participates in research concerning local issues. This is commonly conceptualised as participation in environmental monitoring, but may involve action at any stage in research - from formulating the questions, to evaluating the answers. My aim is to find ways in which professional researchers and citizens can work together in catchment management. Certainly these groups have different skills, however they both hold valuable knowledge and can meet as equals in order to foster partnerships for collaborative catchment management.

My research approach involves an initial KAP (knowledge, attitude & practice) survey of CRC scientists and agency professionals. Community group members from organisations including Waterwatch, Streamwatch and Landcare within the CRC's five focus catchments will also be surveyed. This will be followed by a detailed case study assessment of several community groups and projects where they have been involved in research partnerships with professional researchers.

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CRC PROFILE

Report by John Coleman

I'm not a scientist – I never wanted to be a scientist – how did I ever get involved in a Cooperative Research Centre? As a somewhat younger person, I wanted to get out of big city life and have an impact on the environment – a career in forestry was the obvious choice. So, there it is - I've "outed" myself to the whole CRC community - I'm one of the growing band of foresters who have infiltrated the CRC community (see Tim Fletcher's profile – *Catchword* June 2001).

After graduating from ANU with a licence to do forestry, I did the business for a few years, but finally tired of butchering and burning native forests, designing and building roads and bridges, poisoning, polluting and generally rampaging through our fragile forest ecosystems.

Instead, I decided to chart a new career as a geek – writing software. So for ten years or so, I wrote software and dabbled in research with various groups within CSIRO – never quite comfortable with the epithet of scientist. Initially I worked on forestry-related projects; native forest growth simulation and then wild-fire-spread simulation software. I moved on to projects involving the simulation of harvesting machine movement and the estimation of the likely impact of alternate forest coupe harvest plans. All the forestry-related projects involved a combination of research and software development.

I decided a couple of years ago that I'd had enough of research, it was time take a slice of the big $$ out there in the software industry and then retire young. So I jumped across to CSIRO Land and Water into a job that promised full-time software development for 12 months – just long enough to give me street cred as a software developer.

Unfortunately, I got interested in the problem domain and shelved the early retirement plan in favour of doing work that I actually enjoy. For the last 12 months, I've been working with the CRC Program 4 team developing MUSIC – the Model for Urban Stormwater Improvement Conceptualisation – with a team from Monash and Griffith Universities.

The near-term future will see me involved with the completion of version 2 of ICMS – the Integrated Catchment Management System – a software product that has been under development within CSIRO for a number of years. I'm confident that ICMS will be a serious contender for the role of THE 'Modelling Toolkit' for the CRC. Any of you who are interested in developing models of catchment behaviour in a simple programming language should have a look at a beta version. It relieves you of the burden of File I/O, provides sophisticated visualisation of data and visualisation of the relationships between entities in a catchment. It's a seriously neat piece of software that, with a bit of polishing, will take the catchment modelling community by storm and leave all others for dead. Unfortunately, I can't take the credit for it – but you'll see me about over the next 12 months singing its praises – it's a great bit of software that's terrific value for money.

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If you would like to reduce the paper on your desk please contact the Centre Office on 03 9905 2704 or email virginia.verrelli@eng.monash.edu.au

Over 1200 people receive Catchword each month.

WHAT'S HAPPENING WHEN?

FIND OUT ABOUT CRC ACTIVITIES BY EMAIL

THE CRC WILL NOTIFY YOU OF AN UPCOMING CRC ACTIVITY IN YOUR AREA OF INTEREST

You can register to receive this information on line at www.catchment.crc.org.au/subscribe

or you can contact Virginia Verrelli at the Centre Office on 03 9905 2704.

WHERE ARE THEY NOW?

Report by Phillip Jordan

I moved from my home town of Brisbane to Melbourne in March 1997 to commence work on my PhD at Monash University. Just over three years later, I submitted my thesis on the Effect on Flood Modelling of Rainfall Variability and Radar Rainfall Measurement Error. By the end of my PhD I also met a wonderful woman in Melbourne, named Kylie, and married her as well!

I really valued the contribution of my supervisors Erwin Weinmann (from Monash University) and Alan Seed (from the Bureau of Meteorology), who guided me through the PhD process of learning how to do research.

As I was concluding my PhD research, I decided that the next challenge that I wanted to tackle was in the consulting industry. After a very short break (to paint the bathroom and toilet of our house), I started with the hydrology group of SMEC Victoria.

During the 15 months that I spent with SMEC, I was fortunate to work on a wide range of projects. These projects included:

- Dam break and consequence assessments for several dams throughout Victoria;
- Assessments of acceptable flood capacity for several dams, including joint probability analysis of storage level and inflow floods;
- Several flood studies, which included both the flood hydrology and one and two-dimensional hydraulic modelling; and
- Designing a flood recognition system for a large dam in north-east Victoria.

However, earlier this year I became aware of an opportunity to continue my career in research. I had the desire to continue my research career by contributing to the development of radar as the rainfall measurement "tool of choice" for operational hydrologists.

I started working as a research fellow in the Hydrology Section of the Bureau of Meteorology in June on a project to test new technologies in quantitative rainfall measurement for the Sydney Basin. The work is under the direction of one of my PhD supervisors, Dr Alan Seed. I am also working in close collaboration with the radar meteorology experts in the Bureau of Meteorology Research Centre (BMRC), Dr Tom Keenan, Dr Peter May and (former CRC postgraduate) Dr Sun Xudong.

The quantitative rainfall measurement project takes advantage of the considerable rainfall data that has been acquired in the Sydney area since just prior to the Olympics, in September last year. Data is available from the two conventional radars that are permanently located at Kurnell and Letterbox, as shown on *Figure 8.1.* (Images from the Bureau's radars are now available to the public in real-time at www.bom.gov.au.)

For the period from September 2000 to June 2001, the BMRC has also had its research radar located at Badgery's Creek. The BMRC research radar is a polarmetric radar, which means that it transmits alternate pulses of radiation that are polarised in the horizontal and vertical planes. The advantage for rainfall rate estimation is that radiation returned by the horizontal and vertical polarised beams indicate the shape of the rainfall drops as well as their size, which can give a more accurate estimate of the instantaneous rainfall rate. It can also assist with other quality control issues, such as identifying ground clutter, correcting for attenuation of the radar beam, and separating regions of hail from rainfall.

We have also obtained rainfall data from over 200 tipping bucket raingauges that are located within the Sydney basin. These will be used for radar calibration and quality control of rainfall data.

The aims of our project are to:

1. Improve techniques for quality control and calibration of radar data in real time;
2. Compare the performance of the three radars for quantitative rainfall measurement and forecasting;
3. Determine the characteristics of the radar hardware that provide the largest benefits for quantitative rainfall estimation;
4. Determine the resulting performance of the radars for hydrological applications, such as real-time flood forecasting and warning;
5. Develop an hourly rainfall estimate field for the Sydney basin that provides an optimum combination of the rainfall data from the three radars and the telemetered raingauge network; and
6. Improve techniques that have been developed for short-term (1 to 2 hour) quantitative rainfall forecasts that are based upon rainfall data.

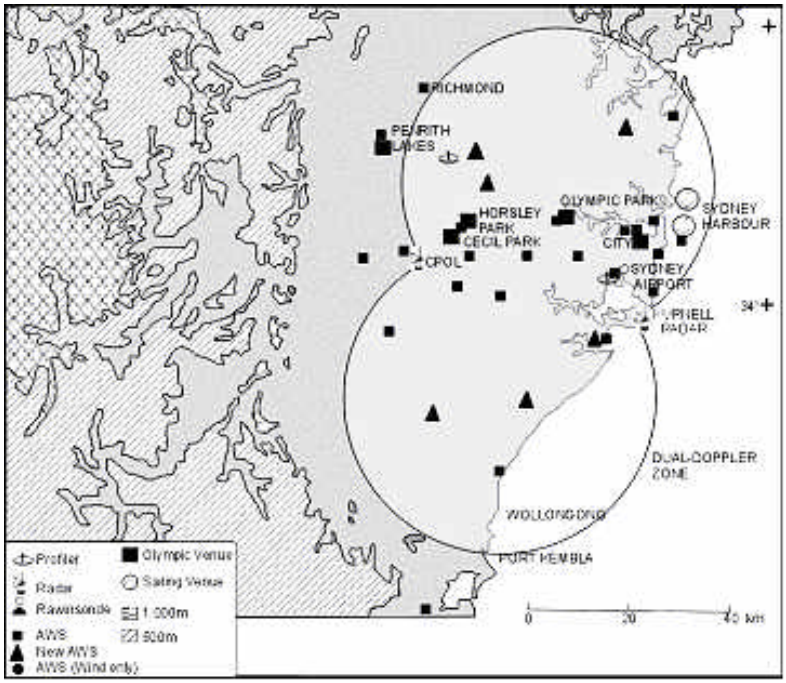

Figure 8.1 Observational network for the Sydney 2000 Forecast Demonstration Project, showing radars at Badgery's Creek (C-Pol) and Kurnell (Keenan et al., 2001)

We are looking forward to improving the usefulness and availability of radar data for rainfall measurement in Australian hydrology. We will keep you informed of our progess over the coming three years of the project.

Reference

T. Keenan, J. Wilson, P.Joe, C. Collier, B. Golding, D. Burgess, R. Carbone, A. Seed, P.May, L. Berry, J. Bally and C. Pierce (2001); "The World Weather Research Programme (WWRP) Sydney 2000 Forecast Demonstration Project: Overview"; 30th Int. Conf. Radar Meteorol., American Meteorol. Soc., Munich, Germany, 19-24 July, 2001.

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UPDATED AWBM CATCHMENT WATER BALANCE MODEL MANUAL

The AWBM is a catchment water balance model developed by Dr Walter Boughton. The model can relate runoff to rainfall with daily or hourly data, and calculate losses from rainfall for flood hydrograph modelling.

Recently Dr Boughton and Professor Russell Mein have updated the AWBM manual to improve its readability and usefulness.

For those who would like to update their manual or learn more about the use of AWBM, the updated versions are on the CRC website at www.catchment.crc.org.au/models

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To deliver to resource managers the capability to assess the hydrologic impact of land-use and water-management decisions at whole-of-catchment scale.

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To achieve our mission the CRC has six multi-disciplinary research programs:

- Predicting catchment behaviour
- Land-use impacts on rivers
- Sustainable water allocation
- Urban stormwater quality
- Climate variability
- River restoration

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