

Connected Waters Initiative Research Centre

Annual Report 2010

2010 Summary

Summary of CWI performance in 2010

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 2010 the CWI:

- Published 27 journal articles, 40 conference presentations and 9 technical reports
- Attracted international collaborators including Jim Hendry (Saskatchewan), Chris Bradley (Birmingham)
- Attracted significant new Category 1 funding through ARC LIEF, Superscience Fellowship (with CCRC), and Discovery Projects
- Strengthened State and Federal Government contacts through NCGRT, Groundwater EIF and Cotton CRC research projects, including the commencement of a Federal Government funded EIF groundwater database, and a formal collaborative agreement between NCGRT and NSW Office of Water.
- Completed drilling at the UNSW Wellington Research Station, established and launched a training facility for field methods in groundwater and surface water hydrology, and ran the 1st NCGRT Field Methods short course
- Significantly expanded staffing to fulfil NCGRT and EIF contracts, including 4 research fellows, a field and centrifuge engineer, a site manager at the UNSW Wellington Field Station, an administrator, 5 NCGRT scholarship students and 4 PhD students.

In 2011, the major goals are:

- To complete NCGRT staffing expansion with the addition of a minimum of three more new post doc appointments.
- Routine use of the Wellington Field Training facility for short course and undergraduate student training.
- To launch the NCGRT Centrifuge Permeameter Facility at the UNSW Water Research Laboratory

- Continued successful management of the DIISR Super Science funding program for the Groundwater Education Infrastructure Fund (GEIF)
- Continued growth of ERA A/A* journal outputs to meet and exceed NCGRT Key Performance Indicator targets
- Complete major drilling programs as part of the NCGRT and Super Science expenditure.
- Continue to expand the successful CWI Web pages.

Publications, Research Projects, Consultancies and other scholarly achievements in 2010

See also:

<http://www.connectedwaters.unsw.edu.au/news/cwiscienceexcellenceaward.html>

For hyperlinks to journal articles see:

http://www.connectedwaters.unsw.edu.au/technical/research/pubs/pubs_journals.html

Journal articles

Baker, A., Asrat, A, Fairchild, IJ, Leng MJ, **Jex, CN** et al (2010). Decadal scale rainfall variability in Ethiopia recorded in an annually laminated, Holocene-age, stalagmite. *Holocene* vol 20 (6), pp. 827 - 836. <http://dx.doi.org/10.1177/0959683610365934>

Baker, A, Bradley, C, **Jex, CN**, & Leng MJ (2010). Hydrological uncertainties in the modelling of cave drip-water $\delta^{18}O$ and the implications for stalagmite palaeoclimate reconstructions. *Quaternary Science Reviews* vol 29 (17-18), pp 2201-2214. <http://dx.doi.org/10.1016/j.quascirev.2010.05.017>

Bieroza, MZ, Bridgeman, J. & **Baker, A**, (2010). Fluorescence spectroscopy as a tool for determination of organic matter removal efficiency at water treatment works. *Drinking Water Engineering Science* vol 3 pp 63-70. <http://dx.doi.org/10.5194/dwes-3-63-2010>

Bradley, C, & **Baker A** (2010). Modern stalagmite $\delta^{18}O$: Instrumental calibration and forward modelling. *Global and Planetary Change* vol 71(3-4), pp. 201 - 206. <http://dx.doi.org/10.1016/j.gloplacha.2009.05.002>

Carstea, E.M., **Baker, A.**, Bieroza, M. & Ryenolds, DM (2010). Continuous fluorescence excitation-emission monitoring of river organic matter. *Water Research* vol 44(18), pp 5356-5366. <http://dx.doi.org/10.1016/j.watres.2010.06.036>

Cendon, DI, **Larsen, JR**, Jones, BG, Nanson, GC, et al (2010). Freshwater recharge into a shallow saline groundwater system, Cooper Creek floodplain, Queensland, Australia. *Journal of Hydrology* vol 392 (3-4), pp 150-163. <http://dx.doi.org/10.1016/j.jhydrol.2010.08.003>

Dominguez-Villar, D, Fairchild, IJ, Carrasco, R, Pedraza, J, **Baker, A** & et al (2010). The effect of visitors in a touristic cave and the resulting constraints on natural thermal conditions for palaeoclimate studies (Eagle Cave, central Spain). *ACTA Carsologica* vol 39, pp. 491 - 502. <http://carsologica.zrc-sazu.si/?stran=article&id=471>

Fernandez martinez, J, Garcia gonzalo, E, **Mariethoz, G**, et al (2010). Posterior Sampling using Particle Swarm Optimizers and Model Reduction Techniques. *International Journal of Applied Evolutionary Computation* vol 42, pp. 27 - 48. <http://www.minds.ch/gm/pdf/fernandezmartinez2010a.pdf>

Greve, AK, Acworth, RI, & Kelly, BFJ (2010). Detection of subsurface soil cracks by vertical anisotropy profiles of apparent electrical resistivity. *Geophysics* vol 75 (WA85) <http://dx.doi.org/10.1190/1.3474590>

Greve, AK, Andersen, M, & Acworth, RI (2010). Investigations of soil cracking and

preferential flow in a weighing lysimeter. *Journal of Hydrology* vol 393 (1-2), pp 105-113
[doi:10.1016/j.jhydrol.2010.03.007](https://doi.org/10.1016/j.jhydrol.2010.03.007)

Hambly, A, Henderson, RK, Storey, M, **Baker A**, et al (2010). Fluorescence monitoring at a recycled water treatment plant and associated dual-distribution system - implications for cross connection detection. *Water Research* vol 44 (18), pp. 5323 - 5333
[doi:10.1016/j.watres.2010.06.003](https://doi.org/10.1016/j.watres.2010.06.003)

Hambly, A, Henderson, RK, **Baker A**, Stuetz, RM, & et al (2010). Fluorescence monitoring for cross-connection detection in water reuse systems: Australian case studies. *Water Science and Technology* vol 61, pp. 155 - 162. <http://dx.doi.org/10.2166/wst.2010.795>

Hambly, A, Henderson, RK, **Baker A**, Stuetz, RM, & et al (2010). Probabilistic analysis of fluorescence signals for monitoring dual reticulation water recycling schemes. *Water Science and Technology* vol 62, pp. 2059-2065. <http://dx.doi.org/10.2166/wst.2010.504>

Hartland, A, Fairchild, IJ, Lead JR, & **Baker A** (2010). Fluorescent properties of organic carbon in cave dripwaters: effects of filtration, temperature and pH. *Science of the Total Environment* vol 408 (23), pp. 5940-5950. <http://dx.doi.org/10.1016/j.scitotenv.2010.08.040>

Jex, CN, Baker, A, Fairchild, IJ, Eastwood, WJ, et al. (2010). Calibration of speleothem $\delta^{18}\text{O}$ with instrumental climate records from Turkey. *Global and Planetary Change* vol 71 (3-4), pp. 207 - 217. [doi:10.1016/j.gloplacha.2009.08.004](https://doi.org/10.1016/j.gloplacha.2009.08.004)

Leng MJ, Baneschi, I, Zanchetta, G, **Jex, CN**, et al (2010). Late Quaternary palaeoenvironmental reconstruction from Lakes Ohrid and Prespa (Macedonia/Albania border) using stable isotopes. *Biogeosciences* vol 7, pp. 3109-3122.
<http://www.biogeosciences.net/7/3109/2010/>

Mariethoz, G (2010). A general parallelization strategy for random path based geostatistical simulation methods. *Computers and Geosciences* vol 36 (7), pp. 953-958.
<http://dx.doi.org/10.1016/j.cageo.2009.11.001>

Mariethoz, G, Renard, P, & Caers, J. (2010). Bayesian inverse problem and optimization with iterative spatial resampling. *Water Resources Research* no 46. Article number W11530 - 1178. <http://www.agu.org/journals/ABS/2010/2010WR009274.shtml>

Mariethoz, G, & Renard, P. (2010). Reconstruction of Incomplete Data Sets or Images Using Direct Sampling. *Mathematical Geosciences* vol 42 (3), pp. 245-268.
<http://www.minds.ch/gm/publications.htm>

Mariethoz, G, Renard, P, & Straubhaar, J. (2010). The direct sampling method to perform multiple-point geostatistical simulations. *Water Resources Research* no 46, Article number W11536 <http://www.minds.ch/gm/publications.htm>

Muller, CL, Kidd, C, Fairchild, IJ, & **Baker A** (2010). Investigation into clouds and precipitation over an urban area using micro rain radars, satellite remote sensing and fluorescence spectrophotometry. *Atmospheric Research* vol 96 (2-3), pp. 241-255.
<http://dx.doi.org/10.1016/j.atmosres.2009.08.003>

Rau G, Andersen MS, McCallum A. & Acworth RI (2010): Analytical methods that use natural heat as a tracer to quantify surface water-groundwater exchange, evaluated using field temperature records. *Hydrogeology Journal* vol 18 (5), pp1093-1110. <http://dx.doi.org/10.1007/s10040-010-0586-0>

Spencer, RGM, Hernes P, Ruf R, **Baker, A** et al (2010). Temporal controls on dissolved organic matter and lignin biogeochemistry in a pristine tropical river, Democratic Republic of Congo, *Journal of Geophysical Research* vol 115, pp G03013-15.
<http://dx.doi.org/10.1029/2009JG001180>

Straubhaar, J, Renard, P, **Mariethoz, G**, & Besson, O (2010). An improved parallel multiple-point algorithm using a list approach. *Mathematical Geosciences*.
<http://www.minds.ch/gm/publications.htm>

Wynn, PM, Fairchild, IJ, Frisia, S, Spötl, C, **Baker, A**, Borsato, A, & EIMF (2010). High-resolution sulphur isotope analysis of speleothem carbonate by secondary ionisation mass

spectrometry. *Chemical Geology* no 271, pp 101-107.
<http://dx.doi.org/10.1016/j.chemgeo.2010.01.001>

Conference Papers

Peer Reviewed

Douglass, J and **B Kelly** (2010). 3d Geological Modelling And Carbon Storage Potential Of The Sydney Basin. Thirty Seventh Symposium on the Geology of the Sydney Basin. *Abstracts: Edited by A. Hutton, C. Ward and H. Bowman. May 6-7, 2010, Pokolbin, NSW, Australia.*

Foley J, Silburn M & **Greve AK** (2010). Resistivity imaging across native vegetation and irrigated vertosols of the Condamine catchment - a snapshot of changing regolith water storage. *19th World Congress of Soil Science, 1-6 Aug. 2010, Brisbane, QLD, Australia.* Published on CD-ROM.

Ward, J, **Andersen, MS**, Appleyard, S, & Clohessy, S (2010). Acidification and trace metal mobility in soil and shallow groundwater on the Gngangara Mound, Western Australia. *World Congress of Soil Science, Brisbane, QLD, Australia, 16 August 2010.* Published on CD-ROM.

Non-peer-reviewed

Andersen, MS, McCallum, AM, Meredith, K, & **Acworth, RI** (2010). Investigation of recharge pathways and recharge rates using environmental isotopes (2H, 18O, 14C and 3H) in the Maules Creek Catchment, NSW, Australia. *38th IAH Congress, Krakow, Poland, 12-17 September 2010.*

Andersen, MS, Meredith, K, **Timms, WA**, & **Acworth, RI** (2010). Investigation of $\delta^{18}\text{O}$ and $\delta^2\text{H}$ in the Namoi River catchment surface water/groundwater interactions.', *15th Australian Cotton Conference, Gold Coast, QLD, Australia, August 10-12, 2010.* **SCIENCE EXCELLENCE AWARD.**

Fernández martínez, J, **Mariethoz, G**, Garcia gonzalo, E, et al. (2010). Particle Swarm Optimization (PSO) and model reduction techniques. Application to hydro-geological inverse problems. *IAHR International Groundwater Symposium, Valencia, Spain, 22-24 September 2010*

Kelly, BFJ, Andersen, M, Timms, W, Giambastiani, B, McCallum, A. and Acworth, I. (2010) Groundwater in Cotton Growing Regions: Recent Insights and Future Research. *15th Australian Cotton Conference, Gold Coast Convention Centre, QLD, Australia, August 10, 2010.*

Larsen, JR., Cendón, DI, Nanson, GC, Jones, BG (2010). Radiocarbon and geochemical constraints on shallow groundwater recharge in a large arid zone river, Cooper Creek, S/W Queensland, Australia. *Geophysical Research Abstracts, Vol. 12, EGU General Assembly 2010.*

Mariethoz, G, Caers, J., & Renard, P. (2010). Iterative Spatial Resampling for solving inverse problems. *IAHR International Groundwater Symposium, Valencia, Spain, 22-24 September 2010.*

Mariethoz, G, Renard, P, & Straubhaar, J (2010). MP Simulations without Computing MP Statistics. *ECMOR XII conference, Oxford, UK, 6-9 September 2010.*

May, JH, **Larsen, JR**, Cohen, TC & Nanson, GC (2010). Mt. Chambers Creek alluvial fan - a recorder for Late Quaternary flow regime changes along the eastern Flinders Ranges (South Australia). *Geophysical Research Abstracts, Vol. 12, EGU General Assembly 2010.*

McCallum, A, Andersen, MS, Rau, GC, & Acworth, RI (2010). Investigation of surface water-groundwater interactions and temporal variability of streambed hydraulic conductivity using streambed temperature data. *38th IAH Congress, Krakow, Poland, 12-17 September, 2010.*

Pells, S., **Timms, WA.**, Carley, J., **Andersen, MS**, Glamore, W., Turner, IL, & **Acworth, RI**

(2010): Potential impact of sea-level rise on coastal aquifers. *Groundwater 2010 IAH Australia Canberra, Australia, 31 October-4 November 2010.*

Rau, GC, Andersen, MS, & Acworth, RI (2010). Uncertainty of vertical streambed seepage rates under realistic field conditions using diel temperature fluctuations. *38th IAH Congress, Krakow, Poland, 12-17 September 2010.*

Renard, P, **Mariethoz, G**, & Straubhaar, J. (2010) 3D modeling of geological heterogeneity: the direct sampling multiple-points simulation method. *IAHR International Groundwater Symposium, Valencia, Spain, 22-24 September 2010.*

Timms WA, Acworth RI, Greve A & Whelan M. (2010) Centrifuge permeameter testing, cores, bores and geophysics for characterising aquitards and leaks. *Groundwater 2010, Canberra, Australia 31 October-4 November, 2010.*

Abstract only

Andersen, MS (2010). Geochemical and Water Quality Implications of Changing Dynamics in Surface Water Groundwater Interactions. *Australian Earth Sciences Convention (AESC), Canberra, ACT, Australia 4-8 July 2010.*

Andersen, MS, Rau, G C, McCallum, AM, & Acworth, RI (2010). Investigations of surface water groundwater interactions in a water stressed semi-arid catchment. *University of Copenhagen Geocenter seminar, Copenhagen, Denmark, 24th September 2010. Also presented at the Namoi Groundwater Forum, Tamworth, NSW, 3 December 2010.*

Andersen, MS, Rau, G C, McCallum, AM, & Acworth, RI (2010). On the Temporal Variability of Streambed Hydraulic Conductivity. *Groundwater 2010, Canberra, ACT, Australia, 31 October-4 November 2010.*

Giambastiani, B, McCallum, AM, Andersen, MS, Kelly, BFJ, & et al (2010). Using groundwater modelling to enhance the understanding of the Maules Creek alluvial aquifer, Upper Namoi, NSW. *1st Australia & New Zealand FEFLOW Users Workshop, Sydney, NSW, Australia 4-6 May 2010.*

Jeong, C, Mukerji, Z, & **Mariethoz, G** (2010). Iterative Spatial Resampling for Seismic Subsurface Characterization. *AGU Fall Meeting, San Francisco, USA 13-17 December 2010.*

Kelly, BFJ, Andersen, MS, Timms, W., Giambastiani, B., McCallum, AM. & Acworth, RI. (2010). Groundwater in Cotton Growing Regions: Recent Insights and Future Research, *15th Australian Cotton Conference, 10-12 August, Gold Coast, Queensland, Australia.*

Mariethoz, G, Caers, J & Scheidt, C (2010). Multi-way sensitivity analysis using clustering techniques. *geoENV10, Gent, Belgium, 13-15 September 2010.*

Mariethoz, G, Renard, P, & Straubhaar, J (2010). The direct sampling method to perform multivariate multiple-points geostatistical simulations. *geoENV10, Gent, Belgium, 13-15 September 2010.*

Rau, G, Andersen, MS, & Acworth, RI. (2010): Laboratory and field investigation of heat transport in shallow saturated hydrogeological systems. *Oral presentation at the Umwelt-forschungszentrum, Leipzig, Germany, 21 September 2010.*

Straubhaar, J, Renard, P, **Mariethoz, G**, Froidevaux, R, & et al (2010). List-based algorithm for multiple-point statistics simulation. *geoENV10, Gent, Belgium, 13-15 September 2010.*

Timms, WA, Hendry, MJ, Kerrich, R, Muise, J, & et al (2010). Retardation of rare earth metals in clay barriers innovative application of centrifuge modeling and laser ablation ICP-MS. *10th Australasian Environmental Isotope Conference & 3rd Australasian Hydrogeology Research Conference, Perth, Western Australia, 1-3 December 2009.*

Presentation, unpublished

Andersen, MS, & Timms, WA (2010). Groundwater Research at Maules Creek & Water Quality in the Namoi Catchment. *2010 Cotton Science Conference, Narrabri, NSW, Australia 26th-28th October, 2010.*

Andersen, MS, Acworth, RI, Rau, GC, & McCallum, AM (2010). Investigations of surface water ground-water interactions in a water stressed semi-arid catchment. *Namoi Groundwater Forum, Tamworth, NSW, Australia, 3 December 2010.*

Andersen, MS, & Acworth, RI (2010). Water quality and ecological implications of changing dynamics in surface water groundwater interactions. *USGS seminars Menlo Park (California), Reno (Nevada), Salt Lake City (Utah), Boulder (Colorado) USA July 2010.*

Rau G. & Andersen, MS (2010): Analytical methods that use natural heat as a tracer to quantify surface water-groundwater exchange, evaluated using field temperature records. *USGS seminars Menlo Park (California), Reno (Nevada), Salt Lake City (Utah), Boulder (Colorado) July 2010.*

Timms, WA, Whelan, M, Greve, AK & Acworth, RI (2010). Centrifuge permeameter testing, cores, bores and geophysics for characterising aquitards and leaks. *Groundwater 2010, Canberra, ACT, Australia, 31 October - 4 November 2010.*

Timms, WA (2010). Connected Waters, Disconnected Waters, *WaterForumBlue MountainsCity Council, Katoomba, NSW, Australia 30 October, 2010.*

Timms, WA, Kelly, BFJ, Jones, P, et al (2010). Evaluating groundwater quality trends, risks of aquifer salinisation and aquifer connectivity, Namoi catchment, Murray-Darling Basin. *Groundwater 2010, Canberra, Australia, 31 October - 4 November 2010.*

Timms, WA (2010). Reality bytes - an evolution of numerical groundwater modelling in research and consulting. *First Australia & New Zealand FEFLOW Users Workshop, Sydney, Australia 4-6 May 2010.*

Timms, WA (2010). Where's the salt gone? Groundwater quality issues in the Namoi catchment. *Groundwater Forum, Tamworth, NSW, Australia, December, 2010.*

Poster

Andersen, MS, Serov, P, & Acworth, RI (2010). Linking Hyporheic Zone Water Chemistry and Streambed Ecology to Groundwater Discharge and Recharge, Maules Creek, NSW, Australia. *2010 Australian Cotton Conference, Gold Coast, QLD, Australia, August 10-12.*

Timms, WA, Kelly, BFJ, Badenhop, AM, et al (2010). Groundwater monitoring, evaluation and grower survey, Namoi catchment. *2010 Australian Cotton Conference, Gold Coast, QLD, 10 - 12 August 2010.*

Timms, WA (2010). Introducing the NCGRT centrifuge permeameter facility, Sydney, Australia. *International Conference on Physical Modelling in Geotechnics 2010, Zurich, Switzerland, 28 June - 1 July 2010.*

Other presentations

Kelly, BFJ. (2010) Crystallize: Mathematica Scripts for 3D Geological Modelling, 3D Geological Modelling workshop. *Groundwater 2010, Canberra Act, Australia 31 October - 4 November 2010.*

Kelly, BFJ, Ludowici, K. and Giambastiani, BS (2010) Groundwater in the Namoi Catchment: Past Trends, Connectivity and the Future. *Groundwater Forum Tamworth, NSW Australia 3rd December, 2010.*

Kelly, BFJ. (2010) Visualising the Impacts of Groundwater Usage with Crystallize. *National Water Commission, Canberra, ACT Australia 15th December 2010.*

Technical Reports

Burkett, DA & **Kelly, BFJ** (2010) Lachlan Catchment Groundwater Hydrographs. *A report by the Connected Waters Initiative, UNSW and National Centre for Groundwater Research and Training for the Cotton Catchment Communities CRC.*

Carr, JR & **Kelly, BFJ** (2010) Gwydir Catchment Groundwater Hydrographs. *A report by the Connected Waters Initiative, UNSW and National Centre for Groundwater Research and Training for the Cotton Catchment Communities CRC.*

Giambastiani, BS. & Kelly, BFJ (2010) Macquarie-Bogan Catchment Groundwater Hydrographs. *A report by the Connected Waters Initiative, UNSW and National Centre for Groundwater Research and Training for the Cotton Catchment Communities CRC.*

Giambastiani, BS, McCallum, A, Andersen, MS, & Acworth, RI (2010). Maules Creek Project: A Groundwater Flow Model of the Maules Creek Catchment. *Research Report prepared for Cotton Catchment Communities CRC. Final 15/02/2010.*

Kelly, B, Giambastiani, BS, Andersen, M, McCallum A, & Acworth RI (2010) Development of a 3D Geological Mapping and Database Interface to Support Interconnected Groundwater and Surface Water Management. *A report by the Connected Waters Initiative, UNSW and National Centre for Groundwater Research and Training for the Cotton Catchment Communities CRC and the National Water Commission.*

Timms, W, McCulloch S, Studholme, H. & Greve, A. (2010). Drilling completion report - Upper Namoi campaign, May 2010. *UNSW Water Research Laboratory Research Report No. 243.*

Timms, WA, Badenhop, AM, Rayner, D, & Mehrabi, S (2010). Groundwater Monitoring, Evaluation and Grower Survey, Namoi Catchment, Report No. 2, Part A: Results of 2009 Groundwater Monitoring and Recommendations for Future Best Practice Monitoring Framework, Part B: Groundwater User Survey. *UNSW Water Research Laboratory Technical Report 2009/25.*

Timms WA, Wasko, C, Pells, SE, & Miller, BM (2010). Ranger Pit No.1 - Groundwater Flow modelling of Post-closure Conditions. *UNSW Water Research Laboratory Technical Report 2010/15 UNSW Water Research Laboratory Technical Report.*

Ruprecht, J., **Timms, W** (2010). Hat Head effluent disposal: monitoring results to September 2010. *UNSW Water Research Laboratory Technical Report, 2010/31.*

Research Projects

Cotton Catchment Communities CRC

The Cotton CRC/National Water Commission project "Development of a 3D Geological Mapping and Database Interface to Support Interconnected Groundwater and Surface Water Management" was successfully completed and has been well received by the National Water Commission. Associate Professor Bryce Kelly was awarded the Cotton CRC researcher of the month in September for this work. In 2011 UNSW Water Research Laboratory projects team are likely to be awarded a contract with the Namoi CMA using methods developed as part of Cotton CRC project. Also, NSW Office of Water is seeking funding to extend this work for communicating groundwater information to the public via the web.

Stage 1 for Cotton CRC project 2.02.21 was completed. This consisted of three reports examining the 3D groundwater temporal and spatial trends in the Lachlan, Macquarie and Gwydir Catchments. These reports provide background information for the discussions

about water allocations associated with the Murray-Darling Basin Plan and NSW Water Sharing Plans.

The NWC (National Water Commission)/NPSI (National Program for Sustainable Irrigation) project on heat as a groundwater tracer is progressing on schedule with most field and experimental laboratory work is now completed. PhD student Gabriel Rau published one International journal paper on this work in 2010 and two more are in preparation.

Results from the above projects have been presented at public meetings in Narrabri, Tamworth, and Canberra. These presentations have been attended by farmers, researchers, concerned community members, government staff and mining company representatives. In addition 3 conference papers were presented in 2010 as a result of this work at the international IAH Congress in Krakow, Poland. Two keynote presentations were given: one at the Australian Earth Science Convention (AESC) in Canberra and at the Annual Cotton Science Conference in Narrabri. A PhD thesis by Anna Greve on her work on electrical geophysical methods to map soil moisture change was submitted for examination in December. Work by two other PhD students (Gabriel Rau and Andrew McCallum) continues on this program, with completion expected this year.

National Centre for Groundwater Research and Training

NCGRT recruitment commenced at the start of 2010 and continued all year. Research Fellow appointments within 2010 included Gregoire Mariethoz, Hoori Ajami, Anna Greve and Cath Jex. PhD researchers included Mark Peterson, Cecilia Azcurra, Rebecca Higgins and Ali Ershadi. Five NCGRT honours students were supported. Construction of the NCGRT Centrifuge Permeameter facility was started at the Water Research laboratory, with the Centrifuge constructed, laboratory tested and en-route to WRL by the year end. A centrifuge technician was funded to support this facility. CWI staff ran the first NCGRT Field Methods shortcourse at the newly established Wellington Field Station teaching facility.

For further details see:

<http://www.connectedwaters.unsw.edu.au/news/breakinggroundindustrytraining.html>

NSW Science Leveraging Fund

NSW SLF was used to complete the research and training facility at the UNSW Wellington Field Station, with a borehole array completed and the establishment of a study centre. A fixed-term site manager position was appointed (Peter Graham), funded primarily from the NSW SLF, with additional support from UNSW Facilities and the NCGRT.

For further details see:

<http://www.connectedwaters.unsw.edu.au/news/ncgrtfacilityestablished.html>

http://www.connectedwaters.unsw.edu.au/news/forecast_for_plenty_of_water.html

Super Science

Australian Government Super Science Initiative funding commenced at the start of the reporting period (documents signed on 17th December 2009). Four quarterly milestone

reports were submitted and approved by DIISR, as well as the first Annual Business Plan. Sub contracts were set up with UQ and Flinders University to manage the Super Science sites outside of NSW, and a sub contract with ANU to develop the groundwater database. Two proposals to the associated ARC Super Science Fellowships scheme were submitted in November 2009, and one (led by the CCRC) was successful, leading to the recruitment of three post docs within the CCRC. New appointments to support Super Science activity were Sam McCulloch (drilling engineer) and Antonio Woo (Project Manager).

Ground water EIF activities directly run by UNSW focuses on the Namoi and Wellington sites. At Namoi, wet weather and flooding prevented significant activity in 2010. At Wellington, new infrastructure includes boreholes, water level and temperature loggers, cave drip-water loggers, a geoprobe, weather stations, remote sensing equipment such as scintillometers and imaging cameras, and isotope mass spectrometers. Three research nodes have been identified and established in the region: Baldry for a specific focus on vegetation-groundwater interactions (McCabe), and Caves Reserve and the UNSW Field Station for fractured rock investigations in contrasting geology (Acworth, Baker, Andersen).

For further information see:

<http://www.connectedwaters.unsw.edu.au/news/wellingtoncavesnaturallaboratories.html>

http://www.connectedwaters.unsw.edu.au/news/new_geoprobe_commissioned.html

ARC Discovery, Linkage, LIEF and other grants

New grants to CWI in 2010 were DP11 (Baker) and LIEF (Baker, Acworth et al.) awards. Additionally, CWI staff were co-investigators on an ARC Superscience Fellowship award (to CCRC) and ARC Linkage (to WRC). The DP11 and LIEF were awarded at the end of this reporting period, to start in 2011.

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 is a decline on those reported in 2009, and with the conclusion of the Cotton CRC project and the strengthening focus on journal outputs, this trend is expected to continue.

Significant managerial or personnel changes

Prof Andy Baker was interviewed and appointed to the CWI with a start date of 1/1/2010. He took on the duty of Deputy Director of the CWI, and for the latter part of 2010 became Acting Director of the CWI and acting leader of NCGRT Program 1.

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 undertook the following teaching and research supervision in 2010:

GEOS2291 Ground and Surface Water
GEOS9633 Geophysical Techniques in Groundwater, Engineering and Agriculture
GEOS9634 3D Geological Computer Models and Spatial Data Analysis
CVEN9630 Groundwater Resource Investigation
GEOS9632 Groundwater Management
CVEN3501 (part) Water Resources Engineering
GEOS3321 Introduction to Petroleum Geology
GEOL4511 Professional Skills: Module E Quantitative Methods
CVEN9884 Environmental Engineering Science 1
CVEN9885 Environmental Engineering Science 2
CVEN9631 Hydrogeochemistry
CVEN4703 Advanced Water Quality

Honours Theses

Kathryn Ludowici (2010 S1 S2) A Conceptual and Statistical Analysis of Groundwater Management in the Lower Namoi. School of Civil and Environmental Engineering, The University of New South Wales.

Edward Kearney (2010 S1 S2) Porewater extraction from clay sediments using dilution, squeezing and centrifugation. School of Civil and Environmental Engineering, The University of New South Wales, and NCGRT Scholarship

Malinda McDonnell (2010 S1 S2). Consolidation of clay aquitards. School of Civil and Environmental Engineering, The University of New South Wales, and NCGRT Scholarship

Masters Projects

Jasson Carr (2010 S1/S2) The 3D analysis of bore hydrographs and lithology data to advance our understanding of aquifer connectivity and sustainable groundwater use in the Gwydir Catchment, Groundwater Master's Thesis (GEOL 9124). School of Biological Earth and Environmental Sciences, The University of New South Wales.

Danielle Ord (2010 S1/S2) Hydrogeological Assessment for Site X, Groundwater Master's Thesis (GEOL 9124). School of Biological Earth and Environmental Sciences, The University of New South Wales.

Matteo Malagutti (2010 S1) 3D Hydrograph Analysis Lachlan Catchment GEOS9019 Special Topic in GIS. School of Biological Earth and Environmental Sciences, The University of New South Wales.

Catherine Cockburn (2010 S2). Back trajectory analysis of rainfall, Wellington, NSW. GEOL 9124. School of Biological Earth and Environmental Sciences, The University of New South Wales.

Nerilee Edwards (2010 S2) Stalagmite Diameters and Spatial Variations in Stable Isotopes, Wellington Caves, NSW. GEOL 9124. School of Biological Earth and Environmental Sciences, The University of New South Wales.

PhD Completions

Anna Katrin-Greve (2010) Detection of Subsurface Cracking Depth through Electrical Resistivity Anisotropy. Supervisor Prof. Ian Acworth, Co-supervisor A/Prof Bryce Kelly

Justin Ugbo (2010) Direct Estimation of an Equivalent Shaliness Parameter Using Resistivity and Spectroscopy Logs: A Total Expansible Clay Approach. Supervisor Col Ward, Co-supervisor A/Prof 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

3rd Management Board Meeting 26th May 2009.

Prof. Graham Davies (Chair), Prof. Merlin Crossley, Prof. Ian Acworth, Prof. Andy Baker, Prof. David Waite, A/Prof. David Cohen. *Apologies*: Dr. Bill Peirson, Mr. Gary Johnson

4th Management Board Meeting, 5th October 2010

Prof. Merlin Crossley (chair), Prof Andy Baker, Prof David Waite, A/Prof David Cohen, Mr Antonio Woo. *Apologies*: Prof Graham Davies, Prof Ian Acworth, Dr Bill Peirson

**Statement of Financial Performance
For CWI - Connected Water Initiative
Period between 1st of January 2010 – 31st December 2010**

	2010
	\$
Income	
TOTAL	5,712,450
 Expenses	
Payroll	1,090,332
Equipment	1,458,829
Materials	670,528
Travel	111,885
Subcontract - Flinders University	771,200
Subcontract - ANU	140,617
Total Expenses	4,243,391
 Operating result	 1,469,059
 Surplus(Deficit) B/fwd from Prior Year	 4,724,128
 Accumulated Funds Surplus(Deficit)	 6,193,187
 Excludes debtors (unpaid invoices)	 Nil

The Connected Water Initiative chart fields.

RM07362, RM07363, RM07364, RM07365, RM07366 & RM07367 - NCGRT, ARC & Non ARC
 RM07764, RM07765, RM07766, RM07767, RM07768 & RM07769 - EIF Super Science DIISR
 RM06822 - Land and Water Australia National
 RM07194 - NSW Department of State and Regional Development
 RM07808 - New Cotton CRC
 RM07904 - NSW Department of Climate
 PS18224 – CWI Admin Support
 PS10559 – Gary Johnson Chair of Water