

## **Thomas Aquinas McMahon (1937- )**

**BE (Agr), PhD, Dip Ed, D Eng, FTSE**

Emeritus Professor Tom McMahon is one of the key reasons that Australia punches above its hydrological weight on the world scene. His international contributions in hydrology and water resources are as extensive as they are diverse: they range from seminal contributions on the science of hydrology to books providing practical guidance to consultants working in the fields of engineering and the natural environment; his textbooks are standard reading for many undergraduates both here and overseas, and he has successfully guided a legion of post-graduate students who are now employed across Australia in industry, government and research.

Tom is an uncommon blend of powerful intellect and dynamic personal qualities. He demonstrates modes of behaviours and thinking styles that tend to be mutually exclusive in most people: he has an equal facility for big picture strategic thinking as well as the detailed analysis of data and processes; he is both inspirational leader of teams and consultative team player; he is both entrepreneur and careful administrator; playful extrovert as well as private introvert.



But most effectively, Tom has a gift for co-opting partnerships from beyond the boundaries of his core focus: these partnerships cross academic disciplines (statistics, geography, economics, psychology, earth sciences), organisational boundaries (universities, government agencies, research organisations, private industry), and national borders (South Africa, North America, South East Asia and Europe). In all these interactions Tom takes a positive view and persists in moving on in the direction of greatest promise - he never dwells on the problems of the past, and invariably reframes disagreement into a research opportunity for evidenced-based resolution.

In short, Tom is a highly unusual blend of world-leading researcher, pedagogue, academic administrator, and inspirational leader.

### **Brief Biography**

With a family background in farm machinery and agriculture in Western Victoria, Tom McMahon entered agricultural engineering at the University of Melbourne. On graduating with a Bachelor of Engineering (Agricultural) in 1960, he immediately began his professional career as a research hydrologist with the Hunter Valley Research Foundation in Newcastle. While working full-time at the Foundation, he completed a PhD at the University of NSW (under Crawford Munro) which dealt with the hydrology and water resources of the Hunter Valley (and incidentally conducted the first groundwater pump test in Australia to estimate aquifer characteristics using the non-equilibrium Theis equation). His work provided the basis for the development of a water plan for the Hunter, which included recommendations for dams on the Patterson River and Glennies Creek.

Following an interest in academia, in 1967 Tom was appointed initially as a Lecturer, then Senior Lecturer and, in 1973, an Associate Professor of Civil Engineering at Monash University. This rapid rise to Associate Professor recognized, firstly, the major contribution he had made to the development of rural hydrology teaching and research during the previous five years at Monash and, secondly, the reputation he had gained through his international research in reservoir capacity-yield-reliability studies of large irrigation and metropolitan water supplies.

Tom spent 1973/74 working in Canada with a large engineering consulting firm (Acres Consulting Services) and, following the presentation of a major workshop on applied hydrology to consulting engineers in Canada, he returned to Monash in 1974 and jointly initiated a series of week-long workshops on storage-yield analysis, stochastic data generation and flood hydrology for practising engineers.

During 1978/79, Tom returned to Canada and carried out a major consultancy for Inland Water Directorate, Canada. In 1980, his expertise in rural hydrology was again recognised when he was invited to visit South Africa and presented a one week workshop to South Africa, Namibian and Zimbabwean engineers.

Following eight years of research in private industry and 13 years as an academic at Monash University, in 1980 Tom McMahon was appointed Professor of Agricultural Engineering at the University of Melbourne. As the most senior academic in agricultural engineering in Australia he played a key role in advising government and industry on issues relating to engineering in agriculture and was responsible for the teaching and research in agricultural engineering at Melbourne. Following the downturn in agriculture and especially in the wool industry in the late eighties, he shifted his role at the University of Melbourne to that of Professor of Environmental Hydrology, a position he held until he retired in 2005 and was made an Emeritus Professor. As Professor of Environmental Hydrology, he inaugurated the Bachelor of Environmental Engineering degree in 1992. He held senior positions in the University as a member of the University Council, Chair of the University's PhD Committee and Head of the Department of Civil & Environmental Engineering. He played a leading role in the establishment and operation of the Cooperative Research Centre for Catchment Hydrology.

Since retiring in 2005, Tom continues to progress his research interests. He has taken on leading roles in research into large-scale atmospheric drivers for hydrologic variability, the estimation of evaporation from standard meteorological data, and uncertainty in future streamflow estimates based on climate models. He continues to work as a specialised consultant mainly reviewing water management reports relating to the coal and gold mine industries and also as a reviewer for the Bureau of Meteorology and CSIRO.

## **Professional Achievements**

### *Research Highlights*

- *Comparative global hydrology:* In the 1970's Tom collated a data set of Australian annual streamflows and compared the hydrological behaviour of Australian catchments against published relationships from catchments in the Northern Hemisphere. His observations of the differences in variability and skewness of Australian streams compared to the rest of the world sparked a long-term interest in global hydrology that continues to this day. During the 1980s Tom and Brian Finlayson collated the largest global data set at that time of monthly and annual streamflow data which became the seed dataset for the Global Runoff Data Centre auspiced by the World Meteorology Organisation. Their analysis of this data set continued into the 1990s, and expanded to include investigation of the causes of these continental differences. Tom's ground-breaking Comparative Hydrology work highlighted how Australian hydrology is characterised by high inter-annual variability – an insight that informs Australian hydrologic and eco-hydrologic research to this day.
- *Storage Yield Analyses:* He introduced to the water engineering profession in the early 1970s the application of reservoir storage-yield-reliability procedures including the application of stochastic data generation and probability analysis. His first book on the subject co-written especially to help consulting water engineers was, at that time it was published in 1976, the only one available that dealt with the subject in the English-speaking world. A further two books on yield analysis were published, as well as numerous journal papers.
- *Environmental hydrology:* Tom deserves high praise for his leadership of research into environmental hydrology and has played a highly significant role in updating engineering practice in this area. He introduced quantitative hydrologic tools and analytical techniques to the Australian aquatic ecologists in

1985 (resulting in two major books published and the establishment of the Centre for Environmental Applied Hydrology) and was one of the first engineering academics to bring ecologists, geographers and engineers together in common cause, and that common cause was better environmental management.

- *Low flow hydrology*: Tom has long-maintained a research interest in low flow and arid-zone hydrology, a topic that has received little attention from academics, even in Australia. His work in this area began in the 1970s, where his contribution was recognised by being invited to become Chairman of the UNESCO Working Group on Low Flow Hydrology. The outcome of this four year project was another co-authored book which has since been translated into Russian. His research into characterising low flow regimes and their estimation in regions with limited data has continued over three decades, and has included analysis of the hydrology of the Lake Eyre Basin.

### *Awards*

In 1986 for services to hydrology and water resources, Tom was elected a Fellow of the Australian Academy of Technological Sciences and Engineering. He also received a Centenary Medal for services to Australian society relating to water issues. In 1978, he received the Institution of Engineers, Australia, W. H. Warren award for academic excellence and was co-recipient of the Guy Parker award by the Australian Water & Waste Water Association in 1994 and again in 1997. He was the Crawford Munro Orator at the international hydrology and water resources symposium in Auckland in 1997. In 1981 he was awarded a Doctorate of Engineering from the University of Melbourne based on published research (at the time he was only the seventh person in 60 years to be awarded such an honour at Melbourne, the first being Sir John Monash). Also in 1997, he was a joint recipient of the American Society of Civil Engineers, Journal of Irrigation and Drainage Engineering prize for best paper in that year. In 2006, the American Society of Civil Engineers awarded McMahon the Arid Lands Hydraulic Engineering Award for his “noteworthy contribution to the advancement of hydraulic engineering in arid and semi-arid climates”.

### *Research Centre Leadership*

Tom has played a leading role in the establishment and conduct of a number of key research centres that have encouraged training and cooperative research across national, agency, university and discipline boundaries. These include:

- The Centre for Environmental Applied Hydrology (CEAH) was established at the University of Melbourne in 1987. This was a game changing interdisciplinary water research centre that brought together ecologists, geographers and engineers with the objective of improving environmental management. Tom was instrumental in guiding this development to be one of the most productive water research centres in Australia, turning out many post-graduates who are now employed across Australia in industry, government and research.
- Centre for International Irrigation Training and Research (CIITR), established at the University of Melbourne in 1988, provided training in irrigation water management to engineers from both Australia and Asia.
- From 1992 to 2004 Tom was a prime driver and Deputy Director of the Co-operative Research Centre for Catchment Hydrology (CRCCH). This was a highly successful research centre that forged (for the first time) bonds between a number of different partners (universities, industry bodies, research agencies, and private industry). The centre generated many useful research outcomes and post-graduate students in many areas of practical and research interest relevant to the movement and occurrence of water, water management, climate variability, vegetation, soil, and extreme event hydrology.

### *Post-Graduate Mentoring*

One of the most notable and striking aspects of Tom's career in academia has been the way he encouraged and supported graduate students, both Masters and PhD. His approach to dealing with graduate students

involves a number of unusual features. First, he encouraged anyone who showed an interest in a higher degree to pursue that course, and second he made himself available as a supervisor across an astonishing range of research topics. In cases where he identified the need for supervision expertise that he didn't have, he recruited additional supervisors from virtually anywhere in the University and outside it. While multiple supervisors are now mandatory (at least at the University of Melbourne), Tom did this regularly from the beginning of his career. He always gave generously of his time, and was actively involved in the conduct of the research undertaken. He ensured that he was available for regular meetings with his students, and often co-opted the *ad hoc* input of other students and academics at different stages of the research. All draft material was thoughtfully reviewed and returned promptly, and he always took a careful role in contributing to papers where he was a joint author. He has overseen the successful completion of 45 PhD students, and one indicator of his generosity of spirit is that he has attended the graduation ceremonies of almost all them. He has also supervised 21 Masters by research students, as well as numerous Masters by coursework students. In addition, he has supervised 34 post-docs or research fellows. Many of these researchers are now in senior positions in Australian industry or in academia.

### *Publications*

In terms of international journal publications and research citations, Tom McMahon is Australia's leading researcher in surface hydrology and water resources. During his career he has published 9 books and 550 book chapters, scientific papers, reports and articles on hydrology and water resources engineering. Of these, 214 papers are published in peer-reviewed journals and a further 34 are book chapters. His most cited and seminal papers include:

- McMahon, T.A. (1978): Australia's surface water resources: potential development based on hydrologic factors. *Civil Engg Trans, Institution of Engineers, Australia*, 20 (2), 155-164. (Awarded W.H. Warren Medal for the best paper in Civil Engineering)
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