SA Water Centre for Water Management and Reuse
The SA Water Centre for Water Management and Reuse was established in 2004 as a joint venture between the South Australian Water Corporation and the University of South Australia (UniSA), adding significant expertise to the water research capability in South Australia. The significant investment in research by the South Australian Water Corporation has delivered important outcomes for South Australia, to such an extent that their investment is continuing for a further five years. The successful relationship will undoubtedly continue to deliver sustainable water solutions both nationally and internationally.

Since its inception in 2004 the SA Water Centre for Water Management and Reuse (CWMR) has added significant expertise and capability in research on water supply and conservation, reuse and recycling in South Australia and Australia. In the eight years of its existence the Centre has built on established strengths in urban water management and reuse and established core capabilities in water supply and conservation, sustainability of water resources and advanced water quality monitoring.

The CWMR complements and works closely with other research concentrations such as the Australian Water Quality Centre (AWQC) within SA Water, Water Quality Research Australia (WQRA) and the newly established Goyder Institute. It also houses a unique facility – The Australian Irrigation and Hydraulics Technology Facility (AIHTF) that provides testing to Australian Standards and pattern verification on a range of water delivery products such as valves, meters and irrigation appliances for a range of Australian and overseas companies.

Nineteen staff from the School of Natural and Built Environments are now involved in Centre activities and since 2004 the Centre has generated income of $11,589,620. The Centre also prides itself on its strong industry connections and many of its adjunct staff are sourced from industry partners. For example there are currently six SA Water staff that hold such positions. This ensures that the Centre remains au fait with the applied problems facing the water industry and can structure its research portfolio accordingly. SA Water plays a major part in the annual CWMR Research Workshop and the direction of funding to relevant projects.

The Centre was initially established to meet the need for a concerted research effort into the issues surrounding the treatment and management of wastewater and has spanned a time where wastewater has gone from being viewed as a liability to being considered as a resource. Climate change induced drought and the profligate use of water resources have led to important research endeavours that deal with working smarter with the water we have, and what we can expect to have, into the future. The Centre is positioned to play an important role in this, both nationally and internationally, going forward.

There has never been a time where greater innovation has been required to optimise the earth’s precious water resources and many of the problems faced by mankind in this regard do not respect national borders. The future path for the Centre then, is to further strengthen its collaborative relationships, especially the international connections. The goal is to establish the Centre as a respected International Supported Research Centre by 2014.
In July 2011 I “jumped the fence” and left SA Water Corporation after 16 years to become Director of the SA Water Centre for Water Management and Reuse. I have to say though, it was actually more like opening and walking through a handily placed gate in the fence, as my close relationship with UniSA goes back as far as 1997.

It was then that I was asked to supervise a young Lionel Ho (now Dr Lionel Ho, Senior Research Scientist with SA Water) through his honours year working on detection methods for Legionella bacteria. Since that time I have been fortunate enough to have supervised several students through this connection who have gone on to become valuable employees of SA Water and other organisations.

So although I now find myself looking at this important relationship from an academic perspective, my opinions on the role that the Centre can play in providing answers to pressing applied research problems and the joint training that can be offered for students, many of whom will be snapped up by industry because of their experience, have not changed. The relationship with our key partner SA Water is a unique one in Australia in that we clearly work together to solve problems and so “the gate” opens and closes very frequently through joint projects, students, adjunct appointments and a governance structure that permits a true partnership.

I have also been associated with the SA Water Centre for Water Management and Reuse since its inception in July 2004 and in that time have seen its impact and influence grow exponentially. The Centre has six defined research and operational themes all of which are relevant to water research and water related industries today. The activities and outcomes of these themes are detailed further throughout this document. The structure of the Centre’s activities and the way they are managed allows for flexibility and a change of direction and focus when it is required; there is no mantra that dictates “This is my area of research and I am going to stick to it”. There is a belief in applying the skills and knowledge that the team has to specific problems and emerging issues as they arise. I believe this attitude will stand the Centre in good stead as we move to the next phase of its development.

The University has a vision for 2020 (Horizon 2020) and Research Strategic Plan (2011-2015) with the avowed intention of building world class research and innovation. This will be met by employing international benchmarks of high quality and impact. The 2020 Vision will see many multidisciplinary research concentrations working with key partners to solve complex problems that include protecting the planet’s natural resources.

We are working with the Centre’s major partner, SA Water Corporation, to put in place a world leading Centre that will be tackling issues of local, national and international significance with regard to water supply.

We will continue to work closely with our SA Water colleagues to ensure their needs and influence on the direction of the Centre is maintained. We are mindful of the changing governance of SA Water Corporation that will be brought about by regulation and the major emphasis on “customer value”. The Centre will work hard to promote its positive outcomes in this regard and ensure that this aspect has strong representation in its strategic planning.

Professor Christopher Saint
Director
SA Water Centre for Water Management and Reuse
Our Research Focus
The Centre will focus on the following key areas of research

Desalination, Membrane and Nanotechnology

- Integrated membrane technologies for brackish and seawater desalination
- Low energy desalination processes including electrosorption
- Advanced oxidation processes and nanotechnology enhanced adsorption processes to remove salts and trace organic pollutants for non-potable water reuse and for aquifer recharge

The Desalination, Membrane and Nanotechnology Research Group, led by Professor Linda Zou, was established in 2008. The research team has developed novel nano-structured carbon materials as electrodes for capacitive deionisation. In other research fields, the team is involved in understanding the fouling behavior and performance of futuristic forward osmosis and other membrane processes. The photocatalyst/adsorbent composites developed by this group can be self-regenerated, and is finding its way in applications of dissolved organic removal from water. The research outcomes contribute significantly to addressing the current and future “water crisis” caused by global climate change and unpredictable weather patterns in Australia.

Securing Water Supplies

- Developing resilient fit-for-purpose supplies by judiciously utilising water in the landscape
- Climate and rainfall modelling (statistical and risk analysis)
- Water balance modelling
- Water quality modelling
- Demand and end user modelling
- Catchment management, including high, low and environmental flow modelling
- Water and energy
- Ecohydrology

CWMR conducts world-leading research in sustainable water resource management with a focus on Australia’s highly variable and uncertain future climate. We study the statistical characteristics of rainfall and flow regimes including flooding, channel-forming and environmental (low) flow modelling, and predictions for gauged and ungauged catchments. We also research the impact of land use changes on hydrology, and the possibility for restoration of natural flow regimes and flood mitigation using Water Sensitive Urban Design (WSUD) principles.

We investigate novel technologies that may help to secure water supplies including rainwater and stormwater harvesting, managed aquifer recharge, water recycling and desalination, with a critical interest in energy requirements.
Treatment for Fit for Purpose Reuse

- Developing innovative treatment processes for water reuse (domestic and industrial)
- Changes in water quality associated with seasonal variation and climate change
- Water and wastewater treatment optimisation (domestic and industrial)
- Water and wastewater treatment modelling
- Catchment and water resource management for water quality improvement
- The role of carbon and inorganic cycling in treatment and reuse and soil-water interactions
- Removal of contaminants from water using natural processes

Lead by Associate Professor John van Leeuwen, the research conducted within this group is diverse, including catchment processes, fate of pollutants in the environment, water treatment processes for potable supply, domestic and industrial wastewater quality and treatment. Research conducted includes development of novel modelling methods for water treatment optimisation, for both conventional treatment and desalination. Research is also conducted on wastewater treatment technologies and process optimisation and the fate of pollutants from pulp and paper mills in receiving environments. Research partners include SA Water, SARDI, Natural Resource Management Board, Chinese Academy of Science, University of Amberg-Weiden, Korean Atomic Energy Research Institute (KAERI) and private enterprises.

Water Recycling Systems Design and Operation

- Water Sensitive Urban Design
- Permeable pavement treatment and reuse systems
- Siphonic harvesting systems for commercial and industrial buildings
- Vegetated stormwater and greywater treatment systems, including systems for enhancement of biodiversity and habitat connectivity
- Green infrastructure and heat island effects
- Reclaimed Water
- Stormwater treatment and management
- Reclaimed water in agriculture and aquaculture

The Centre undertakes fundamental and applied research in water recycling systems design and operation. A fit for purpose approach is a key consideration for water recycling systems and has a strong influence on the research outcomes. Many of the Centre’s research projects are in the field of Water Sensitive Urban Design and include systems such as rainwater harvesting (including siphonic systems), permeable paving, green walls, roof gardens, wetlands and biofiltration systems. A major research focus for many of the system designs has been water quality control and the incorporation of flood storage in the WSUD systems so as to avoid unnecessary duplication with conventional stormwater systems.

Advanced Monitoring

- Molecular based technologies for water monitoring
- Application and assessment of commercial sensors
- Development and deployment of novel sensors

With a recently re-furbished laboratory in Building H (H2-03), the group is well equipped for many years of productive research with a focus on improving the ways of conducting both laboratory and field analyses for chemical and microbiological contaminants in water. The group has close links with SA Water and is responsive to the needs of the water industry for improved detection technologies. Research ranges from microdistillation analysis for chemical contaminants through to DNA technology for the rapid detection of nuisance microorganisms.

An example of the group’s work is the development of an improved ammonia/chloramine analyser unit that has been funded by Water Quality Research Australia and Sydney Water Corporation. An exciting area of work that the group is involved with is the development of microfluidics and nanosystems and their application to sensor technology and internal links have been developed with, for example, the Mawson Institute to develop this area.

Field equipment development will continue to be a group emphasis. The group sees this direction as important and has been communicating with centres of excellence in the UK, USA and Switzerland. Development of spectrometric systems based on LED light sources is now a strong emphasis in the scientific literature, and this is an area which is under development within the group.
The Australian Irrigation and Hydraulics Technology Facility (AIHTF) exists to service the specialised testing demands of the water industry and advance the technology of irrigation and engineering hydraulics through fundamental and applied research.

The facility consists of a range of unique infrastructure suited to testing and research of water related equipment and technology. Through a competitive grant process the facility was awarded a total of $1.63 M by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities to upgrade the facility and attain necessary accreditations. This upgrade has significantly lifted the capacity and capability of the facility and international accreditation and the role with the National Water Commission water metering initiative have given it an increased level of national and international exposure.

In 2011 the facility gained NATA accreditation in the field of metrology and mechanical testing. The accreditation is recognised internationally by other accreditation bodies and now conforms to ISO17025 – general requirements for the competence of testing and calibration laboratories. Under the National Measurement Act, the facility was appointed by the Commonwealth’s National Measurement Institute in early 2012 as both a Pattern Approval Authority and Water Utility Verifying Authority.

Appointee by the National Measurement Institute can be found at: http://www.measurement.gov.au/measurement-system/Pages/LegalMetrologyAuthoritiesAppointed.aspx

The recent establishment of an internationally accredited laboratory in a highly specialised area of water management at the Centre presents a unique opportunity to develop new, and strengthen existing, relationships with specific sectors of the water industry. Importantly the opportunity now exists to establish the facility on a stable operational platform to provide the resources needed to support and produce high quality research outputs.

The funding obtained for the upgrade has enabled the facility to vastly expand its capabilities. Key areas of expansion include:

- Environmental climatic testing with temperatures ranging from -30 to +60 degrees C and with humidity up to 95%.
- Ingress protection testing for dust penetration.
- Electromagnetic vibration machine producing up to 70g motion and 150g impact.
- Gravimetric flow test rigs with an uncertainty of less than 0.1%.
- Electromagnetic compatibility testing with radio frequencies ranging from 10MHz to 6 GHz at stress levels up to 10 V/m.
- Electrical testing for Fast/Transient/Burst Immunity.
- Upper flow capacity up to 520 L/s.

The facility continues to undertake under and post-graduate student laboratory based research projects together with commercial R & D and testing activities in the general field of hydraulics. The testing activities include:

- water quality improvement devices
- road surface drainage hydraulic devices
- gate and butterfly valves
- drippers, sprinklers and other irrigation emitters
- hydrostatic testing up to 15000 kPa
- fishway passage scale hydraulic models
- moisture sensors
- pipes

NATA accreditation details can be found at: http://www.nata.asn.au/index.php/scopeinfo/?key=18730

Appointment by the National Measurement Institute can be found at: http://www.measurement.gov.au/measurement-system/Pages/LegalMetrologyAuthoritiesAppointed.aspx
Collaborations

International Collaborations

2 Beijing University of Chemical Technology  Desalination and membrane  China
2 Beijing University of Civil Engineering and Architecture BUCEA  Civil Engineering Department  China
2 Chinese Academy of Sciences CAS  RCEES  China
2 Xi’an University of Architecture and Technology  Key Laboratory of Northwest Water Resources, Environment and Ecology  China
2 Yellow River Conservancy Commission  Water Resources Department  China
2 Zhejiang University  Desalination and membrane  China
3 RWTH Aachen University – Germany  Desalination and membrane  Germany
3 Technische Universität Dresden  Water and Wastewater Treatment  Germany
3 University of Applied Sciences Amberg – Weiden  Water Quality Treatment  Germany
4 Directorate of Water Management, Bhubaneswar  India Government  India
5 Shiraz University  Faculty of agriculture, irrigation  Iran
6 TECHNION – Israel Institute of Technology  Desalination and membrane  Israel
7 Monash University Sunway Campus  Chemical Engineering  Malaysia
7 Universiti Sains Malaysia USM  Civil Engineering Department  Malaysia
7 Universiti Tenaga Nasional (UNITEN) Universiti  Civil Engineering Department  Malaysia
8 Gwangju Institute of Science and Technology, Center for Seawater Desalination  Desalination and membrane  South Korea
8 Korean Atomic Energy Research Institute  Waste Water and Pollution Management  South Korea
8 Sunchon National University  Desalination and membrane  South Korea
9 ACCIONA Agua  Desalination and membrane  Spain
10 KWR – Scientific Researcher Waterbehandeling  Desalination and membrane  The Netherlands
10 Technische Universität Delft  Water Resources Management  The Netherlands
10 University of Twente  Civil Engineering Department  The Netherlands
11 Imperial College London  Water Resources  United Kingdom
11 Heriot-Watt University -Edinborough  Hydraulic Engineering  United Kingdom
11 University of Sheffield  Pennine Water Group  United Kingdom
12 University of Washington  Department of Civil Engineering  United States of America

Australian Collaborations

1 SA Water
1 Water Quality Research Australia (WQRA)
1 Water Industry Alliance
1 National Centre of Excellence in Desalination Australia
1 International Centre of Excellence in Water Resources Management (ICEWaRM)
1 Goyder Institute for Water Research
1 City of Salisbury
1 ZeroWaste
1 Syfon Systems
1 Adelaide and Mt Lofty NRM Board
1 SARDI
1 SA Arid Lands NRM board
1 Northern Business Research Partnership
1 Aquaponic Solutions
1 1aquaponics
1 Flinders University
1 Power and Water Northern Territory
1 LT Green Energy
1 City West Water, Melbourne
1 University of Queensland
1 University of New South Wales
1 University of Adelaide
1 Griffith University
1 CSIRO