University of New South Wales
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CONNECTED WATERS

National Centre for Groundwater Research and Training
sustaining a vital water resource

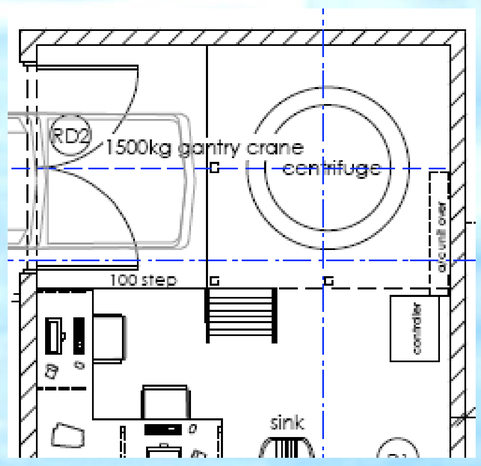
NCGRT at UNSW Connected Waters Initiative

Introducing the NCGRT Centrifuge Permeameter Facility, Sydney, Australia

Dr Wendy Timms, Mark Whelan, Anna Greve and Professor Ian Acworth

National Centre for Groundwater Research and Training; Water Research Laboratory, School of Civil and Environmental Engineering, University of New South Wales, AUSTRALIA

A world class centrifuge permeameter facility is currently being constructed for the National Centre for Groundwater Research and Training (NCGRT). Funded by the Australian Research Council and National Water Commission, the facility will be commissioned in late 2010 at the UNSW Water Research Laboratory, located on Sydney's northern beaches. The facility including a Broadbent G-max geotechnical centrifuge, will be available to researchers from various agencies, and will provide services to industry.



Aquitard Research (NCGRT Program 1B)

Aquitards are low permeability sediments and rocks that can disconnect flow systems. The centrifuge permeameter will be used together with advanced field tools including micro-gravity and borehole tomography to measure in-situ hydraulic storage and diffusivity of aquitards. A multi-scaled approach of field and laboratory centrifuge testing, combined with numerical modelling is essential to fully characterise complex aquitard systems. This research program aims to characterise the hydraulic properties of aquitards, quantify fluxes of water and contaminants through aquitards, and identify the significance of leakage pathways such as corroded bores.

Accelerated Gravity Testing

The centrifuge permeameter provides opportunities for leading edge research focused on fluid flow processes over spatial and time scales that cannot be readily studied. Centrifugation can directly address questions of sub-surface flow at scales that are not otherwise possible, simulating flow over thousands of years within a reasonable experimental time frame of weeks or months. Importantly, in-situ stresses can be applied.

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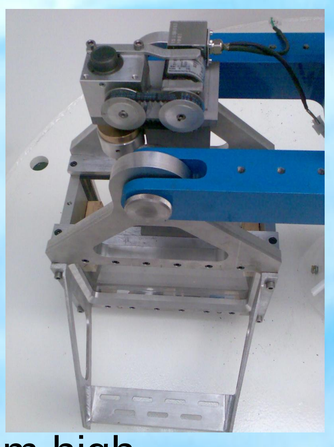
Information: w.timms@wrl.unsw.edu.au
www.connectedwaters.unsw.edu.au
www.groundwater.com.au, www.wrl.unsw.edu.au

Centrifuge Permeameter Applications

- Repeatable testing of recharge rates and permeability for a variety of sandy and clayey soils;
- Physical models of long term performance of natural and engineered seepage barriers;
- Measurement of contaminant retardation at in-situ stress conditions and liquid:solid ratios;
- Efficient pore water extraction for estuarine muds and contaminated sediments;
- Rapid measurement of soil-water-characteristic-curves for unsaturated sediments;
- Interactions of contaminants that are geochemically reactive or subject to radioactive decay such as landfills, hazardous waste disposal, tailings containment and uranium mining.

Centrifuge Specification

- **Broadbent GMT GT 18/0.7 F**
  - Speed 10 to 875 RPM, 18 g-tonne, 0.7 m radius
  - Hydraulic rotary union 2x port 10 bar g
  - Fibre optic rotary union
- **Permeameter Module**
  - Effective radius 0.4 to 0.6 m
  - Acceleration 514 g max, 428 g mean
  - Diameter 100 mm max
  - Length 200 mm max
  - Payload volume 1.6 Litres
  - Collection reservoir 1.0 Litre
- **Beam Module**
  - Speed 10 to 638 RPM
  - Acceleration 300 g max
  - Effective radius 0.66 m
  - Payload volume 5.4 Litres
  - Payload size 100x300 mm, 180 mm high



Unlike the smaller UFA centrifuge, it will be possible to analyse pore pressures and effluent from the core while this centrifuge is in operation. Advanced data acquisition systems (DAS) designed by UWA COFS and sensors that operate 'in-flight' will provide realistic measurements in real-time and at in-situ stress conditions. Sensors are currently being tested in a benchtop centrifuge.

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