

Connected Waters Initiative Research Centre

Annual Report 2009

2009 Summary

Summary of CWI performance in 2009

The UNSW Research centre was approved on 19/1/09 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 2009 the CWI:

- Published 7 journal articles, 21 conference presentations and 12 technical reports
- Attracted international collaborators including Jim Constance (USGS), Douglas Graham (DHI)
- Attracted significant Category 1 funding from the ARC and National Water Commission as a key member of the National Centre for Groundwater Research and Training (NCGRT).
- Commenced drilling at the Wellington Farm Site to establish a training facility for field methods in groundwater and surface water hydrology

In 2010, the major goals are:

- Launch of the Wellington Field Training facility on 8th November
- Establish a contract and commence expenditure of the DIISR Super Science funding program for the Groundwater Infrastructure Facility (GIF)
- Staff expansion to fulfil the NCGRT contract including 7 Post Docs; a Field Engineer and a Centrifuge Engineer; a Site Manager for Wellington Farm; 5 Scholarship students and 5 new PhD students.
- Complete major drilling programs as part of the NCGRT and Super Science expenditure
- Completion of the Cotton CRC Phase 1 contract
- Initiate a coastal research program
- Continue the successful CWI Web pages

Publications, Research Projects, Consultancies and other scholarly achievements in 2009

Publications

Journal articles

1. Acworth, I. (2009). Theme editorial - Surface water and groundwater: understanding the importance of their connections. *Australian Journal of Earth Sciences* 56 (1).
2. Acworth, I. and Timms, W (2009), Evidence for connected water processes through smectite-dominated clays at Breeza, New South Wales. *Australian Journal of Earth Sciences* 56 (71-86).
3. Andersen, M.S., and Acworth, I.R. (2009) Stream-aquifer interactions in the Maules Creek catchment, Namoi Valley, New South Wales, Australia *Hydrogeology Journal*, 17: 2005 - 2021.
4. Anderson, D.J., W.A. Timms and W.C. Glamore (2009). Optimising subsurface well design for coastal desalination water harvesting. *Australian Journal of Earth Sciences* 56, 53-60.
5. Kelly B.F.J., Allen D., Ye K., Dahlin, T. (2009) Continuous Electrical Imaging for Mapping Aquifer Recharge Along Reaches of the Namoi River in Australia. *Near Surface Geophysics*, Volume: 7 Issue: 4 Pages: 259-270.
6. Timms, W, Hendry, J., Muise J, and Kerrich, R. (2009). Coupling Centrifuge Modeling and Laser Ablation ICP-MS to determine contaminant retardation in clays. *Environmental Science and Technology*. 2009, 43, 1153-1159
7. Ugbo J.O., Kelly B.F.J., Ward C.R. (2009) Estimation of an Equivalent Shaliness Parameter Using Resistivity and Spectroscopy Logs: A Total Expansible Clay Approach. *Journal of Petroleum Geology*, Volume: 32 Issue: 4 Pages: 383-406.

Conference Publications (peer reviewed)

1. Badenhop A.M, W.A. Timms (2009). Managed Aquifer Recharge in Sydney Coastal Sand Aquifers. In: Milne-Home, W (ed.) *Groundwater in the Sydney Basin*. IAH NSW Symposium, 4-5th August, 2009.
2. Giambastiani B.M.S., Kelly B.F.J., The C., Andersen M.S., McCallum A.M. & Acworth R.I. (2009): 3D time and space analysis of groundwater head change for mapping river and aquifer interactions. In Andressen, R.S., Braddock R.D. & Newhaw, L.T.H. (Eds.) *18th World IMACS Congress and MODSIM09 International Congress on Modelling and Simulation*. Modelling and Simulation Society of Australia and New Zealand and International Association for Mathematics and Computers in Simulation, 13-17 July 2009, pp. 3067-3073.
3. Greve, A.K., Acworth, R.I. (2009) Monitoring soil moisture changes and deep drainage pathways, 37th IAH Congress 6-10 Sep. 2009, Hyderabad, India.

4. McCallum, A.M., Andersen, M.S., Kelly B.F.J., Giambastiani, B. & Acworth, R.I. (2009): Hydrological investigations of surface water-groundwater interactions in a sub-catchment in the Namoi Valley, NSW, Australia In: Trends and Sustainability of Groundwater in Highly Stressed Aquifers eds.: Taniguchi M. et al. Proc. of the Joint IAHS & IAH Congress, Hyderabad, India, 6th - 12th of September 2009. IAHS Publ. 329, 2009, 157-166.
5. Rau G., Andersen, M.S., McCallum A.M. & Acworth R.I. (2009): Field Investigation Testing Methods Using Natural Heat as a Tracer to Quantify Surface Water Groundwater Connectivity: Maules Creek, NSW, Australia. Proc. of the 37th IAH Congress, Hyderabad, India, 6th - 12th of September 2009.
6. Timms, WA and RI Acworth (2009). Quantifying the potential impact of leaky boreholes. In: Milne-Home, W (ed.) Groundwater in the Sydney Basin. Proceedings of IAH NSW Symposium, 4-5th August, 2009.
7. Timms, WA, Acworth RI and T Bernadi (2009). Groundwater and salt fluxes through sediments, weathered and fractured granite at the Baldry site, NSW, Australia. International Association of Hydrogeologists 37th Congress, Hyderabad India, 6-12 September 2009.
8. Timms, W., Hendry, M.J., Muise, J., Kerrich R., Acworth R.I. (2009). Retardation of rare earth metals in clay barriers - innovative application of centrifuge modeling and laser ablation ICP-MS. Abstract in Grice K., and Trinajstic K., (2009) Proceedings of the 3rd Australasian Hydrogeology Research Conference, Curtin University, Perth, 1-3rd December, 2009. ISN 978-0-9807436-0-9

Conference Publications (Non-peer-reviewed)

9. Andersen, M.S., Serov, P., Berhane, D., Acworth R.I, (2009): Linking hyporheic zone water chemistry and streambed ecology to groundwater abstraction: Maules Creek, NSW, Australia. Proc. of the 37th IAH Congress, Hyderabad, India, 6th - 12th of September 2009.
10. Andersen M.S., McCallum, A.M., Meredith K.T., Acworth R.I. (2009): Investigation of surfacewater/groundwater interactions using environmental isotopes (2H, 18O, 14C and 3H) in the Maules Creek Catchment, NSW, Australia. 10th Australasian Environmental Isotope Conference & 3rd Australasian Hydrogeology Research Conference 1-3 December 2009, Perth, WA.
11. Kelly, BFJ, Giambastiani BMS, Timms W, The C (2009). 3D Hydrograph analysis for constraining the construction of hydrogeological models. Australian 3D Hydrogeology workshops, August 2009.
12. Giambastiani B.M.S., Kelly B. F.J, McCallum A., The C. (2009). Three dimensional temporal analysis of surface and ground water interactions. First Australian 3D Hydrogeology Workshop, Geoscience Australia, Canberra, Australia, 31st August - 1st September 2009; pp. 29-30.

13. Greve, A.K., Acworth, R.I., Bryce, B.F.J. (2009) Electrical resistivity methods to monitor soil moisture changes and deep drainage, Cotton Catchment Communities CRC Science Forum, 17-19 Aug. 2009, Narrabri, Australia.
14. Kelly, B.F.J, Giambastiani B., and A.M. McCallum and W.Timms (2009), Aquifer connectivity in the Namoi. Cotton CRC Science Forum. August, 2009.
15. Kelly, B.F.J., and Giambastiani, B.M.S. (2009) The Need for Better Conceptual Models of Aquifers in the Murray-Darling Basin and the Goals of the National Centre for Groundwater Research and Training. First 3D Hydrogeology Workshop, 31 August - 1 September, Geoscience Australia, Canberra.
16. Kelly, B.F.J., Giambastiani, B.M.S., Timms, W. and The, C. (2009) 3D Hydrograph Analysis for Constraining the Construction of Hydrogeological Models. First 3D Hydrogeology Workshop, 31 August - 1 September, Geoscience Australia, Canberra.
17. Kelly, B.F.J. (2009). Catchment Scale 3D Geological Models from Sparse Data International Mathematica User Conference 2009. October 22-24, Champaign, Illinois, USA.
18. Kelly, B.F.J. and Giambastiani, B.M.S. (2009). Functional Programming Algorithms for Constructing 3D Geological Models. In Lees, B.G. & Laffan, S.W. (eds), 10th International Conference on GeoComputation, The University of New South Wales, Sydney, 30th November - 2nd December, 2009.
19. McCallum, A.M., Andersen, M.S., Meredith K.T., Acworth R.I. (2009): Investigations of the Impact of Groundwater Abstraction on Surface Water/Groundwater Interactions using carbon-14. 16th AINSE Conference on Nuclear and Complementary Techniques of Analysis, ANSTO, 25th to 27th of November 2009.
20. McCallum, A.M., Andersen, M.S., Kelly B.F.J., Giambastiani, B. & Acworth, R.I. (2009): Hydrological investigations of surface water groundwater interactions in a sub-catchment in the Namoi Valley. Presentation at: Cotton Catchment Communities CRC, 2009 Science Forum, Narrabri. 17th August - 19th August 2009.
21. Rau G., Andersen, M.S., McCallum A.M. & Acworth R.I. (2009): Field Investigation Testing Methods Using Natural Heat as a Tracer to Quantify Surface Water Groundwater Connectivity: Maules Creek, NSW. Presentation at: Cotton Catchment Communities CRC, 2009 Science Forum, Narrabri. 17th August - 19th August 2009.

Research Reports

1. Acworth, R.I., Timms W, Bernadi R. (2009). Hydrogeological study of the Baldry site. UNSW Water Research Laboratory Research Report No. 235. April, 2009.
2. McCallum, A.M., Andersen, M.S., Giambastiani, B. & Acworth, R.I. (2009): Maules Creek Project: Steady State Groundwater Model Parameters. Research Report prepared for: Cotton Catchment Communities CRC.

3. Giambastiani B.M.S., McCallum A.M., Andersen M.S., Kelly B.F.J. & Acworth R.I. (2009): Maules Creek Project: Steady-State Groundwater Model. Research Report prepared for: Cotton Catchment Communities CRC.
4. Giambastiani B.M.S., McCallum A.M., Andersen M.S., Kelly B.F.J. & Acworth R.I. (2009): Maules Creek Project: A Groundwater Flow Model of the Maules Creek Catchment. Research Report prepared for: Cotton Catchment Communities CRC.
5. Kelly B.F.J. (2009) Cox's Creek Groundwater Hydrograph Analysis, UNSW Connected Waters Initiative report for the Cotton Catchment Communities CRC, 20 pages
6. The C. and Kelly B.F.J. (2009) 3D Analysis of Irrigation Bore Water Chemistry Data from the Namoi Catchment, Cotton Catchment Communities CRC summer scholarship final report, Version 2, 9th February, 40 pages.

Technical Reports

1. Anderson, DJ, WA Timms and CD Wasko (2009). Conjola regional Sewerage Scheme - Groundwater monitoring and response plan. UNSW Water Research Laboratory Technical Report 2008/37, March 2009.
2. Anderson, DJ, CD Wasko, WA Timms and SE Pells (2009). Numerical model testing of groundwater flow concepts for Mine Pit No. 1. UNSW Water Research Laboratory Technical Report 2000/02, June 2009.
3. Glamore, WC and WA Timms (2009). Yarrahapinni Wetlands National Park Restoration Plan. UNSW Water Research Laboratory Technical Report 2009/05, April 2009.
4. Timms, WA, Badenhop A, Rayner D and Mehrabi S (2009). Namoi groundwater monitoring and evaluation. Report No. 2 Review of Groundwater Information and Monitoring Framework. UNSW Water Research Laboratory Technical Report 2009/25
5. Timms, W. (2009). Groundwater Availability In The Central West Catchment Management Area, Report For The Groundwater Dependent Ecosystems Project. WRL Letter Report for IPR Environmental and Central West CMA. July, 2009.
6. Timms, WA, Badenhop A, Rayner D (2009). Namoi groundwater monitoring and evaluation. Report No. 1 Review of Groundwater Information and Monitoring Framework. UNSW Water Research Laboratory Technical Report 2009/04, March 2009.

Research Projects

Cotton Catchment Communities CRC

The major part of the CCC CRC contracted works were completed at the end of December. An extension of 4 months was negotiated with the CRC to better implement some of the 3D modelling codes. A new contract was awarded at the end of the year to cover the period January 2010 to end June 2012.

Field work was completed during the year at Maules Creek and a major modelling exercise brought to completion at the end of September. Five research reports were completed for the CRC (Listed above) and four peer-reviewed papers were presented at an international IAH Congress in Hyderabad, India. Aspects of these have been prepared for journal publications.

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 program.

National Centre for Groundwater Research and Training

The head contract between the ARC and Flinders University for the new National Centre for Groundwater Research and Training was signed on 10th June 2009 with a subcontract to UNSW implemented on 31st August. Expenditure accounts were established in September 2009. Advertisements were prepared in October for a recruitment campaign in December.

Super Science

Australian Government Super Science Initiative funding commenced at the end of reporting period (documents signed on 17th December 2009) with first \$3M of funding. Two proposals to the associated ARC Super Science Fellowships scheme were submitted in November 2009.

Consultancies

The Technical Reports listed above were prepared as a result of consultancy contracts operated through the Water Research Laboratory at Manly Vale. They are included here to demonstrate the width of groundwater work being undertaken but were carried out by staff employed at WRL rather than by the CWI staff.

Significant managerial or personnel changes

Prof Andy Baker was interviewed and appointed to the CWI with a start date of 1/1/2010. It is proposed that Prof Baker will become the Deputy Director of the CWI.

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 2009:

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

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; 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

1st Management Board Meeting 26th May 2009.

Prof. Graham Davies (Chair), Prof. Mike Archer, A/Prof David Cohen, Prof. Mark Hoffman, Dr Bill Peirson, Prof Laura Poole-Warren, Dr Leigh Schwartzkoff, Prof David Waite and Prof. Ian Acworth, A/Prof Bryce Kelly (Minutes)

2nd Management Board Meeting 16 December 2009

Prof. Graham Davies (Chair), Prof Ian Dawes, A/Prof. Paul Adam, Dr Bill Peirson, Prof David Waite Prof. Ian Acworth. A/Prof Bryce Kelly (Minutes).

Apologies

A/Prof David Cohen

**Statement of Financial Performance
for the Year Ended 31 December 2009**

	2009 \$	2008 \$	Notes
Income			
External Funds *	5,046,982.00	0.00	
UNSW Contribution	15,303.37	0.00	
Total Income	5,062,285.37	0.00	
Expenses			
Payroll	273,694.32	0.00	
Equipment	34,822.82	0.00	
Materials	14,043.51	0.00	
Travel	15,598.74	0.00	
Total Expenses	338,159.39	0.00	
Operating result	4,724,125.98	0.00	
Surplus(Deficit) Bfwd from Prior Year	0.00	0.00	
Accumulated Funds Surplus(Deficit)	4,724,125.98	0.00	
* Excludes debtors (unpaid invoices)	0.00	0.00	

Notes to the Statement of Financial Performance