Connected Waters Initiative Research Centre

Annual Report 2011

2011 Summary

Summary of CWI performance in 2011

The UNSW Research centre was approved in January 2009 and builds on the pre-existing CWI, which was not formally operating as a UNSW Research Centre. Key Performance Indicators as detailed in the application to become a UNSW Research Centre were:

- To become the first point of contact by Government for advice on groundwater matters and 3D geology in particular. This will include working with the BoM on updated groundwater data networks.
- To establish a field training centre on the UNSW farm at Wellington for training of UNSW students and extension training.
- To carry out significant fundamental research in Groundwater and to have this published in international journals.
- To attract significant international collaborators to the Centre.
- To attract further Category 1 and 2 funding from the Government.

With respect to these indicators, in 2011 the CWI:

- Published 27 journal articles, 57 conference presentations and 3 technical reports
- Attracted international collaborators including Jim Hendry (Saskatchewan), Denis O'Carroll (Western Ontario), Matthew Jones (Nottingham), Julian Ortez (Chile), John Bridgeman, Ian Fairchild and Mark Cuthbert (Birmingham)
- Completed NCGRT staffing expansion with the addition of a three more new post doc appointments. Successfully met NCGRT Key Performance Indicator targets.
- Continued the use of the Wellington Field Training facility for undergraduate student training.
- Launched the NCGRT Centrifuge Permeameter Facility at the UNSW Water Research Laboratory
- Continued the successful management of the DIISR Super Science funding program for the Groundwater Education Infrastructure Fund (GEIF), including an official opening of the headquarters at the UNW Water Research Laboratory.
- Completed major drilling programs as part of the NCGRT and Super Science expenditure.
- Continued to expand the successful CWI Web pages.

In 2012, the major goals are:

- To attract further research funding, including category 1 and 2 funding from the Government
- Continue to meet NCGRT Key Performance Indicator targets and to prepare for a rebid for National Centre of Excellence for 'NCGRT2' (2014-2019, rebid due to be submitted early in 2013)

- To continue to successfully manage the DIISR Super Science funding programme for the GEIF towards completion in mid-2013.
- Continued expansion in the use of the Wellington Field Training facility, including undergraduate field teaching in both Engineering and Science.
- To support the development of centre staff, especially the development of NCGRT early career researchers and professional staff.
- To undertake the UNSW Centre Review

Publications, Research Projects, Consultancies and other scholarly achievements in 2011

See also:
https://www.connectedwaters.unsw.edu.au/news/eurekafinalists.html
https://www.connectedwaters.unsw.edu.au/news/agu2011.html

For hyperlinks to journal articles see:
http://www.connectedwaters.unsw.edu.au/technical/research/pubs/pubs_journals.html

Journal articles

Ajami, H, Meixner, T, Maddock III, T, Hogan, JF & Guertin, DP (2011). Impact of land-surface elevation and riparian evapotranspiration seasonality on groundwater budget in MODFLOW models. *Hydrogeology Journal*, vol. 19 pp. 1181-1188.

Ajami, H, Maddock III, T, Meixner, T, Hogan, JF & Guertin.DP (2011). RIPGIS-NET: A GIS tool for riparian groundwater evapotranspiration in MODFLOW. *Ground Water*, vol. 50 (1) pp. 154-158.

Ajami, H, Troch, PA, Maddock III, T, Meixner, T & Eastoe, C (2011). Quantifying mountain block recharge by means of catchment-scale storage-discharge relationship. *Water Resources Research*, vol. 47 (W04504).

Baker, A, Gulliver, P, Ascough, P, Roe, J and Bridgeman, J, 2011. Assessing the effect of sterilization on the radiocarbon signature of freshwater dissolved organic carbon. *Radiocarbon*, 53, 659-667

Baker, A, Wilson, R, Fairchild, IJ, Franke, J, Spötl, C, Mattey, D, Trouet, V & Fuller, L (2011). High resolution $\delta^{18}O$ and $\delta^{13}C$ records from an annually laminated Scottish stalagmite and relationship with last millennium climate. *Global and Planetary Change*, vol. 79, pp. 303-311.

Bayer, P, Huggenberger, P, Renard, P & **Comunian, A** (2011). Three-dimensional high resolution fluvio-glacial aquifer analog: Part 1: Field study *Journal of Hydrology* vol. 405, pp. 1- 9.

Bieroza, M, **Baker, A**, & Bridgeman, J (2011). An assessment of low pH coagulation using fluorescence spectroscopy. *Journal of Environmental Engineering*, vol. 137, pp. 596-601.

Bieroza, M, **Baker, A** & Bridgeman, J (2011). Classification and calibration of organic matter fluorescence data with multi-way analysis methods and artificial neural networks: an operational tool for improved drinking water treatment. *Environmetrics*, vol 22, pp 256-270.

Blyth, AJ, Thomas, LE, Calsteren, PV & **Baker, A** (2011). A 2000 year lipid biomarker record preserved in a stalagmite from NW Scotland. *Journal of Quaternary Science*, vol. 26, pp. 326-334.

Bridgeman, J, Bieroza, M & **Baker, A** (2011). The application of fluorescence spectroscopy to organic matter characterisation in drinking water treatment. *Reviews in Environmental Science and Biotechnology*. Vol. 10, pp. 277-290.

Goel, G. & **O'Carroll, DM** (2011). Experimental investigation of nonequilibrium capillarity effects: Fluid viscosity effects, *Water Resources Research* vol. 47 (W09507).

Greve, AK, Acworth, RI & Kelly, BFJ (2011). 3d cross-hole resistivity tomography to monitor water percolation during irrigation on cracking soil. *Soil Research* vol. 49 (8) pp. 661-69.

Kelly, BFJ, Acworth, RI & Greve, AK (2011) Better placement of soil moisture point measurements guided by 2D resistivity tomography for improved irrigation scheduling (2011). *Soil Research* vol. 49 (6) pp. 504-12.

Koh J, **Roshan H,** Rahman SS 2011, A Numerical Study on the Long Term Thermo-PoroElastic Effects of Cold Water Injection into Naturally Fractured Geothermal Reservoir. Computer and Geotechnics, DOI: 10.1016/j.compgeo.2011.03.007.

Jex, CN, Baker, A, Eden, JM, Eastwood, WJ, Fairchild, IJ, Leng, MJ, Thomas, L. & Sloane, HJ (2011). A 500 yr speleothem-derived reconstruction of late autumn-winter precipitation, North East Turkey. *Quaternary Research*, vol. 75, pp. 399-405.

Mariethoz, G, Renard, P & Straubhaar, J (2011). Extrapolating the fractal characteristics of an image using scale-invariant multiple-point statistics. *Mathematical Geosciences* vol. 43 (7), pp.783-797.

Mariethoz, G & Kelly BFJ (2011). Modelling complex geological structures with elementary training images and transform-invariant distances. *Water Resources Research* vol. 47(W07527).

Mattison, NT, **O'Carroll, DM**, Rowe, RK & Petersen EJ (2011). Impact of porous media grain size on the transport of multi-walled carbon nanotube. *Environmental Science and Technology* vol. 45 (22) pp. 9765-9775

Molnar, I, **O'Carroll, DM** & Gerhard JI (2011). Impact of surfactant-induced wettability alterations on DNAPL invasion in quartz and iron oxide-coated sand systems. *Journal of Contaminant Hydrology*, vol. 119 (1-4) pp. 1-12

Mumford, KG & **O'Carroll DM** (2011). Dynamic effects in capillary pressure: exploring wettability and dynamic contact angle effects using bundle-of-tubes simulations. *Vadose Zone Journal* vol. 10 (4) pp. 1162-1172

Petersen, EJ, Zhang, L, Mattison, NT, **O'Carroll, DM**, Whelton, AJ, Uddin, N, Nguyen, T, Huang, Q, Henry, TB, Holbrook, RD & Chen, KL (2011). Potential release pathways, environmental fate, and ecological risks of carbon nanotubes. *Environmental Science and Technology* vol. 45 (23) pp. 9837-9856

Renard, P, Straubhaar, J, Caers, J & **Mariethoz, G** (2011). Conditioning facies simulations with connectivity data. *Mathematical Geosciences* vol. 43 (8) pp. 879-903.

Straubhaar, J, Renard, P, **Mariethoz, G**, Froidevaux, R &, Besson, O (2011). An improved parallel multiple-point algorithm using a list approach. *Mathematical Geosciences* vol. 43 (3) pp. 305-328.

Mudarra, M, Andreo, B. & **Baker, A** (2011). Characterisation of dissolved organic matter in karst spring waters using intrinsic fluorescence: relationship with infiltration processes. *Science of the Total Environment*, vol. 409, pp. 3448-3462.

Murphy, KR, Hambly, A, Singh, S, Henderson, RK, **Baker, A**, Stuetz, RM, & Khan, SJ (2011). Spectral uniformity in PARAFAC decompositions of organic matter fluorescence in municipal water recycling schemes. *Environmental Science and Technology, vol.* 45, pp. 2909-2916.

Roshan H, Oeser M., 2011. A Non-isothermal Constitutive Model for Chemically Active Elastoplastic Rocks. Rock Mechanics and Rock Engineering 1-14, DOI 10.1007/s00603-011-0204-z.

Roshan H, and Rahman S.S., 2010. A Fully Coupled Chemo-Poroelastic Analysis of Pore Pressure and Stress Distribution around a Wellbore in Water Active Rocks. Rock Mechanics and Rock Engineering, Vol. 44, pp. 199-210.

Roshan H, Aghighi M.A., 2011. Chemo-poroelastic Analysis of Pore Pressure and Stress Distribution around a Wellbore in Swelling Shale: Effect of Undrained Response and Horizontal Permeability Anisotropy, Geomechanics and Geoengineering 1-10, DOI: 10.1080/17486025.2011.61693.

Roshan H, and Rahman S. S., 2011, Analysis of pore pressure and stress distribution around a wellbore drilled in chemically active elastoplastic formation. Rock Mechanics and Rock Engineering, 10.1007/s00603-011-0141-x.

Timms, WA, Young, R & Huth, N (2011) Implications of deep drainage through saline clay for groundwater recharge and sustainable cropping in a semi-arid catchment, Australia. *Hydrology and Earth Systems Science Discuss* (8), pp. 10053-10093.

Conference Papers

Peer-reviewed

Badenhop, A, Timms, WA, Kelly, BFJ, Witts, B, **Rayner, D** & Mehrabi, S (2011) Are groundwater salinity changes in the Namoi catchment leading to the degradation of beneficial uses? *NSW IAH Symposium 2011: Hydrogeology in NSW - the Challenge of Uncertainty. Dockside, Sydney, Australia, 5-6 September.*

Baker, A,Kelly, BFJ & **Mariethoz Gregoire** (2011). Quantifying the value of laminated

stalagmites for Paleoclimate reconstructions. *AGU Fall Meeting 2011, San Francisco, California, USA. 5-9 December.*

Blakers RS, **Kelly, BFJ**, Anderssen, R, **Mariethoz, G** & **Timms WA** (2011). 3D dendrogram analysis for mapping aquifer connectivity and flow model structure. *MODFLOW and More 2011: Integrated Hydrologic Modelling, Colorado School of Mines, Golden, Colorado, USA, June 5 - 8*.

Cheolkyun, J, Mujerji, T & **Mariethoz, G** (2011). Iterative spatial resampling applied to seismic inverse modeling for lithofacies prediction. *81st SEG Annual Meeting 2011, San Antonio, USA, 18-23 September.*

Daly,C & **Mariethoz, G** (2011). Recent Advances and Developments in MPS. *73rd EAGE Conference & Exhibition, Vienna, Austria, 23-26 May 2011*.

Greve, AK (2011) Monitoring water migration processes in cracking clay soil with depth profiles of square array resistivity measurements. *Near Surface 2011 - 17th European Meeting of Environmental and Engineering Geophysics, Leicester, UK, 12-14 September.*

Jeong, C, Mujerji, T & **Mariethoz, G** (2011). Adaptive spatial resampling for seismic inverse modelling. *AGU Fall Meeting 2011, San Francisco, California, USA. 5-9 December.*

Jeong, C, Mujerji, T & **Mariethoz, G** (2011). Adaptive iterative spatial resampling for subsurface reservoir characterization constrained to seismic data. *24th Stanford Center for Reservoir Forecasting Annual Meeting, Stanford University, USA, 4-5 May 2011*.

Jex, C, **Mariethoz, G**, **Baker, A**, **Graham, P, Andersen, MS**, Edwards N, **Kelly, BFJ** &**Azcurra, C** (2011). Tracing hydrological variability and isotopic composition of waters from surface to cave at the Wellington Caves in SE Australia: Paleoclimate implications. *INQUIA Conference, Bern, Switzerland 21-27 July, 2011*.

Mariethoz, G & **Kelly, BFJ** (2011). A new look at multiple-point geostatistics for geological modelling. *35th APCOM Symposium, Wollongong, Australia 24-30, September 2011.*

Mariethoz, G, Renard, P & Straubhaar, J (2011). Integrating geological concepts in numerical inversion methods. *ModelCare 2011, Leipzig, Germany, 18-22 September.*

Mariethoz G (2011). Parameterizing training images used for multiple-point simulations. *24th Stanford Center for Reservoir Forecasting Annual Meeting, Stanford University, USA, 4-5 May, 2011*.

Mariethoz, G & **Kelly, BFJ** (2011). Parameterizing training images used for multiple-point simulations. *1st Conference on Spatial Statistics 2011, Enschede, The Netherlands, 23 - 25 March.* (Awarded Best Paper)

Mariethoz, G, **McCabe, M** & Renard, P (2011). Reconstruction of remote sensing soil moisture data for input to groundwater models. *ModelCare 2011, Leipzig, Germany, 18-22 September.*

Mariethoz, G & Renard, P (2011). Simulation of karstic networks using high order discrete Markov processes. H2Karst. *9th Conference on Limestone Hydrogeology, Besancon, France, 1-3 September 2011.*

Mariethoz, G (2011). Stochastic imaging, randomness and uncertainty in environmental modelling. *Climate Change Research Centre, University of New South Wales, Sydney, Australia, 20 April 2011.*

Mariethoz, G (2011). Stochastic imaging and randomness in geological models. *University of Chile, Santiago, 28 June 2011*.

Pirot, G, Meerschman, E, **Mariethoz, G**, Straubhaar, J, Van Meirvenne, M & Renard, P (2011). Optimizing direct sampling algorithm's parameters to perform multiple-points geostatistical simulations. *AGU Fall Meeting 2011, San Francisco, California, USA. 5-9 December.*

Timms, WA, Kelly, BFJ ,Blakers, R, Farley, C, **Regmi, G**, **Larsen, J** & Bowling, A (2011) Implications of 3D geological architecture for surface-groundwater connectivity in the Mooki catchment. *NSW IAH Symposium 2011: Hydrogeology in NSW - the Challenge of Uncertainty, Dockside, Sydney, Australia, 5-6 September.*

Non-peer-reviewed

Andersen, MS, Rau, GC, McCallum, AM, Meredith, MK, & **Acworth, RI** (2011). Constraining water fluxes through the streambed of a semi-arid losing stream using natural tracers: heat and radioisotopes. *AGU Fall Meeting 2011, San Francisco, California, USA. 5-9 December.* (Invited speaker).

Andersen MS, Rau, GC, McCallum, AM, Meredith, K, & **Acworth, RI** (2011). Groundwater recharge and geochemical processes in a semi-arid losing stream using temperature, isotopes and geochemistry. *11th Australasian Environmental Isotope Conference & 4th Australasian Hydrogeology Research Conference, Cairns, Australia, 12-14 July 2011.*

Andersen, MS, Meredith, **K, Timms, WA & Acworth, RI** (2011). Investigation of δ18O and δ2H in the Namoi River catchment - surface water/groundwater interactions. *NSW IAH Symposium 2011: Hydrogeology in NSW - the Challenge of Uncertainty. Dockside, Sydney, Australia, 5-6 September.* (Awarded Best Poster).

Andersen, MS, Rau, GC, McCallum, AM, & Acworth, RI (2011). Redox processes and arsenic release in the streambed of a semi-arid losing stream. *AGU Fall Meeting 2011, San Francisco, California, USA. 5-9 December.*

Baker A, **Kelly BFJ**, & **Mariethoz, G** (2011) Quantifying the Value of Laminated Stalagmites for Paleoclimate Reconstructions. Presentation: PP21D-05, *AGU Fall Meeting 2011, San Francisco, California, USA. 5-9 December.*

Cohen, T., Nanson, G., Jansen, J., Jones, B., Jacobs, Z., **Larsen, J.,** May, J-H., Price, D., Smith, A. (2011). Late Quaternary mega-lakes of central Australia: varying moisture sources and increased continental aridity. International Quaternary Association (INQUA), conference abstracts Bern 2011.

Greve, AK, Timms, WA & Rogan A (2011) Disconnected waters in the Gunnedah Basin? Part 1: Geophysical field methods to characterise geological barriers to flow *NSW IAH Symposium 2011: Hydrogeology in NSW the Challenge of Uncertainty, Dockside, Sydney, Australia, 5-6 September.*

Jex, C, Mariethoz, G, Baker, A, Graham, P, Andersen, MS, Edwards N, **Kelly, BFJ** &**Azcurra, C** (2011). Tracing hydrological variability and isotopic composition of waters from surface to cave at the Wellington Caves in SE Australia: Paleoclimate implications. *INQUIA Conference, Bern, Switzerland,21-27 July 2011.*

Kelly BFJ, Giambastiani B, **Larsen J**, Ralph T & **Baker, A** (2011) Neogene Climate Change and the Impact on the Hydrostatigraphy of the Lower Namoi Catchment, Australia. *AGU Fall Meeting 2011, San Francisco, California, USA. 5-9 December.* Poster: EP31A-0791

Larsen, J, Mariethoz, G, Andersen, MS &**Kelly, BFJ** (2011). Long term water quality trends in Australia's largest river basins. *European Geosciences Union General Assembly, Vienna, Austria, 3-8 April 2011*.

Larsen, J.R., Cendón, D.I., Nanson, G.R., McTainsh, G.H., Jones, B.G. 2011. The origin and transport of salts in the Australian landscape. 14th Australian & New Zealand Geomorphology Conference, Omaru, New Zealand.

Larsen, J.R., Mariethoz, G., Andersen, M., Kelly, B. 2011. Long term water quality trends in Australia's largest river basin. EGU General Assembly 2011, Vienna, Austria.

Larsen, J.R., Nanson, G.C., Cendón, D.I. (2011) Land-atmosphere coupling during the Last Glacial Maximum: An Australian perspective. International Quaternary Association (INQUA), conference abstracts Bern 2011.

Mariethoz G (2011). Randomness, geological uncertainty and data assimilation. *Flinders University, Adelaide, Australia, 10 February 2011.*

Mariethoz, G & **Kelly, BFJ** (2011). A New Look at Multiple-Point Geostatistics for Geological Modelling. *35th APCOM Symposium, Wollongong, Australia, 24-30 September 2011.*

May, J-H., **Larsen, J**., Cohen, T., Nanson, G. (2011) Paleosols at Mt. Chambers alluvial fan (Flinders Ranges, S Australia) and their paleoenvironmental implications. International Quaternary Association (INQUA), conference abstracts Bern 2011.

McCallum, AM, Andersen, MS, Rau, GC, & Acworth, RI (2011). Using combined temperature, flow and level data to investigate river-aquifer interaction scaling issue. *AGUFall Meeting 2011, San Francisco, California, USA. 5-9 December.*

Nanson, G.C., **Larsen, J.R**., Cohen, T., May, J-H. (2011) The likely sources of moisture driving changes in Australia's rivers and lakes during the Mid to Late Quaternary. International Quaternary Association (INQUA), conference abstracts Bern 2011.

Neilson, KL, **Andersen, MS, & Acworth, RI** (2011). An investigation into recharge sources in a semi-arid mountain front aquifer using stable isotopes signatures and groundwater

chemistry. *11th Australasian Environmental Isotope Conference & 4th Australasian Hydrogeology Research Conference, Cairns, Australia, 12-14 July 2011.*

Rau, GC, Andersen, MS, & Acworth, RI (2011). Is thermal dispersivity significant for the use of heat as a tracer in sediments? *AGU Fall Meeting 2011, San Francisco, California, USA. 5-9 December.*

Stone, A., **Larsen, J.R** (2011). The peaks and troughs of dune records: What do the frequency based distributions of luminescence ages from dunefields actually mean? International Quaternary Association (INQUA), conference abstracts Bern 2011.

Timms, WA. (2011). Recharge and leakage through clay sediment. *NCGRT Hydrology Research Discovery, Gunnedah, 10th August, 2011*

Timms, WA (2011). Groundwater hydrology: the basics. *A component of NCGRT industry course Groundwater for Decision Makers, Canberra, 1st September, 2011*

Timms, WA (2011). Groundwater research update for the Upper Namoi catchment. *Community workshop organised by Cotton Catchment Communities CRC at Gunnedah Services Club, 10th March, 2011*

Timms, WA (2011). Managed aquifer recharge. *A component of NCGRT industry course Introduction to groundwater and surface water interaction. Sydney, 29th March, 2011*.

Abstract only

Badenhop A, Timms WA, Kelly BFJ, Witts B, **Rayner D** & Mehrabi, S (2011) Are groundwater salinity changes in the Namoi catchment leading to the degradation of beneficial uses? In: McLean, W., and Milne-Holme B. *NSW IAH Symposium 2011: Hydrogeology in NSW - the Challenge of Uncertainty, Dockside, Sydney, Australia, 5-6 September.*

Bayer, P, **Comunian, A,** Straubhaar, J, Huggenberger, P & P.Renard: High-resolution reconstruction of three- dimensional sedimentary aquifer analog: the Herten case study. *Geophysical Research Abstracts* Vol. 13, EGU 2011.

Greve AK, Timms, WA & Rogan, A (2011) Disconnected waters in the Gunnedah Basin? Part 1: Geophysical field methods to characterise geological barriers to flow. In McLean, W & Milne-Holme, B. *NSW IAH Symposium 2011: Hydrogeology in NSW - the Challenge of Uncertainty, Dockside, Sydney, Australia, 5-6 September.*

Regmi G, Timms, WA, Greve, AK, Bambrook, B & Walmsley, H (2011) Disconnected waters in the Gunnedah Basin? Part 2: Centrifuge technology to characterise geological barriers to flow In: McLean, W., and Milne-Holme B. *NSW IAH Symposium 2011: Hydrogeology in NSW - the Challenge of Uncertainty, Dockside, Sydney, Australia, 5-6 September*.

Timms, W, Whelan, M & Regmi G (2011). Contaminant retardation of 10,000 within aquitards: development of centrifuge permeameter techniques. *2nd Canadian Symposium on Aquitard Hydrogeology, University of Ottawa, Canada, 21-23 June, 2011*.

Timms WA, Kelly BFJ, Blakers, R, Farley, C, **Regmi, G, Larsen, J** & Bowling, A (2011).

Implications of 3D geological architecture for surface-groundwater connectivity in the Mooki catchment. In McLean, W & Milne-Holme, B. *NSW IAH Symposium 2011: Hydrogeology in NSW - the Challenge of Uncertainty, Dockside, Sydney, Australia, 5-6 September.*

Poster

Ajami, H, **McCabe**, **MF**, Stisen, S & Evans, JP (2011). On the performance of integrated hydrologic models in simulating catchment scale land surface fluxes. Poster Presentation. *European Geophysical Union, 2011 General Assembly, Vienna, Austria, 3-8 April 2011*

Ajami, H, **McCabe**, **MF**, Stisen, S & Evans, JP (2011). Exploring impacts of groundwater dynamics on catchment scale land surface fluxes. Poster presentation. *American Geophysical Union, 2011 Fall meeting, San Francisco, USA, 5-9 December 2011*

Ajami, H, **McCabe**, **MF**, Stisen, S & Evans, JP (2011). Toward improved estimation of groundwater recharge and evapotranspiration using coupled vs. integrated hydrologic models. Poster Presentation. *International Union of Geodesy and Geophysics (IUGG) 2011, Melbourne, Australia, 28 June-7 July 2011*

Kelly BFJ, Giambastiani B, **Larsen J**, Ralph T, & **Baker, A** (2011) Neogene climate change and the impact on the hydrostatigraphy of the Lower Namoi Catchment, Australia. Poster: EP31A-0791 AGU Fall Meeting 2011, San Francisco, CA, USA. 5-9 December.

Regmi G, Timms WA, Acworth RI, Whelan M & McDonell M (2011). Characterisation of hydraulic properties of clay aquitards in the Namoi Catchment. Poster presentation. *11th Australasian Environmental Isotope Conference & 4th Australasian Hydrogeology Research Conference, Cairns, Australia, 12-14 July 2011*

Technical Reports

Pells, SE, Bacon, P, **Miller, BM** & **Timms, WA** (2011). Assessment of stream restoration and aquifer management options for Borambil Creek. *WRL Technical Report 2011/15*.

Pells, SE & **Timms, WA** (2011) Initial review of surface water and groundwater connectivity. *WRL Technical Report 2011*.

Timms, W, Ruprecht, J, Greve, AK & **Whelan, M** (2011). Hydraulic conductivity testing of drill core Broken Hill MAR. *WRL Technical Report 2011/30.*

Research Projects

Cotton Catchment Communities CRC

The NWC (National Water Commission)/NPSI (National Program for Sustainable Irrigation) 3-year project on heat as a groundwater tracer was successfully completed in December 2011. The final report was approved by both NWC and NPSI with very favourable feedback from both organisations. Gabriel Rau submitted his PhD thesis based on experimental laboratory work in this project in December 2011. It is anticipated that Mr Rau will graduate in mid-2012. Two journal articles based on his work were submitted in 2011 and have now been

accepted for publication in Water Resources Research. The current state of the heat tracing methodology was presented at a combined IAH regional meeting - New South Wales Office of Water (NOW) workshop in Tamworth on 19th July 2011 by Gabriel Rau. The meeting was attended by about 20 NOW regional hydrogeologists from different areas in NSW and by professional consultants from major regional centres. The availability of computational tools for simplified analysis and interpretation of temperature data was promoted. Gabriel Rau and Martin Andersen both participated in planning, convening and chairing sessions as well as presenting invited talks at the 2011 AGU conference in San Francisco based on the heat project work.

The Cotton Catchment Communities CCC funded an Honours student scholarship over the summer 2010-2011 to UNSW Civil Engineering undergraduate Garth Cooper. Garth was supported by Martin Andersen, Andrew McCallum and Gabriel Rau in a numerical study: A Numerical Analysis of Groundwater Abstraction on Aquifer-River Interactions. The CCRC also funded an Undergraduate Summer Scholarship in 2011-2012 to UNSW Advanced Science undergraduate Mukhlis Mah. Supported by Wendy Timms, Bryce Kelly, Adam Hartland and Andy Baker, Mukhlis undertook a baseline organic and inorganic water quality survey of the Namoi catchment.

In 2011 CWI continued its public outreach on groundwater conditions in the Murray-Darling Basin for the Cotton CRC with four presentations for farmers and researchers:
Acworth, R.I., Kelly, B.F.J., Timms, W., Andersen, M., McCallum, A.M. and Rau G. (2011) Australian Cotton Water Story Groundwater Resource Conditions. A research review hosted by Cotton Australia, Cotton Catchment Communities CRC (Cotton CRC) and Cotton Research and Development Corporation as part of the Cotton Collective in Narrabri NSW on the 10-11th of August 2011.
Andersen, M.S. (2011) Water quality and ecological implications of changing dynamics in surface water groundwater interactions. Talk presented at a New South Wales Office of Water (NOW) workshop in Tamworth on 19th July 2011. The meeting was attended by about 20 NOW regional hydrogeologists from all over NSW.
Kelly, B.F.J., Andersen, M. and Timms, W. (2011) Groundwater in the Lower Namoi", Grower Information Day, for the Cotton Catchment Communities CRC, Australian Cotton Grower Research Centre, Narrabri, March 17th.
Timms, WA (2011). Groundwater research update for the Upper Namoi catchment. *Community workshop organised by Cotton Catchment Communities CRC at Gunnedah Services Club, 10th March, 2011*

National Centre for Groundwater Research and Training

The NCGRT provides ~$7M of research funding from 2009-2014, focussed on post-doctoral research salaries and PhD and honours training scholarships. NCGRT recruitment continued in 2011, focussing on postdoctoral appointments. These included Adam Hartland, Alessandro Comunian, Sanjeev Jha, and Gabriel Rau, leading to a near-full NCGRT staffing by the end of the year. The major NCGRT equipment item, the Centrifuge Permeameter facility, was commissioned and launched in 2011. NCGRT supported researchers produced the majority of the papers and conference presentations in 2011 and this is expected to continue to be the case for the next few years.

For further details see:

https://www.connectedwaters.unsw.edu.au/news/centrifugepermeametercommissioned.html
https://www.connectedwaters.unsw.edu.au/news/coringbreeza.html
https://www.connectedwaters.unsw.edu.au/news/gravitystation.html
https://www.connectedwaters.unsw.edu.au/news/breezafieldday.html
https://www.connectedwaters.unsw.edu.au/news/timemachine.html

NSW Science Leveraging Fund

NSW SLF funding in 2010 was used to construct the research and training facility at the UNSW Wellington Field Station. The fixed-term site manager (Peter Graham) continues to be funded primarily from the NSW SLF, with additional support from UNSW Facilities and the NCGRT. Peter continued to oversee research and training at the site in 2011. This included regular visits by NCGRT supported postdoctoral research and PhD students, including intensive field campaigns by Matt McCabe and team, and support of undergraduate field classes at the field station.

For further details see:
https://www.connectedwaters.unsw.edu.au/news/ncgrtsupports.html

Super Science

Australian Government Super Science Initiative funding (2009-2013) continued throughout the reporting period. Four quarterly milestone reports were submitted and approved by DIISR, as well as the second Annual Business Plan. A new subcontract was set up with Monash to manage an additional Super Science site in Victoria. Management of the project activities at most of the sites has proceeded satisfactorily and milestone payments have been made to sub-contractors at ANU (Data Management project), Queensland University (Stradbroke and Bribie Islands) and Monash University (Ovens Catchment). However, progress has remained very slow with the Flinders University subcontract (Ti Tree and Willunga) when compared to the timelines contained in the Business Plan.

Ground water EIF activities directly run by UNSW focuses on the Namoi and Wellington sites. At Namoi, improved weather mid-year permitted significant activity in 2011, including the installation of a second gravity station is underway on the Liverpool Plains at Breeza and commencement of the installation of extra climate stations and monitoring equipment in the upper part of Maules Creek. Unfortunately, work was again delayed due to heavy rain and flooding in December. At Wellington, new infrastructure included further boreholes as part of the “fractured rock investigation and monitoring facility”. By the end of the year, 11 boreholes had been completed with a mixture of open hole completions and double piezometers. A total depth of 497 m drilling was achieved. The rigs will return to site in 2012 to complete a further 11 boreholes and a small pumping test bore. This will complete the works at the Wellington Research station. In 2011, further water level and temperature loggers and weather stations were installed, and the year also saw the delivery and commissioning of a rainfall radar. The GEIF infrastructure was utilised by UNSW honours and PhD researchers, NCGRT post-doctoral researchers and external collaborators including ANSTO and Macquarie University

For further information see:
https://www.connectedwaters.unsw.edu.au/news/geiflaunch.html

ARC Discovery, Linkage, LIEF and other grants

The ARC DP11 Discovery Grant investing lipid and lignin phenol biomarkers commenced in 2011; Catherine Jex was appointed as the post-doctoral researcher and this project focussed on establishing new laboratory methods in collaboration with Stuart Khan (WRc). Progress was good with the first ARC end-of-year report submitted on time.

The ARC LE11 infrastructure grant to establish a carbonate mass spectrometry facility at UNSW commenced and was completed in 2011, with the successful commissioning of the equipment within the Biomedical Mass Spectrometry Facility in late 2011. This equipment is now being utilised by project partners from ANSTO and Newcastle Universities, and collaborators from Wollongong.

For further information see:
https://www.connectedwaters.unsw.edu.au/news/massspectrometer.html

Consultancies

The Technical Reports listed above were prepared as a result of consultancy contracts operated through the Water Research Laboratory at Manly Vale and reports written as part of Cotton CRC commitments. The total number continues to decline, and this trend is expected to continue.

Significant managerial or personnel changes

Prof Andy Baker started 2011 as Acting Director of the CWI and acting leader of NCGRT Program 1. From April 2011 he became Program Leader of NCGRT Program 1, with Prof Ian Acworth returning as CWI Director. These changes allowed Prof Acworth to focus on the management of the GEIF project, and Prof Baker to focus on the management of the NCGRT project.

CWI post-doctoral researcher Dr Gregoire Mariethoz was appointed to the School of Civil and Environmental Engineering in August 2011. Correspondingly, be became a co-investigator in the NCGRT.

Dr Denis O'Carroll joined the CWI in July 2011 for one year, on sabbatical from the University of Western Ontario.

CWI personnel at the end of 2011 comprised (funding source in brackets):
Academic Staff. Prof Ian Acworth, Dr Martin Andersen, Dr Gregoire Mariethoz, Dr Wendy Timms (all CVEN), Dr Bryce Kelly (BEES), Prof Andy Baker (CWI)
Professional Staff. Mark Whelan (NCGRT), Sam McCulloch, Jodi Adams, Antonio Woo (all GEIF), Peter Graham (NSW SLF/UNSW FM / NCGRT).
Post-doctoral staff. Joshua Larsen, Adam Hartland, Anna Greve, Alessandro Comunian, Sanjeev Jha, Hamid Roshan, Hoori Ajami, Josiah Strauss (all NCGRT), Catherine Jex (ARC), Gabriel Rau, Andrew McCullum (CRDC).
PhDs. Mark Peterson, Cecilia Azcurra, Ali Ershadi (all NCGRT).

List of teaching and research supervision carried out by the centre on behalf of units

Centre staff employed by the Schools of CVEN and BEES contributed the following teaching and research supervision in 2011:

GEOS2291 Ground and Surface Water
CVEN3501 Water Resources Engineering
CVEN4503 Groundwater Resource Investigation
CVEN4703 Advanced Water Quality
CVEN4501 Catchment And Water Resources Modelling
GEOS9632 Groundwater Management
GEOS9633 Geophysical Techniques in Groundwater, Engineering and Agriculture
GEOS9634 3D Geological Computer Models and Spatial Data Analysis
CVEN9612 Catchment and Water Resources Modelling
CVEN9884 Environmental Engineering Science 1
CVEN9885 Environmental Engineering Science 2
CVEN9631 Hydrogeochemistry

Honours Theses

Brake Bambrook (2011). Aquitards and Groundwater Sustainability – Comparison of Geotechnical Centrifuge Test and Numerical Modelling. School of Civil and Environmental Engineering

Garth Cooper (2011). A Numerical Analysis of Groundwater Abstraction on Aquifer-River Interactions. School of Civil and Environmental Engineering.

Chris Farley (2011). Aquitards and Groundwater Sustainability: Three-dimensional Mapping Of Aquitard Architecture. School of Civil and Environmental Engineering

Inigo Irrarazaval (2011). Meandering river modelling using direct sampling. School of Biology, Earth and Environmental Science.

Alexander Rogan (2011). Aquitards and Groundwater Sustainability – Investigating Soil Moisture Changes in the Unsaturated Zone. School of Civil and Environmental Engineering

Hannah Wamsley (2011). Centrifuge Testing of Natural Clay Barriers. School of Civil and Environmental Engineering

Masters Projects

Amy Becke (2011). Quantifying groundwater discharge into Barratta Creek, north Queensland, Australia. School of Biology, Earth and Environmental Science.

Jason Carr (2010) 3D Analysis of Groundwater Hydrographs and Driller Logs in the Gwydir Catchment, Supervisor Bryce Kelly. Submitted in 2011.

Danielle Ord (2010) Hydrogeological assessment of site X. Supervisor Bryce Kelly. Submitted in 2011.

Melissa Woltmann (2011) 3D Geological Model of the Phanerozoic Cover for the Kintyre Area, Western Australia. Supervisor Bryce Kelly

Statement of in-kind contributions including academic/other salaries, infrastructure and resources provided to the centre

Academic salaries are contributed by the Schools of BEES and CVEN and the DVC Research; related infrastructure and resources including offices, website hosting and administration support are provided by BEES and CVEN, the latter including a substantial base at the Water Research Laboratory, Manly Vale.

Record of dates and attendance of management and advisory committee

5th Management Board Meeting, Thursday 14th April 2011, BEES
Prof. Merlin Crossley, (Dean Science), Prof. Graham Davies (Dean Engineering), Prof. David Waite (HoS CVEN), Prof. Ian Acworth (Director CWI), Prof. Andy Baker (Deputy Director CWI), Mr Antonio Woo (Manager - EIF Super Science), Dr Ian Turner (Acting Director WRL). Apologies: A/Prof. David Cohen (HoS BEES)

6th Management Board Meeting, 7th September 2011, WRL

Prof. Graham Davies (Dean Engineering), Prof. David Waite (HoS CVEN), Prof. Ian Acworth (Director CWI), Prof. Andy Baker (Deputy Director CWI), Dr Bill Peirson (Director WRL).
Apologies: A/Prof. David Cohen (HoS BEES), Prof. Merlin Crossley, (Dean Science), Mr Antonio Woo (Manager - EIF Super Science).

Statement of Financial Performance
For CWI - Connected Water Initiative
Period between 1st of January 2011 – 31st December 2011

Research Income / Sundry Grant / Other		5,667,268
Interest Revenue	(GEIF)	343,986
Internal Revenue	(RF accounts)	271,586
Total Income		**6,282,840**

Other Payments

Payroll	1,814,755
Equipment	2,343,914
Other Expenses	97,086
Repairs and Maintenance	1,175
Contract Services	833,978
Consumables	75,646
Scholarships	60,900
Investment Expenses	-
Overheads	3,531
Internal Expenses	- 1,521
Travel Domestic	131,377
Travel International	92,549
Internal Travel	-
Total other payments	**5,453,390**

Operating Result	829,450
B/Forward from 2010	6,110,580
Accumulated funds Surplus (Deficit)	**6,940,030**
Unpaid Invoices (including GST):	**783,161**

Connected Waters Initiative chart field

PS18850	STRATEGIC HIRE : ANDREW BAKER	RM07764	DIISR Educ Invest Fund EIF
PS20578	Faculty Admin support for CWI	RM07765	DIISR Educ Invest Fund EIF
PS24923	2011-12 Strategic P-I. Acworth	RM07766	DIISR Educ Invest Fund EIF.
PS18224	ENG Gary Johnston Chair	RM07767	DIISR Educ Invest Fund EIF.
PS23647	IT Infrastructure WRL	RM07768	DIISR Educ Invest Fund EIF.
PS23704	LE110100045_Baker,A	RM07769	DIISR Educ Invest Fund EIF
PS23850	2011 MREII_Baker, Andrew Blair	RM07808	CRC for Cotton Catchment Community
RM06822	CottonRes&Dev Ex Land&WaterAus	RM07904	NSW Dept of Environment & Climate
RM07194	NSW Dept of State & Regional D	RM08646	ARC LP110102124 PROJ Baker, A
RM07362	ARC/NWC Co-Funded Centre for G	RM08936	ARC LE110100045 PROJECT
RM07363	ARC/NWC Co-Funded Centre for G	RM09016	UniOfNewcastl Shared Grnt LIEF
RM07364	ARC/NWC Co-Funded Centre for G	RM09017	ANSTO Shared Grnt Mass Spectrometer
RM07365	ARC/NWC Co-Funded Centre for G	RM09038	Numerical modeling river-aquif
RM07366	ARC/NWC Co-Funded Centre for G	RM09860	Main RM07764_ Ovens Valley Sit
RM07367	ARC/NWC Co-Funded Centre for G	RM09883	Main RM07764_North Stradbroke