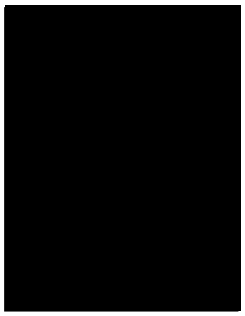
Curriculum Vitae



Dr Rory Nathan

Practice Leader Hydrology

Qualifications

- B.E.(Agr), University of Melbourne, 1980
- M.Sc., D.I.C., University of London, 1984
- Ph.D., University of Melbourne, 1990

Affiliations

- Fellow, Institution of Engineers, Australia
- Australian Representative, Floods Committee, International Committee on Large Dams
- Member Hydrology Sub-committee, NSW Dams Safety Council
- Honorary Fellow, Department. Civil Engineering., Monash University
- Past Honorary Fellow, Dept. Civil and Environmental Engin., University of Melbourne

Awards

- Named as member of "Top 100 Most Influential Engineers" in Australia, 2009
- National Civil Engineer of the Year, awarded by the Institution of Engineers, 2000
- W.H. Warren Medal (1992, 1998, and 2005) for the best paper in Civil Engineering (national award by the Engineers Australia).
- ASCE Journal of Irrigation and Drainage Engineering Best Research Paper Award (1997)
- G.N. Alexander Medal (1998) for the best paper in Hydrology and Water Resources, (national award by the Engineers Australia)
- Best presentation of a technical paper at the Hydrology & Water Resources Conf. (1993)
- ACEA Award of Excellence (1998).
- Victorian Engineering Excellence Award (2003).

Fields of Special Competence

Dr Rory Nathan has around 30 years experience in engineering hydrology in both the academic and consulting fields. He is actively involved in a number of research projects under the auspices of Engineers Australia and with the University of Melbourne. While he has generally worked in areas of flood estimation, hydrological processes, regionalisation, and catchment hydrology, he has developed specialist skills in the following areas:

- Estimation of extreme hydrologic events (floods and low flows)
- Characterisation of risk for dam safety
- Hydrologic estimation in ungauged catchments
- Regionalisation of hydrologic information
- Characterisation of flow regimes for environmental flows
- Modelling and simulation of hydrologic processes
- Hydrologic model development and application

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Relevant experience

- Convenor and senior author of the national guidelines for the estimation of large to extreme floods published by the Institution of Engineers Australia.
- Contracted by the U.S. Bureau of Reclamation to provide input to the development of guidelines on the characterisation of hydrologic inputs for risk analysis
- Contracted by the U.S. Army Corps of Engineers to help formulate research directions to be undertaken in the area of hydrologic risk using federal agency funding
- Contracted by the Murray Darling Basin Commission to oversee and review the flood risk assessment of Hume Dam being undertaken by NSW State Water (and SMEC).
- Member of panel undertaking risk review of the Dam Safety Program for Western Australia's South-West Irrigation Dams
- Member, Expert Review Panel for the Preliminary Risk Assessment of the portfolio of dams owned by the Hydro-Electric Authority, Tasmania
- Member, Expert Review Panel for the Preliminary Risk Assessment of Somerset, Wivenhoe, and North Pine Dams owned by the South East Queensland Water Board
- Member, Expert Review Panel for the upgrading of Rosslynne Dam owned by the Southern Rural Water
- Project Manager consequence assessment and risk characterisation of Dartmouth Dam (Goulburn-Murray Water)
- Project Director for the consequence assessment and risk characterisation of Hume Dam (DLWC, NSW)
- Variously Project Manager and Project Director for the estimation of hydrologic loads, risk characterisation, and consequence assessment of several dams owned by Goulburn-Murray Water (and its predecessor the Rural Water Corporation); Dartmouth, Eildon, Cairn-Curran, Nillhacootie, Laanacoorie, Mokoan, Waranga, Buffalo, Fyans, Bellfield, Rocklands,
- The estimation of hydrologic loads and review of spillway adequacy for many major water storages owned by the (then) Rural Water Corporation (Eildon, Dartmouth, Laanacoorie, Wartook, Bellfield, Fyans, Waranga, Lonsdale, Rocklands, Pine, Taylors, Cairn-Curran, Tullaroop, Upper Coliban, Lauriston, Malmsbury, Buffalo, and Pykes Creek).
- Responsible for event tree development and risk characterisation of hydrologic inputs to the Preliminary Risk Assessment of all dams owned by the Snowy Mountain Hydro-Electric Authority.
- Responsible for the derivation and characterisation of hydrologic and hydraulic inputs to the Preliminary Risk Assessment of all dams owned by South Australia Water.
- Use of quantitative risk analysis for evaluation of floodplain development options for AMP
- Provision of advice to ACTEW/AGL on how to best account for climatic variability in the development of options for their future water supply options (ongoing)
- Assessment of the vulnerability to climate change and variability for the water resources of the Fitzroy River
- Project Director for the consequence assessment of four major dams owned by the Dept. of Land and Water Conservation, NSW (Blowering, Burrinjuck, Split Rock and Keepit)
- Project Director for the consequence assessment and risk characterisation of the Kiewa Hydroelectric Scheme (Southern Hydro)
- Expert reviewer of extreme event hydrologic studies undertaken by Melbourne Water (Upper Yarra and Devils Bend reservoirs)

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- The estimation of hydrologic loads and review of spillway adequacy for O'Shannassy Reservoir (Melbourne Water).

Refereed Journal and Book Publications

Dr Nathan has authored or co-authored over 150 papers that have been published in refereed journals, conference proceedings, books, and monographs, as well as contributed to the writing of national IEAust and ANCOLD guidelines on extreme flood estimation and acceptable flood capacity. Those papers most relevant to flood estimation are listed below.

Refereed Journal and Book Publications Relevant to Flood Estimation

Nathan, R.J. (1992): The derivation of design temporal patterns for use with generalised estimates of probable maximum precipitation. *Civil engineering Transactions, I.E. Aust.* CE34(2): 139-150.

Dyer B., Nathan R.J., McMahon T.A., and O'Neill I.C. (1993): A cautionary note on modelling baseflow in RORB. *I.E. Aust. Civil Engin. Trans.* CE35(4): 337-340.

Dyer, B.G., Nathan, R.J., McMahon, T.A., O'Neill. I.C. (1996) Prediction equations for the RORB parameter Kc based on catchment similarity. *Aus J Water Resources,* 1(1): 29-38.

Nathan, R.J. and Weinmann, P.E. (1995): The estimation of extreme floods - the need and scope for revision of our national guidelines. *Aus J Water Resources,* 1(1): 40-50.

Nathan, R.J. and Weinmann, P.E. (1996): Reply to Discussion by Green et al.: "The estimation of extreme floods - the need and scope for revision of our national guidelines". *Aus J Water Resources,* 1(2): 106-107.

Bailey, M.A., Connell, L.D. and Nathan, R.J. (1996): Accuracy of uncertainty estimation using inverse first-order reliability analysis. In *Calibration and Reliability in Groundwater Modelling, IAHS Publication* No. 237, ed K. Kovar and P. van der Heijde, pp 523-531.

Grayson, R.B., Argent, R.M., Nathan, R.J., McMahon, T.A., and Mein, R.G. (1996): *Hydrological Recipes: Estimation Techniques in Australian Hydrology.* Cooperative Research Centre for Catchment Hydrology. (ISBN 1 876006 13 7), 125 pp.

Nathan, R.J., Weinmann, P.E., and Minty, L. (1999): Estimation of the Annual Exceedance Probability of Probable Maximum Precipitation in South East Australia, *Aus J Water Resources* 3(1), 143-154.

Nathan, R.J., Weinmann, P.E., (2000) *Book VI - Estimation of Large to Extreme Floods* in National Committee on Water Engineering (Eds) *Australian Rainfall and Runoff A Guide to Flood Estimation.* I.E. Aust. Canberra.

Hill, P.I. Nathan, R.J., Weinmann, P.E., and Green, J.A.H. (2000): Improved estimates of hydrologic risks for dams - impacts of the new flood guidelines. *ANCOLD Bulletin* 114: 49-58.

Hill, P.I., Cook, D., Nathan, R.J., Crowe, P., Green, J., Mayo, N., (2001): Development of a Comprehensive Approach to Consequence Assessment. *ANCOLD Bulletin* 117: 33 - 46.

Green, J.H., Weimnann, P.E., Kuczera, G.A., Nathan R.J. and Laurenson E.M. (2002): Probabilities Of Extreme rainfall - Past, Present and Future *ANCOLD Bulletin* - Issue No. 122, 65-76

Hill, P.I., Bowles, D.S., Nathan, R.J. and Herweymen, R. (2002): On The Art Of Event Tree Modeling For Portfolio Rish Analyses. *ANCOLD Bulletin* – Issue No. 121, 99-108.

Nathan, R.J., Hill, P.I. and Griffith, H. (2002): Risk Implications Of The PMF and The PMP Design Flood *ANCOLD Bulletin* – Issue No. 121, 47-53.

Nathan, R.J., Weinmann, P.E. and Hill, P.I. (2002): Use Of A Monte Carlo Framework To Characterise Hydrological Risk, *ANCOLD Bulletin* - Issue No. 122, 55-64 .

Weinmann, P.E., Rahman, A., Hoang, T.M.T., Laurenson, E.M. and Nathan, R.J., (2002): Monte Carlo Simulation of Flood Frequency Curves from Rainfall – The Way Ahead. *Aust. Journal of Water Resources* 6(1) 71-79.

Jordan, P. Nathan, R., Mittiga, L., Pearse, M., Taylor, B. (2004): Rainfall depths and temporal patterns for short duration extreme events, *ANCOLD Bulletin*, No. 126: 87-95.

Hill, P., Bowles, D., Jordan, P. and Nathan, R. (2004): Estimating Overall Risk of Dam Failure: Practical Considerations in Combining Failure Probabilities. *ANCOLD Bulletin* - Issue No. 127, 63-72.

Jorden P, Nathan R., Mittiga L and Taylor B (2005): "Growth Curves and Temporal Patterns for Application to Short Duration Extreme Events". *Aust J Water Resour* 9(1), 69-80.

Nathan, R.J. (2007): The future: A hydrological SWOT analysis. *Aus J Water Resour* 11(2): 133-144.

Mittiga, L., Nathan R.J., Hill, P., Weinmann, E., (2007): Treatment of correlated storage drawdown and uncertainty in the flood hydrology for dams. *Aus J Water Resour* 11(2): 169-176.

Wang, QJ and Nathan, RJ (2007): A method for coupling daily and monthly time scales in stochastic generation of rainfall series. *J Hydrol* 346: 122-130.

Westra, S., Varley, I., Jordan, P., Nathan, R., Ladson, A., Sharma, A, and Hill, P. (2010): Addressing climatic non-stationarity in the assessment of flood risk. Aus J Water Resources 14(1): 1-16.

Conference Proceedings Publications Relevant to Flood Estimation

Nathan, R.J. and P.E Weinmann (1991): Application of at-site regional flood frequency analyses. *International Hydrology and Water Resources Symposium 1991, Perth, 2-4 October 1991 Volume 3. Institution of Engineers National Conference Publication* No. 91/19: 769-774.

Dyer, B., R.J. Nathan, T.A. McMahon, and I.C. O'Neill (1992): Regional relationships for the RORB model: a need for understanding. *Conference on Engineering in Agriculture*, Albury: 79-83.

Dyer B., Nathan R.J., McMahon T.A., and O'Neill I.C. (1993): Towards regionalisation of the RORB parameters. *Engineering for Hydrology and Water Resources Conference, Newcastle., I.E. Aust. National Conf. Publ. No. 93/14*, 133-139.

Nathan, R.J., Weinmann, P.E., and Gato, S (1994): A quick method for estimation of the probable maximum flood in south-east Australia. *International Hydrology and Water Resources Symposium: Water Down Under, November, Adelaide, I.E. Aust. Natl. Conf. Publ. No. /*94, 229-234.

Dyer, B., Nathan, R. McMahon, T.A., and O'Neill, I.C. (1994): An overview of some research into the RORB model. *International Hydrology and Water Resources Symposium: Water Down Under, November, Adelaide, I.E. Aust. Natl. Conf. Publ. No. /*94, 457-460.

Weinmann, P.E. and Nathan, R.J. (1994): Assessing spillway adequacy - a continuing challenge for hydrologists. *International Hydrology and Water Resources Symposium: Water Down Under, November, Adelaide, I.E. Aust. Natl. Conf. Publ. No. /*94, 271-277.

McConachy, F.L.N., Weinmann, P.E.W., Nathan, R., and Mein, R. (1996): Estimation of extreme rainfalls for Victoria using Schaefer's method, *23rd Hydrology and Water Resources Symposium: Hobart Tasmania, May 1996,* 701-702.

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Nathan, R.J. and Bowles, D.S. (1997): A probability-neutral approach to the estimation of design snowmelt floods. *Hydrology and Water Resources Symposium: Wai-Whenua, November 1997, Auckland,* 125-130.

McConachy, F.L.N., Weinmann, P.E.W., Nathan, R., and Mein, R. (1997): Confidence limits for rainfall frequency curves in the extreme rainfall range, *Hydrology and Water Resources Symposium: Wai-Whenua, November, 1997, Auckland,* 333-338.

Hoang, T., Rahman, A., Weinmann, P.E., Laurenson, E. and Nathan, R. (1999): Joint probability description of design rainfalls. *Water 99 Joint Congress, Brisbane, Australia, Institution of Engineers* (ISBN 185 825 7165), 379-384.

Hill, P., Nathan, R.J., Weinmann, P.E., Green, J, and Karunaratne, T. (1999): Impact of the revised flood guidelines on the assessment of hydrologic risk for selected catchments. *Water 99 Joint Congress, Brisbane, Australia, Institution of Engineers* (ISBN 185 825 7165), 277-283.

Nathan, R.J., Crowe, P., Hill, P. and Green, J. (1999): A quick method for estimating Probable Maximum Precipitation in the tropical and south-east regions of Australia. *Water 99 Joint Congress, Brisbane, Australia, Institution of Engineers* (ISBN 185 825 7165), 703-708.

Weinmann, P.E., Nandakumar, N., Siriwardena L., Mein, R.G. and Nathan, R. (1999): Estimation of Rare design rainfalls for Victoria using the CRC-FORGE methodology. *Water 99 Joint Congress, Brisbane, Australia, Institution of Engineers* (ISBN 185 825 7165), 284-289.

Nandakumar, N. Weinmann, P.E., Mein, R.G., and Nathan, R.J. (2000): Estimation of Spatial dependence for the CRC-FORGE method. Proc., Hydro 2000, 3rd International Hydrology and Water Resources Symposium, IE Aust, pp 553-563.

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Nathan, R.J., P.I. Hill, P.I., and Griffith, H. (2001): Risk implications of the PMF and the PMP Design Flood. Proceedings ANCOLD conference, Auckland, New Zealand.

Hill, P.I. D.S. Bowles, R.J. Nathan, R. Herweynen (2001): On the art of event tree modelling for portfolio risk analyses. Proceedings ANCOLD conference, Auckland, New Zealand.

Zou, S., Srikanthan, R., McMahon T.A., Wang, Q.J. and Nathan, R.J. (2002): Stochastic modelling of daily rainfall. Proc., 27th Hydrology and Water Resources Symposium, I.E.Aust, ISBN 0858257785.

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Green, J., Walland, D., Nandakumar, N., Nathan, R. (2003) Temporal Patterns for the Derivation of PMPDF and PMF Estimates in the GTSM Region of Australia, Proc. 28th Int. Hydrology and Water Res. Symp, Wollongong, pp 1.97-1.104.

Nathan, R., Weinmann, E., Hill, P. (2003) Use of Monte Carlo Simulation to Estimate the Expected Probability of Large to Extreme Floods, proc. 28th Int. Hydrology and Water Res. Symp., Wollongong, pp 1.105-1.112.

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Mannix, A.E., Nathan, R.J., Hill, P.I., Cook, D.M. (2003) Application of Quantitative Risk Analysis to Floodplain Management, proc. 28th Int. Hydrology and Water Res. Symp, Wollongong, pp 3.195-3.202.

Jordan, P., Nathan, R., Mittiga, L., Pearse, M. and Taylor, B. (2003): Rainfall depths and temporal patterns for short duration extreme events. Proc. 43rd ANCOLD Conference on Dams, Hobart, Tasmania, 192-200.

Hill, P., Bowles, D., Jordan, P. and Nathan, R. (2003): Estimating the overall risk of dam failure, practical considerations in combining failure probabilities. Proc. ANCOLD Risk Workshop, Launceston, 2003.

Weinmann, P.E. and Nathan, R.J. (2004). The continuing challenge of estimating extreme floods from extreme design storms. *Advances in Hydro-Science and Engineering, Volume VI, Proc. of the 6th Intern. Conf. on Hydro-Science and Engineering*, Brisbane May 31 – June 3, 2004 (on CD-ROM).

Nathan, R.J. and Weinmann, P.E. (2004): An improved framework for the characterisation of extreme floods and for the assessment of dam safety. *Hydrology: Science & Practice for the 21st Century, Vol 1. Proc. British Hydrol. Soc.*, London, 186-193.

Nathan, R.J. and Weinmann, P.E. (2004): Towards increasing objectivity in the Probable Maximum Flood. *Proc. ANCOLD/NZSOLD Conf*, 14-17 Nov 2004.

Hill, P., Sih, K., Nathan, R., Jordan, P (2005): The Extremes of Tropical Hydrology *Proc. Ancold 2005 Conference, Perth.*

Marsden, J.S., Jacob, P.H., Nathan, R.J., Davidson, R.A., McDonald, L.A. (2005): Dam Safety, Risk and Cost-Sharing: Review of the Dam Safety Program for Western Australia's South-West Irrigation Dams *Proc. Ancold 2005 Conference, Perth.*

Marsden, J.S., Jacob, P.H., Nathan, R.J., McDonald, L.A. (2005): Risk Management - Public Policy vs Corporate Liability *Proc. Ancold 2005 Conference, Perth.*

Green, J.H., Nathan R.J., Nandakumar N. (2006): - Characterising non-linearity for the estimation of large to extreme floods. *30th Hydrology & Water Resources Symposium, Launceston.*

Mittiga, L., Nathan R.J., Hill, P., Weinmann, E., (2006) – Treatment of correlated storage drawdown and uncertainty in the flood hydrology for dams. *30th Hydrology & Water Resources Symposium, Launceston.*

Nathan, R.J., Mein, R., Weinmann, E. (2006) – RORB Version 5: A tool to move beyond ARR87. *30th Hydrology & Water Resources Symposium, Launceston.*

Hill, P.I., Nathan, R.J., Jordan, P.W. (2006) Development and Application of a Risk Analysis and Prioritisation Tool (RAPT) for Dam Safety Management. *2006 ANCOLD Conference on Dams*. Sydney November 2006.

Sih, K., Hill, P.I., Nathan, R.J., (2008): Evaluation of simple approaches to incorporating variability in design temporal patterns. Water Down Under 2008 (incorporating 31st Engineers Australia Hydrology and Water Resources Symposium), pp1049 -1059.

Murphy R., B. Neal, R. Morden, R. Nathan, R Evans Basejumper (2008): A Tool for Analysing Time Trends in Baseflow. *Water Down Under 2008* (incorporating 31st Engineers Australia Hydrology and Water Resources Symposium), pp 2741-2746.

Fowler, K., Hill, P.I., Jordan, P.W., Nathan, R.J., Sih, K. (2010) Application of Available Climate Science to Assess the Impact of Climate Change on Spillway Adequacy. ANCOLD 2010 Conference on Dams. Hobart.

Fowler, K., Jordan, P.W., Hill, P.I., Nathan, R.J., Sih, K. (2010) A framework for incorporating available climate Science in Extreme Flood Estimates. Practical Response to Climate Change Conference. Melbourne.