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WATER FRONT

Newsletter of the National Committee on Water Engineering

ENGINEERS AUSTRALIA

In the Pipe NCWE Chairman's Message

This is my last Chairman's message as Chair of the National Committee for Water Engineering. Mark Babister will be taking over as Chair at the Water Down Under Conference in Adelaide.

In looking at the program for the symposium I am impressed at the breadth of work being undertaken in the field of hydrology.

As I step down as Chair of the NCWE I would encourage all those involved in the fields of hydrology and water resources to engage in the activities of the NCWE, be it the conferences, the journal, newsletters or in the many other forums.

I am still very keen to be involved with the NCWE and the many areas of work currently underway, including

- Improving the amount and quality of water data collected,
- Improving the level of hydrology/water resource/groundwater studied, particularly at undergraduate and coursework, and
- Best practice guidelines such as Australian Rainfall and Runoff.

Finally, I would like to wish Mark Babister all the best as the incoming Chair. Mark comes with credential experience on the NCWE, involvement in organising a range of conferences, and more recently with Australian Rainfall and Runoff.

John Ruphrect

Hall of Fame – GN Alexander

Geoffrey Newman Alexander (1908-1975) was one of the greats in the early years of Australian hydrology. He was a member of the working committee which produced the first Australian Rainfall and Runoff publication. He was also a regular contributor at hydrology symposia and in the Civil Engineering Transactions of the Institution of Engineers, Australia.

Geoffrey Alexander lived most of his life in Victoria, Australia, and was well known to many hydrologists in other parts of the world. His contribution to the improvement of statistical hydrology in particular was a long term goal of his later life. It is significant that though retired from his full-time career, he was still writing original papers when he suddenly died in Melbourne on 17 January 1975.

Geoff Alexander graduated in civil engineering at the University of Melbourne late in 1929 when, to his dismay: he had to join the ranks of insurance clerks in order to gain an income. During the 1939-1945 war, he worked for an Australian Mission on the manufacture of tanks in the USA – a significant personal outcome being that he married an American despite his unorthodox approach to the relevant diplomatic procedures. It was his ability to see through an issue and argue a case for it that characterised him throughout his life.

After the war he undertook general civil engineering work and in 1950, he joined the State Rivers and Water Supply Commission, Victoria, to specialise in hydrology related to the capacity of reservoirs and the size of their spillways. From this base, and at a comparatively late stage in his life, he established his main career.

Never satisfied with relatively inadequate techniques, he forever adopted a policy based on enquiry and new ideas. Consequently he developed into a research-type engineering hydrologist, specialising in the statistical aspects of hydrology. He published more than 100 papers in Australia and overseas journals, and attended many international

conferences. In addition, his association with the USA was strengthened when he spent 12 months with the Geological Survey in Washington DC in 1957-1958. His work there and in Australia has become well known and respected internationally.

However, not the least of his achievements was the contribution he made quietly in Australia, in moulding an interest in hydrology amongst the younger hydrologists. The regular and well attended symposia held by the Institution of Engineers, Australia, were enhanced by the keen mind, sardonic humour and sense of originality that he gave in the early years of this development. Those who were privileged to attend those early symposia will remember the spirited debates between Geoff and Professor Crawford Munro, who were firm friends outside the conference hall, and the stimulus these vigorous debates gave to the critical thinking of the audiences.

When Geoff retired from formal duties with the State Rivers and Water Supply Commission in 1973, he became a part-time Associate at Monash University, in order to concentrate on a treatise on floods. It is a great pity that this more leisurely activity was brought to an end so soon, but his general contribution will be long remembered.

In recognition of Geoff Alexander's contribution to Australian hydrology, the National Committee on Hydrology & Water Resources (subsequently the National Committee on Water Engineering) of the Institution of Engineers, Australia created the GN Alexander Medal for Hydrology and Water Resources in 1987. The award is presented to the authors of the best paper in hydrology and/or water resources published in an Institution publication at each Hydrology and Water Resources Symposium.

Geoffrey Alexander will be inducted into the Water Engineering Hall of Fame to honour his outstanding contribution to the water engineering profession at the Water Down Under Conference 2008 to be held in Adelaide.

Rainwater and Urban Design 2007 Conference

The Rainwater and Urban Design 2007 Conference was held at the Sheraton on the Park in Sydney during 21 to 23 August 2007. The conference involved a partnership between Engineers Australia, WSUD in Sydney, the Stormwater Industry Association, the International Water Association and the founding sponsor BlueScope Steel to incorporate the following events:

13th International Rainwater Catchment Systems Conference
5th International Water Sensitive Urban Design Conference
3rd International Water Association Rainwater Harvesting and Management Workshop

Organisation for conferences commenced during 2005 and Tour Hosts were appointed as the Conference Manager early in 2006. The organization of the conference involved 3 different committees that necessitated creation of an organising executive of Associate Professor Peter Coombes from University of Newcastle, John Dahlenburg from WSUD in Sydney, Mark Babister from Webb McKeown, Guenter Hauber-Davidson from Water Conservation Group, Peter May from Engineers Australia, Tony MacAlister from BTM WBM, Dr. Jane Heyworth from University of Western Australia, Dr. Hari Krishna from the Texas Water Development Board and Dr. Stan Abbott from Massey University in New Zealand.

The event attracted 310 delegates from 22 countries and was opened with a traditional "Welcome to Country". Delegates also enjoyed a Welcome reception and a Dinner Cruise on Sydney Harbour.

We had a range of excellent keynote speakers that addressed the key conference themes:

Australian and International situation: Professor Peter Cullen from the National Water Commission, Tony McAlister from BTM WBM, Dr. Peter Breen from Ecological Engineering, Dr. Hari Krishna from the Texas Water Development Board and Professor Mooyoung Han from Seoul National University.

Health and the Environment: Dr. David Cunliffe from the South Australian Department of Health, Don Henry from the Australian Conservation Foundation and Dr Stan Abbott from Massey University in New Zealand.

Human behaviour and environmental management: Josh Bryne from the ABC garden Show, Patrick Lucy and Cori Barraclough from Aquatex in Canada, John Asquith from the Sydney Catchment Authority.

The conference published 120 full papers and about 20 poster papers. The keynote and conference papers were of a high quality that generated lively and ongoing discussions about alternative management of water resources in a changing environment.

The conference would not have been possible without generous sponsorship from BlueScope Water, Davey Water Products, Rain harvesting, Pentair Water, Sydney Water, BMT WBM, Melbourne Water, The Australian Government National Water Commission, The South Australian Department of Health, The Sydney Catchment Authority, eWater CRC, The Sydney Metropolitan CMA, Rockla, Engineers Media, Tankmasta, Humes, Bentley, Wallingford Software, Invisible Structures, Resource Management technologies, CDS Water and the Water Conservation Group.

Finally, I would like to thank the members of the conference executive for their tireless volunteer work in organizing this conference. In addition, I acknowledge the long hours contributed by Mark Babister to this conference.

Peter Coombes

AR&R Update–Continuous rainfall generation

On a world-wide basis, floods are estimated to be responsible for one third of all natural disasters, more than half the fatalities and more than one-third of economic loss. Design flood estimation is, hence, one of the more important services hydrologists provide to the community. Design floods are estimated either based on the observed flood record (using flood frequency analysis) or using the observed rainfall record (using intensity-frequency-duration analysis) in conjunction with a rainfall-runoff model. The former approach is limited by data availability and the latter by the assumption that there exists a design storm that corresponds to a unique design flood.

The next evolution in design flood estimation techniques is happening through the introduction of continuous flow simulation using stochastic continuous rainfall sequences. This provides the ability to ascertain design flows in changing landscapes, naturally account for the variability in soil moisture conditions preceding large flow events, and ascertain accurately the confidence associated with any design flood value. There are several key issues, however, that need careful addressing. What constitutes an acceptable stochastic continuous rainfall sequence? What level of persistence do we need to assume to generate such a sequence? Do we assume that variability at annual or longer timescales has no effect on hourly or sub-hourly rainfall properties? How do we generate such sequences at locations which have no data at all? How do we generate sequences at locations which have no sub-daily rainfall data? How do we generate sequences at locations that have missing or suspect data (and how do we check for this)? How do we generate the rainfall at multiple locations if spatial effects need to be considered? Do we assume certain probability distributions (such as log Pearson III or Gamma or similar) to characterize the randomness in the rainfall amounts? If so, on what basis? Or do we consider nonparametric alternates that rely on observations more than they do on assumptions? These are some of the questions that are addressed in the upcoming chapter on Continuous Rainfall Generation, to be sent for review by early to mid 2008.

By Ashish Sharma (UNSW) and R. Srikanthan (BoM)

ARQ Update Constructed Wetlands and Ponds

Constructed wetlands and ponds are a feature of urban development that provide protection to urban waterways from the pollution and physical disturbance created by urban stormwater runoff. Australian Runoff Quality published by Engineers Australia and edited by Dr Tony Wong provides a guide to the management and treatment of urban stormwater runoff.

Chapter 12 of ARQ describes the use of constructed wetlands and ponds in the stormwater management and treatment. The chapter contains 14 sections discussing all elements of the application of these technologies.

The initial sections highlight and discuss the differences and distinctions between wetlands and ponds as stormwater treatment devices and review the differences in relative treatment processes in wetlands and ponds under the headings of pollutant sedimentation, filtration, adsorption, biological uptake, transformation and storage. These initial sections provide an introduction to the theoretical underpinning to the considered application of these technologies.

Section 4 describes a general design framework for the application of constructed wetland and pond technology. This section discusses and highlights the key relationship between treatment system size, both area and volume, and treatment system detention time, which influences treatment effectiveness, and how these factors combine to determine how much total annual runoff can be treated and what the overall pollutant load reduction can be achieved. This section also identifies how these balances are influenced at various catchment scales.

The next sections discuss the advantages and disadvantages of the location and placement of stormwater treatment systems and provide guidance on the appropriate selection of wetlands or ponds. These decisions are discussed in terms of catchment waterway condition, topography, space constraints and need for flow retardation for flood protection.

Operational issues such as weeds, pests, sedimentation, scour, and short-circuiting are discussed and introduce a section that presents model formats for wetlands and ponds. The model formats outline features such as the treatment train concept, the need for specifically designed inlet and outlet features, the concept of high flow by-pass, and the concept of wetland vegetation zonation to both manage hydraulic conditions and increase vegetation diversity. General advice is provided on vegetations zones outlining typical water depth, plant species and the dominant treatment processes expected in certain zones. This advice allows vegetation zones to be planned and adjusted based on the stormwater runoff pollutant characteristics.

The sections provides some generalised advice on the sizing and hydraulic layout of wetlands in various capital cities based on local rainfall records. This highlights the size differences required to achieve similar levels of treatment in different climatic zones. For example in Melbourne it requires a wetland volume of 2.5% of the Mean Annual Runoff Volume (MARV) to capture and treat 90% of the Mean Annual Runoff. In Brisbane it requires 4% of the MARV to capture and treat 90% of the Mean Annual Runoff.

Finally this chapter of ARQ provides some preliminary advice on managing the risk of algal blooms in open water systems based on algal growth rate modelling, temperature and pond detention time. This section provides some guidance on the size of pond systems to avoid the risk of algal blooms.

In general this chapter of ARQ provides an overview of the use and application of constructed wetlands and ponds for stormwater treatment and presents a starting position for designers.

Upcoming position paper on droughts & drought mitigation

The Engineers Australia National Committee on Water Engineering is currently preparing a position paper on droughts and drought mitigation. The paper draws together some of the lessons learned from past droughts, including how drought is characterised and its incidence of occurrence. The paper summarises some of the key impacts of drought on the community and the water resource planning activities that can be undertaken to minimise those impacts, including the role of individual engineers and the role of Engineers Australia. The paper makes four key recommendations which are focussed on ensuring that there is adequate drought planning across Australia, as well as promoting more effective and practical inter-disciplinary collaboration between engineers, climatologists, paleoclimatologists and economists on drought planning and management.

The principal authors of the paper are Rae Moran, Senior Hydrologist at the Victorian Department of Sustainability and Environment and Brad Neal, Practice Leader for Water Resources Planning at SKM. The paper is due for release in mid 2008.

By Brad Neal

Current Papers in AJWR –

Trade-off analysis for restoring environmental flows through irrigation demand management
Khan, S., Mushtaq, S., Ahmad, A. & Hafeez, M. 2008, *Australian Journal of Water Resources*, Vol. 12, No. 1, pp. 1-20.

The aim of this paper is to evaluate economic trade-offs of introducing irrigation demand management measures to modify river flows in order to mimic natural flow variations in the rivers. A number of irrigation demand management options were identified through the rigorous discussions with the key stakeholder groups in the Murrumbidgee Catchment. The impacts of alternative demand management options are presented in terms of a matrix of economic costs and associated water savings. The modelling results revealed that 10-15% of peak water use during summer can be reduced from the average total annual water use of 1400 GL. This may result in reduced economic return or require private and public investments in the form of on-farm water saving technologies, canal lining or construction of en-route

storage. However, if we value the saved water at current market prices, then benefits are expected to be higher than the costs involved. Among all other options, spreading water use over summer and winter season through new crop mixes promises to be the most cost-effective irrigation demand management option for improving seasonality of flow in the rivers. The study also found that increasing on-farm water use efficiency to reduce peak water use is in the farmer's economic self-interest through reduced water inputs per unit of production; it will also help increase stream flows if suitable mechanisms for securing environmental flows can be implemented.

On spatiotemporal drought classification in New South Wales: Development and evaluation of alternative techniques
Osti, A. L., Lambert, M. F. & Metcalfe, A. V. 2008, *Australian Journal of Water Resources*, Vol. 12, No. 1, pp. 21-36.

The identification, monitoring and characterisation of drought are of importance in water resources management and planning in Australia. The predominance of agriculture and water-rich activities on the eastern seaboard of Australia and the susceptibility of these industries to drought events makes an understanding of the spatial and temporal characteristics of drought significant to long-term water resources and agricultural planning. To assist in the quantification of the risk of the spatial extent of drought, the Standardised Precipitation Index (SPI) and system of percentiles were used to characterise the frequency, severity and spatial extent of drought incidence in 30 meteorological districts of New South Wales (NSW), Australia, for the period 1913-2002. Monthly district rainfall was aggregated on 1, 2, 3, 6, 9, 12 and 24-month time scales, and characterised by SPIs and plotting positions for each phase. To assist in determining the spatial and temporal relationships of drought in NSW, drought severity-area-frequency curves were developed, enabling an assessment of the severity of drought throughout the state. Results obtained were contrasted with historical drought years to show the relationship between the severity and spatial extent of drought events, as well as distinguishing short, medium and long-term drought in NSW. The two methods of drought identification are evaluated against several substantive criteria and recommendations for future practice given.

Adjustment factors for restricted rainfall
Boughton, W. & Jakob, D. 2008, *Australian Journal of Water Resources*, Vol. 12, No. 1, pp. 37-48.

6-minute rainfall data were used to calculate average adjustment factors for rainfall durations 1, 2, 3, 6, 12 and 24 hours at seven locations (Adelaide, Brisbane, Darwin, Hobart, Melbourne, Perth and Sydney). When combined with results from published studies, average values of 1.14 for 24-hour annual maximum rainfalls and 1.16 for sub-daily rainfalls were derived. Considering the large variability in adjustment factors among the various locations and studies, it is recommended that an average value of 1.15 be used for rainfall durations from 1 to 24 hours. There is some indication that adjustment factors for 24-hours duration decrease as the magnitude of the rainfall increases, and reduced factors for large daily rainfalls seem appropriate, but this reduction for large rainfalls was not evident in the sub-daily rainfalls. There is evidence from UK studies that the adjustment factor should be reduced for multiple day storm totals.

Using soil loss models to estimate suspended solids concentrations in stormwater runoff from pre-urban areas
Brodie, I. M. & Rosewell, C. J. 2008, *Australian Journal of Water Resources*, Vol. 12, No. 1, pp. 49-60.

Estimation of pollutant concentrations and mass loads in runoff is often required to develop stormwater management plans for future urban areas. Total Suspended Solids (TSS) is an indicator of stormwater pollution. There is often the need to predict and compare "post-urban" and "pre-urban" conditions to quantify the likely future change in TSS loads due to urban development. This paper will focus on planning-level estimation of TSS concentrations and loads from pre-urban sites, specifically rural grazing land. The proposed method is an adaptation of widely-used variants of the Universal Soil Loss Equation and accounts for site specific characteristics, such as climate, topography, vegetation cover and soil type. A case study is provided to demonstrate the application of the proposed method. The method is considered to be an improvement to current methods based on Event Mean Concentration (EMC), or at least provides guidance on the selection of an appropriate TSS EMC value to apply to pre-urban areas.

Purchasing water for the environment in unregulated systems – what can we learn from the Columbia Basin?
Horne, A., Purkey, A. & McMahon, T. A. 2008, *Australian Journal of Water Resources*, Vol. 12, No. 1, pp. 61-70.

Environmental flows in unregulated rivers require a different management approach to regulated systems, where reservoirs allow more adaptive management of flows and water markets are well established. Governments in Australia have been investigating tender approaches to buy back water in unregulated systems. A number of organisations in the Columbia Basin in northwest America have been actively purchasing water for the environment in unregulated systems. This paper outlines some of the key lessons learnt about purchasing water for the environment in the Columbia Basin and discusses their possible application in the Australian context.

Call for Papers Australian Journal of Water Resources

The AJWR provides a forum for Australian & International researchers and practitioners to publish high quality articles on issues related to and affecting the hydrology & water resources in Australia. Topics covered range from rainfall & rainfall modelling, climatic variability & change, assessment & management of water resources, catchment hydrology, environmental flows and hydraulics, open channel flow and hydraulic structures. Instructions for prospective authors can be found at: http://www.engaust.com.au/transactions/pub_info1.asp

Upcoming Events

9th National Conference on Hydraulics in Water Engineering

The 9th National Conference on Hydraulics in Water Engineering will be held in Darwin, from the 23rd to the 26th September 2008. The theme for the Conference is "Hydraulics in the Environment."

The focus of the conference will be on the latest techniques and challenges in hydraulics reflecting the changes in public attitudes and variability in climate that drive innovation in hydraulics.

Within this overall theme the conference sub-themes are: Climate Change, Methods in Hydraulics, Applied Hydraulics, Geophysical Hydraulics and Coastal Hydraulics.

The conference promises to provide significant technical benefits with eminent keynote speakers and approximately 65 podium papers from both Australia and overseas. Delegates representing government, consultants and research organisations from throughout Australia, New Zealand and other countries are expected leading to significant networking opportunities. The exhibition associated with the conference will feature organisations and products in the water engineering hydraulics field.

For more information, visit: http://www.hydraulics2008.com/

23rd April 2008: Sediment & Flow Dynamics of Large Tropical Rivers in Northern Australia – Implications for Development. Dr Andrew Brooks will be speaking and the event will be held at the University of Technology Sydney. Visit the following link for more information: www.sydneywaterpanel.org.au/pdfs/20080423_flier.pdf

April 22nd 2008: The International Centre of Excellence in Water Resources Management (ICE WaRM) is proud to host leading researchers Professor Ezio Todini and Professor Graeme Dandy at a free seminar titled "**Water Distribution Systems Analysis and Modelling**".

The event will begin at 4:30pm, and will be held at the Australia Asia Water Centre, Adelaide.

Registration for this seminar is required. Please RSVP to Amber Welk at awelk@icewarm.com.au

32nd Hydrology and Water Resources Symposium

The 32nd Hydrology and Water Resources Symposium will be held in Newcastle, NSW from 30 November to 3 December 2009.

The theme for the symposium is "adapting to change" and the organizers have approached some exciting and innovative keynote speakers to compliment their theme.

Newcastle is the heart of the Hunter Region and boasts pristine beaches, Sahara-like sand dunes on one side and rolling hills and vineyards on the other. The harbour side city offers sophistication, elegance and some wonderful dining experiences. Put it in your diary now. Call for papers will be announced in November 2008.

Visit http://www.h2009.org.au/ for more details.

Links

Sydney Division Water Panel:
http://www.sydneywaterpanel.org.au/

Queensland Division Water Panel:
http://qld.ieaust.org.au/jetspeed/?group=water

West Australian Division Water Panel:
http://www.wa.engineersaustralia.org.au/404.shtml

Victorian Water Engineering Branch:
http://www.vic.ieaust.org.au/groups/branches08.html

Hydrological Society of South Australia:
http://www.hydsoc.org/

We welcome your feedback on the newsletter. If you have any comments, or articles you wish to submit, please send them to mlambert@civeng.adelaide.edu.au