


Fostering an **internationally competitive water industry**

James Bradfield Moody

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Australia is already contributing to significant international projects and is in a sound position to become a world-class supplier of knowledge, products and services.

 Water is about to become big business. It is estimated that by 2010, the water business will be worth over \$US400 billion (*Fortune* magazine). By engaging in the water debate, Australian companies are capitalising on this strong growth market internationally. This chapter outlines how new technologies, know-how and services are fostering an internationally competitive water industry in Australia.

Opposite page: Water for life: fresh, safe water slakes the thirst of a Flores child. Image courtesy of AusAID.
Photograph supplied by PT HarvestIndo

• The global market

Currently more than 1.2 billion people cannot access clean drinking water, while 2.9 billion people lack access to adequate sanitation facilities. The world's present day infrastructures are inadequate to address future problems. *Emerging Asia*, published by the Asian Development Bank in 1997, identified water pollution as the most serious environmental problem facing the region.

The market for Australian water products and services is truly global and is already accessed by many leading Australian companies. The Snowy Mountains Engineering Corporation (SMEC) and Hydro Tasmania, for example, sell water infrastructure services in Asia; Sinclair Knight Merz exports water management and efficiency products and services to the United Arab Emirates and Saudi Arabia; and Agrilink International exports waste and water efficiency technologies to Europe and America.

Australia is located in the Asia-Pacific region, which contains over half the world's population and a range of geographic features and climates, from

monsoonal to arid. Nations vary in size from continents to small island states, so a diversity of skills is required to meet the region's water needs.

There is high demand for sewage and wastewater treatment facilities, equipment, goods and services. Australian firms with expertise in canal and river rehabilitation, flood mitigation and sustainable watershed

management are also in high demand. Asia's environmental markets are small but growing quickly. Companies such as Australian irrigation design consultancy Hydro-Plan, which has offices in China, are leading suppliers of services for growing sustainable agriculture and irrigation markets.

The Hong Kong Jockey Club selected Hydro-Plan to design a new racetrack irrigation and pumping system. Image courtesy of Hydro-Plan



• Australian capacity and expertise

Australia has learned many lessons from managing its own water resources. New water policy clarifies rights to access and trade water. Australia has also developed capacity in legal and financial aspects of water, project management, catchment management, environmental technologies, public participation and inter-government coordination. All this expertise is readily transferable to customers, agencies and international water markets.

Water policy

A well-defined property-title system is a pre-requisite for effective markets in the water industry. Traditionally, water title and property title have been linked, both in relation to water extraction from streams and use of water that falls on private property. This nexus has now

been broken in most parts of Australia, allowing trading of water rights on a seasonal, temporary or permanent basis. In Australia, the Council of Australian Governments has developed guidelines for water policy reform that include general principles for water pricing and trading and the separation of water allocations from land titles.

Land & Water Australia, through its *Social and Institutional Research Program (SIRP)*, has reviewed Australian expertise in water property rights. Leading thinkers in this critical area include Poh-Ling Tan, Faculty of Law, Queensland University of Technology; ACIL Tasman; Marsden Jacob Associates; Synapse Research and Consulting; Robin Connor and Stephen Dovers, Centre for Resource and Environmental Studies, the

Australian National University; and Jennifer McKay, Water Policy and Law Group, University of South Australia.

A milestone report by ACIL Tasman in association with Freehills for LWA under this program on an effective system of defining water property titles has recently been released. The Policy and Economic Research Unit of CSIRO Land and Water (contact: Mike Young), through the Wentworth Group has contributed to the development of strategies for rationalising water markets. They encouraged national debate which gave public support to the innovative work of policy units in national and state governments.

CSIRO Land and Water

Fostering an internationally competitive water industry

CSIRO helps to foster an internationally competitive water industry by engaging in international research collaborations and on-ground projects.

CSIRO Land and Water works collaboratively with:

- The Consultative Group on International Agricultural Research (CGIAR) *Challenge Program on Water and Food*, in creating research-based knowledge and methods for growing more food with less water ('more crop per drop'), and developing a framework for setting targets and monitoring progress
- The Australian Centre for International Agricultural Research (ACIAR)
- Universities and research agencies in North and South America, Europe, Africa and Asia

Global role for CSIRO irrigation research

CSIRO Land and Water has won global recognition for its innovative science and power to achieve practical on-ground results in the Lower Murrumbidgee catchment. Research endeavours in this southern New South Wales catchment provide a 'best-practice' example of community engagement in research and integrated catchment management. For this reason, the Lower Murrumbidgee catchment was named in 2003 as the first global reference basin for the *Hydrology, Environment, Life and Policy (HELP) Program*, which is run by the United

Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Meteorological Organization.

The Murrumbidgee catchment covers a total area of 84,000 square kilometres, and shares a number of features with other arid catchments around the world – including problems with water productivity, water quality, soil, salinity, rising water tables and surface-ground water interactions.

In 2004, CSIRO's Sustainable Irrigation Systems Research Directorate (based in Griffith, New South Wales) was selected as the HELP Regional Coordinating Unit for Australia, New Zealand, Oceania, China, India, Pakistan and Philippines. As a result, the Murrumbidgee catchment is now being used as a model for proposals for a full-scale implementation of the *HELP Program* by about 100 other basins worldwide.

Bridging the gaps

The *HELP Program* seeks examples of good solutions-oriented science that are delivering practical outcomes that improve the welfare of people, both locally and globally. HELP aims to bridge the gaps between policy, water resource management and science. The program strives to increase the dialogue between communities, which in turn influences the research agenda and fosters on-farm adoption.

Knowledge transfer

In its regional *HELP* coordinating role, CSIRO's Griffith laboratory promotes the exchange of research outcomes, information and experiences. This knowledge transfer is helping catchment communities around the world to deal with problems with water use efficiency, salinity and wider environmental management.

CSIRO Land and Water has developed a range of innovative models and community education tools that are helping to promote policy development and dialogue between regulators, irrigation companies and farmers. The tools employ a new, unique problem-driven and client-responsive approach in which hydrologists, water resources managers and water law/policy experts work together in developing research outcomes that are put to use in the catchment. These modelling tools and participatory methods are being adopted by communities in the Liuyankou Irrigation Area along the Yellow River in China, and in Rechna Doab in the Indus basin.

Chinese scientists learning water management techniques from Australia.
Image courtesy of ©CSIRO Land and Water



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Legal services

Australian legal firms such as Ernst & Young and Blake Dawson Waldron have experience in complex property and equity matters, ranging from property and title law to regulation. Freehills specialises in water legislation and policy, environmental law and water allocation and licensing. Minter Ellison provides financial services and environmental regulation, and works in projects ranging from organisational capability development to legislative review. PWC Legal specialises in compliance and auditing.

Entrepreneurial and business investment

The finance industry, including banking, venture capital organisations and managed funds, plays an important role in Australia's water competitiveness. A large proportion of the trillions of dollars currently invested internationally in sustainable development is sourced from superannuation and pension funds. In addition, financial advisers such as KPMG Australia assist companies in integrating strategy and financial reporting with environmental sustainability, risk assessment and compliance for the water industry.

Australian banks specialising in financial services for water infrastructure projects include the Commonwealth Bank of Australia and the ANZ Banking Group. The Commonwealth Bank is providing Rouse Hill Infrastructure Cooperation with financing for stage three of the infrastructure works and has secured funds for water supply pipelines in rural western New South Wales. The ANZ bank has forged a partnership with Pratt Water to provide \$AU100 million in low interest loans for upgrading irrigation technology.

Opportunities for investment leverage have been explored by the Allen Consulting Group in *Repairing the*



Stabilisation lagoons hold water from Bolivar Sewage Plant for approximately 20 days prior to treatment at the Recycled Water complex at Bolivar, north of Adelaide, South Australia. Image courtesy of ©CSIRO Land and Water

Country – Leveraging Private Investment, a report commissioned by the Business Leaders Roundtable comprising the Australian Conservation Foundation, CSIRO and business leaders from the agriculture, finance, wine and food sectors. The group found that over ten years, \$AU12.7 billion in new private investment could be generated from a mix of policy and taxation measures, with a cost to taxpayers of less than \$AU3.6 billion.

Banks such as the Commonwealth Bank are following suit, working with private companies in Australia to develop public-private partnerships to fund and develop water infrastructure and recycling projects. These projects engage organisations such as superannuation funds looking for long-term sustainable investments.

Small-to-medium enterprises have flourished in most developed nations because of the critical role venture capital markets play in creating business. In Australia, funds such as the AMP Capital Investors invest in and groom sustainable businesses, while Australian Ethical Investment Ltd manages more than 80 individual investments in sustainability. Companies such as Sustainable Asset Management (SAM), an independent Swiss asset management company operating in Australia, also manage funds such as the Sustainable Water Fund and the Leaders Australia Fund.

Government initiatives

Australia has invested substantially in technological research through organisations such as CSIRO, Land & Water Australia, and the Murray-Darling Basin Commission. The Australian Government's *Backing Australia's Ability* package, emphasises innovation through the Australian Research Council, world-class Centres of Excellence and the Cooperative Research Centre (CRC) program.

CSIRO has recently refocused its research on water through its Flagship Program *Water for a Healthy Country* and together with the Australian Water Association, is brokering a coordinated international program, the *Australian Water Conservation and Reuse Research Program*.

The Australian Government Department of Industry, Tourism and Resources initiatives through *AusIndustry* include programs for the *Commercialisation of Emerging Technologies (COMET)* and *Strategic Assistance for Research and Development (START)*. *Commercial Ready* is a new product and will provide \$AU1 billion over five years in competitive business grants to undertake research and development, proof-of-concept, technology diffusion and early-stage commercialisation activities (page 132).

Commonwealth Bank

Institutional Banking

The Commonwealth Bank's Institutional Banking division provides a wide range of banking and financial solutions to Corporate, Institutional and Government clients. The Bank is a leading provider of investment and wholesale banking services to institutions and corporates internationally and is the largest provider of debt infrastructure finance in Australia.

The Commonwealth Bank is dedicated to creating progressive strategies to improve the sustainability of water in Australia. The Bank has been involved in a number of industry initiatives and has been actively engaged in submissions to Council of Australian Governments (COAG) in relation to the *National Water Initiative*.

Private funding for public infrastructure

The Commonwealth Bank recognises that private sector investment is needed to improve environmental management and water efficiency. The ability of private finance to aid in the management of public infrastructure such as water, toll roads and airports is demonstrated by the Bank underwriting and facilitating major transactions both in Australia and overseas. The use of private finance helps governments free up capital expenditure for other projects in the community such as health, education and social services.



Sustainability

Sustainability of natural resources and their economic benefits has emerged as an essential element of water policy. The worst and hottest drought in a century has increased public acknowledgement of the need to re-balance water allocations in favour of the environment.

The current debate has focused on environmental science, inter-governmental relationships and issues of access to quality water – versus property rights and compensation. While acknowledging the need for funding the purchase of new infrastructure, the debate needs to take account of the role that financial markets and private investment can play, and the importance of integrating these markets into a holistic sustainable solution.

The Bank continues to work to educate the market on the advantages that private funding of water infrastructure can bring, not only for freeing-up government expenditure, but also for capturing environmental benefits.

Working for water

The Commonwealth Bank is working with a number of organisations in Australia to develop private-public partnerships to fund and develop water infrastructure and recycling projects. Some of the initiatives include:

Rouse Hill Development

Rouse Hill, in North West Sydney, is undergoing major urban development. This development requires a substantial water and drainage infrastructure program. The Commonwealth Bank is providing Rouse Hill Infrastructure Corporation with financing for stage three of the infrastructure works.

Western New South Wales

Areas of Western New South Wales such as Cobar and Nyngan face massive inefficiencies in their water reticulation systems. Currently water is being transmitted through open channels allowing substantial transmission losses through seepage and evaporation. The Bank is working with partners to develop funding models for this type of water infrastructure.

Left: Sunset on the River Murray near Mildura, Victoria. Image courtesy of ©CSIRO Land and Water

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Commonwealth Bank

AUSINDUSTRY: PROVIDING FINANCIAL SUPPORT

AusIndustry is helping innovative companies carry out research and development with a suite of products such as grants and tax concessions.

Separation device to improve wastewater treatment

Filtra is developing a new way of separating liquids and solids that will reduce the capital and operating cost of new and upgraded clarification treatment plants. The device rotates the liquid to produce separate concentrate and solid streams. Filtra's equipment can be used to permanently increase capacity, or to manage short term peak flows during wet weather or other seasonal variations.

The market for separating solids from liquids includes the mining, pulp, paper, sugar, waste water and sewerage industries. Filtra's initial focus is in the sewage industry. The company has entered into an agreement with Canberra's ActewAGL to further develop its two core products, the FL2000 and the FL7000.

Vertical gravity separator a positive for environment

Industrial Separation Systems is a Sydney-based company delivering cutting edge wastewater treatment technology to commercial and industrial clients around the globe. The industrial wastewater separation market is valued at \$AU30 million per annum in Australia and is continuing to grow due to tougher environmental standards.

The company has exclusive manufacturing and selling rights of an innovative vertical gravity separator (VGS) unit that effectively removes free oil and suspended solids from wastewater. Through its unique design it only allows clean water to be discharged from the system. High density contaminants fall into a sludge retaining area at the bottom of the vessel and oil droplets and low density suspended solids rise to the top. The oil and suspended solids then drain off into a waste tank for suitable disposal.

The VGS is designed to suit commercial and industrial applications including the automotive repair, petroleum, mining and power generation industries, service stations and commercial car washes.

With the support of an *AusIndustry R&D Start* grant, Industrial Separation Systems has developed the VGS for oil/water separation system for the food industry. The new system can improve the quality of wastewater up to 90 percent over existing systems such as grease traps, for discharge into the sewerage system.

Innovative filtering system

A COMET grant through *AusIndustry* helped V-Fold obtain professional and expert assistance to commercialise a product for treating effluent and slurries from industries such as wineries, sewerage, tanneries, abattoirs, printers and metal finishers.

The V-Fold filter is like a conveyor with a filter fabric as the belt. It differs from other belt presses by using a single belt made from conventional filter fabrics with a reinforced centre-line. As it moves slowly forward the belt folds along the centre to form a v-shaped cavity that can hold feed slurry. Like all dewatering devices, the performance of the V-Fold depends on the feed slurry. Model SS600s are operating with feed slurries from 1 to 10 percent dry solids and can treat up to 30,000 litres a day.

Iodine-based water treatment process

With the help of an Australian Government COMET grant through its business unit *AusIndustry*, one of the world's most effective water treatment systems and environmentally safe disinfection processes is now available in Australia. The unique Ioteq System can substantially reduce the incidence of food-borne diseases and significantly improve water management. The technology also has wide application across multiple industries.

Unlike most sanitation systems using chlorine, the Ioteq System uses iodine in a patented form known as BioMaxA. Much lower concentrations of BioMaxA iodine are required to effectively kill bacteria, viruses and fungal growths. All treatment byproducts are collected by the system and then re-generated for further use within the system. The process is completely automated and is also an environmentally clean system.

Iodine occurs naturally in food and is a human dietary requirement that does not produce cancerous compounds. It is less corrosive than chlorine, and supplied in easy-to-handle, sealed cartridges. Computer automation ensures the correct amount of iodine is always available in the target water stream.

A swell idea to harness waves for power

Seapower Pacific Pty Ltd received an Australian Government *AusIndustry R&D Start* grant to develop technology for electricity generation and water desalination using wave energy and reverse osmosis for the world's first multi-purpose wave-power generation plant. Generally desalination is a more expensive option than normal supply sources but it becomes economical when it is a by-product of the harnessing of wave energy.

Exporting and international networks

Governance and public-private partnerships

The export of Australian knowledge and products will contribute to better management of water resources internationally. However, adjustments of policy, improved institutional governance, stakeholder participation, and cultural sensitivity are also needed if changes are to be effective and benefits shared globally. Good governance is essential to good water management.

These policy settings are critical in managing water resources and services in a sustainable way. Australian assistance is helping to promote an integrated approach, strengthening institutional arrangements governing water management, particularly as it relates to water resources issues across national boundaries.

This builds on Australian experience working with countries involved with the Mekong River Commission. Contributing organisations include the Australian National Parks and Wildlife Service, the New South Wales Department of Infrastructure, Planning and Natural Resources, the University of Melbourne Centre for Environmental Applied Hydrology, and the Murray-Darling Basin Commission.

Halcrow Australia and the CRC for Catchment Hydrology are leading a World Bank project to develop a decision support framework for the Mekong River Basin using Australian expertise. This framework will support countries in the lower Mekong Basin in

making decisions on how to extract the most benefit from the water resources of the Mekong with minimum adverse effects on the environment.

Investments in water have many public benefits, such as reduced environmental impact, which cannot be captured by individual investors, while investments in water-use efficiency may have private benefits that can be captured by individual water users, water corporations and irrigation companies. The development of public-private partnerships may be a useful option for funding in the water sector.

The Pratt Water Project in the Murrumbidgee Valley, New South Wales, is a public-private partnership with international application. The Murrumbidgee Irrigation Area has been selected to test the feasibility of improving water-use efficiency through conversion of a gravity-fed watering system to one using pressurised pipes and new irrigation technology. The Murrumbidgee Valley is also the *Hydrology for the Environment, Life and Policy (HELP)* international reference catchment, so the experience gained should be readily transferable to other catchments internationally.

Over the past ten years, Australian and international companies have achieved successful public-private partnerships in water industry contracts valued at more than \$AU3 billion. The United Water International consortium, consisting of the French water giant, Veolia, the British-based Thames Water and an Adelaide partner, Kinhill Engineers (now known as Kellogg, Brown & Root), won the contract to operate Adelaide's water system in 1995, valued at \$AU1.5 billion. A partnership between Thames Water, the world's third biggest water company, and the Central Highlands

Regional Water Authority has a twenty-five year contract to treat and distribute drinking water to 120,000 people in Ballarat and nearby towns.

Aid and development

Water development underpins food security, livelihoods, environmental sustainability and industrial growth around the world. The Australian Agency for International Development, AusAID, which spends over \$AU600 million annually on Australian goods and services for use in aid projects, has focused on water as one means of delivering aid to the Asia-Pacific region. The agency assists partners in the sustainable management and development of water resources and services.

AusAID supports the export of Australian knowledge through direct projects, while also building Australian capability. For example, in South Asia, more than 800 million people do not have access to adequate sanitation and some 150 million do not have access to safe water. As a result, water-borne disease and faecal contamination are leading causes of death and morbidity. Strengthening local capacity for policy reform, service delivery and community involvement in the water supply and sanitation sector is a key part of Australia's strategy to improve governance and reduce poverty in South Asia.

AusAID's Gangtok-Shillong and South Asia Regional Water and Sanitation Program will help improve water and sanitation for some 400,000 people in the cities of Gangtok and Shillong in north-east India, and help strengthen water governance across the South Asia Region. The program's target is to reduce avoidable water-related diseases by 50 percent. A feature of this program is a partnership with the World Bank's water and sanitation programs.



AusAID project underway in Vietnam for three Delta town's water supply and sanitation systems. Image courtesy of GHD Pty Ltd

The *Provincial Water Supply Project* in Vietnam is a good example of a successful AusAID partnership. The project delivered clean water to over 400,000 Vietnamese in five provincial towns using Australian technical assistance and equipment from Kinhill Engineers (now known as Kellogg, Brown & Root) and MWH, and training and materials from ACIL Australia.

Australia is partnering with the World Bank in initiatives such as the *AusAID Partnership for Water and Coastal Resource Management*. This partnership gives the World Bank access to Australian organisations such as the Murray-Darling Basin Commission, the Great Barrier Reef Marine Park Authority and the Australian Institute of Marine Science, for expertise that includes dryland agriculture, and catchment and river basin management. In undertaking these partnerships, Australian experts help shape the World Bank's major water investments.



Hydro Tasmania is also advising the World Bank on the sustainable development of hydropower projects through the use of the International Hydropower Association's *Sustainability Guidelines and Compliance Protocol*. Hydropower projects not only provide electricity, but also water for drinking, sanitation and irrigation. The United Nation's *Millennium Development Goals* identify the provision of water and electricity as key factors in the alleviation of poverty.

A commitment to building the experience, skills and confidence of communities to manage their own water projects is a central feature of Australian involvement in international aid. SAGRIC International and SMEC are among several leading companies that actively provide aid of this kind. SAGRIC works in Cambodia, China, India, Indonesia, Laos, Mozambique, the Philippines, Thailand and Vietnam.

Above: Rehabilitation of urban water supply for Pyongyang City, North Korea. Image courtesy of SMEC

FLOOD CONTROL IN CHINA

SAGRIC International is a project implementation company that works partly in the international aid industry. In a project sponsored by AusAID, SAGRIC is providing more accurate forecasts of flooding in the Yangtze River and other river basins of China.

SAGRIC is responsible for managing and implementing the project to deliver improved:

- Data acquisition and flood forecasting
- Flood management and communication systems
- Information systems for the management of hydrological data
- Flood management Decision Support Systems

This information gives greater lead times for predicting floods.

AusAID and SAGRIC work closely with China's Ministry for Water Resources to reduce the loss of life, damage to property and social disruption caused by flooding in the upper and middle reaches of the Yangtze River.

Louise Simpson, a community development adviser for North Vam Nao Project, talks to Ho Thi Tu about how her family uses water in Hiep Xuong Commune, Vietnam. Image courtesy of the AusAID



SAGRIC's project management and consulting skills have been critical to its international success in water management. SMEC has successfully completed more than 2,500 major projects in 67 countries and is registered with all the major international funding and aid agencies.

The Australian Centre for International Agricultural Research (ACIAR) brokers natural resources management research to contribute to food security and wealth in developing countries and Australia. The *Land and Water Resources Program* focuses on water management and agriculture and environmental quality, and concentrates on broad-scale management of land and water resources. The *Soil Management and Crop Nutrition Program* focuses on land and cropping systems and soil management, and concentrates at the field scale. Recent projects include:

- Salinity management in south-eastern Australia, north-eastern Thailand and Laos
- Arsenic transfer in water-soil-crop environments of Bangladesh and Australia
- Technologies for assessing the extent and cause of degradation in arid Impact of heavy metals on sustainability of fertilisation and waste recycling in peri-urban and intensive agriculture in south-east Asia
- Development of technologies to alleviate soil acidification in legume-based production systems in the tropics of Asia and Australia
- Water resources and salinity management in agricultural areas of inland Northern China and Northern Australia
- Growing more rice with less water: Increasing water productivity in rice-based cropping systems
- Minimising the off-site impact of pesticides from agricultural systems – a risk based approach
- Improving main system water management in China: A demonstration project in the Zhanghe Irrigation Scheme
- Integrated watershed management for sustainable soil and water resources management of the Inabanga watershed, Bohol Island, Philippines
- Equitable groundwater management for the development of atolls and small islands
- Assessing land suitability for crop diversification in Cambodia and Australia
- Application of innovative irrigated cropping and soil filtration technology for wastewater reuse and treatment in China
- Regional impacts of re-vegetation of water resources of the Loess Plateau, China, and Middle and Upper Murrumbidgee Catchment, Australia (see below)

REGIONAL IMPACTS OF VEGETATION ON WATER RESOURCES

In this project, ACIAR, the Chinese Academy of Sciences and CSIRO Land and Water worked together to develop a re-vegetation program in the Loess Plateau in western China to reduce soil erosion and improve water quality in the Yellow River.

The Loess Plateau is a water-limited agricultural region with deep erodible soils. In parts, this heavily dissected landscape is too steep for cropping. It is also remote from China's developing markets on the eastern seaboard. In combination, these factors mean that those farmers who rely solely on agriculture are among the poorest in China.

The low proportion of perennial vegetation cover and intense summer monsoon rainfall are major contributors to severe soil erosion problems on the Loess Plateau. A solution to this agricultural problem is large-scale revegetation using perennial plants (grasses, shrubs and trees). However this may create another problem, as large-scale revegetation means less water will be available as run-off into dams from the region. The aim of the project is to raise awareness amongst land-water managers of the coupled land-use and water-balance implications.

The project developed a spatial information system using a Digital Elevation Model (DEM), and remotely sensed information about land cover and interpolated meteorological surfaces.

The spatial databases created were used to validate a suitable regional water-balance model for the entire Coarse Sandy Hilly Region (CSHR), an area of 134,050 square kilometres that contributes 73 percent of the sediment to the Yellow River. The modelling will assess the cumulative impact of re-planting perennial plants in different areas of the landscape.

In addition, the software created will allow high-level agricultural policy makers to develop different scenarios for revegetating the Yanhe Basin. Ultimately, if the databases become available, the modelling could be conducted for the entire Loess Plateau.

The Loess Plateau showing typical gullies, some of which are over 200m deep. Image courtesy of the ACIAR Project Team





Rural handpump in Sri Lanka. Image courtesy of Coffey

Consultants and project managers

As well as applying their capabilities nationally, Australian companies undertake a range of international projects, employing their consulting skills in performance reporting, feasibility studies, financial analyses, project management and regulations.

Companies such as GHD, SKM (page 138), URS, Maunsell, Coffey, Hydro Tasmania and Kellogg Brown & Root all supply consulting services to the water industry. Many are large Australian companies with international links, providing expertise in developing and implementing water management. Many other Australian companies have global experience (below).

A range of organisations provide water management and delivery services in Australia and overseas, including SA Water (page 49), SunWater, Murray Irrigation (page 116) and Hydro Tasmania. ECOWISE Environmental (page 65) offers water management solutions including the design, supply, installation, servicing, data collection and data management of total systems.

Australian Water Technologies Pty Ltd specialises in water, wastewater, environmental management and utility management, designing, building, maintaining and operating every aspect of water and wastewater infrastructure.

Complementing these large organisations is a range of niche companies with specialist expertise. For example, Katalyst21 is an Australian consultancy specialising in water sector reform, business development and public-private partnerships for clients in Australia, the Asia-Pacific and Africa.

Members of the Water Services Association of Australia provide water services to more than 15 million Australians (page 47).

Table 5.04 • Water industry consultants

Company	Expertise
Coffey International	Operates 21 offices in Australia and South-East Asia. Geotechnical engineering, environment, hydrogeology, hydrology, and natural resource management
Connell Wagner	Multi-discipline consultants providing environmental, surveying, engineering and project management services throughout the Asia-Pacific Region. Experience includes flood studies and groundwater assessment
Environmental Resources Management (ERM)	Environmental management consultancy, environmental studies, impact assessment and auditing, water management and surface and groundwater studies
Gutteridge Haskins & Davey (GHD)	Environmental science, management and planning, water quality, hydrology, salinity, groundwater measurement, water and wastewater treatment, stormwater and catchment management. The GHD Bellamy & Nevard Alliance was formed recently to provide a global consultancy in environmental advice to industry
Hassall & Associates	Managing projects worldwide for bilateral, multilateral and private sector clients. It is the largest rural consulting company in Australia
Hydro Tasmania	Expertise in freshwater, estuarine and marine ecology, environmental flows, hydrological modelling and monitoring systems, water quality, nutrient management, fish migration, critical habitat assessment, threatened species management, sustainable catchment management; and development and application of sustainability guidelines for hydropower developments
Kellogg Brown & Root (KBR) Maunsell Ltd	Infrastructure projects such as water filtration plants and wastewater treatment plants
MWH	Integrated environmental science and engineering services for natural resource management and rehabilitation, sewerage and solid waste, wastewater treatment, stormwater networks, dams and reservoirs
PricewaterhouseCoopers	Water and environmental consultant, water treatment, water supply, wastewater collection systems, modelling and water demand studies
Sinclair Knight Merz	Experienced in project management and environmental reporting with a focus on solving complex business problems to manage risk and improve performance
Snowy Mountains Engineering Corporation (SMEC)	A leading Australian-owned engineering consulting firm with experience in water management, groundwater exploration, the protection of water resources, geotechnical assessment, modelling and analysis, management and construction, and water policy
Thiess	Leading international multi-disciplinary consultancy group with offices throughout Australia, Asia, Oceania, Africa and the Middle East. Expertise in waste management and water resources management
URS Australia	Provides products and environmental services to the water and waste management industry. Values engineering excellence and quality results
Veolia Environment (formerly Vivendi Environment)	Employs scientists, engineers and planners to offer comprehensive services (concept to implementation) as well as specialised assignments
	Collex-Onyx (a Division of Veolia) provides a broad spectrum of waste and environment management services, including the development of infrastructure and filtration systems

The Australian Water Association members come from a broad range of disciplines, including engineers, resource managers and public health professionals across the globe. The Water Industry Alliance comprises members with high levels of expertise in all aspects of water treatment and distribution. This expertise is the basis of an international export industry in manufacturing, systems integration, and management and servicing of water infrastructure.

Technology adoption

Water is a social, economic and environmental resource. Both planning and the appropriate choice of technology need to reflect the complex interaction of water with other natural and socio-economic systems.

This requires an integrated approach, cultural sensitivity and cooperation between governments, the private sector and communities.

Hassall & Associates and Sinclair Knight Merz are examples of highly regarded Australian companies whose experience in catchment and river system management is sought internationally.

Australian firms and government departments have developed a number of water and landscape modelling and Decision Support Systems that can be packaged for different target audiences, including policy-makers and water managers in government agencies.

Regional and community groups can be engaged more effectively by including local knowledge. These tools also capture Australian expertise, allowing it to be adapted for use in other projects, both domestic and international.

Outstanding examples include:

- The Integrated Quantity and Quality Model (IQQM) tool developed by the New South Wales Department of Infrastructure Planning and Natural Resources, used to implement a river basin model in China
- Toolkit, developed by CRC for Catchment Hydrology, and Environmental Management Support System (EMSS), developed by CSIRO Land and Water, used to support the South East Queensland Regional Water Quality Management Strategy
- Decision Support Systems and Geographic Information Systems, used by the Bureau of Rural Sciences to select areas for irrigation development in Argentina (see below)

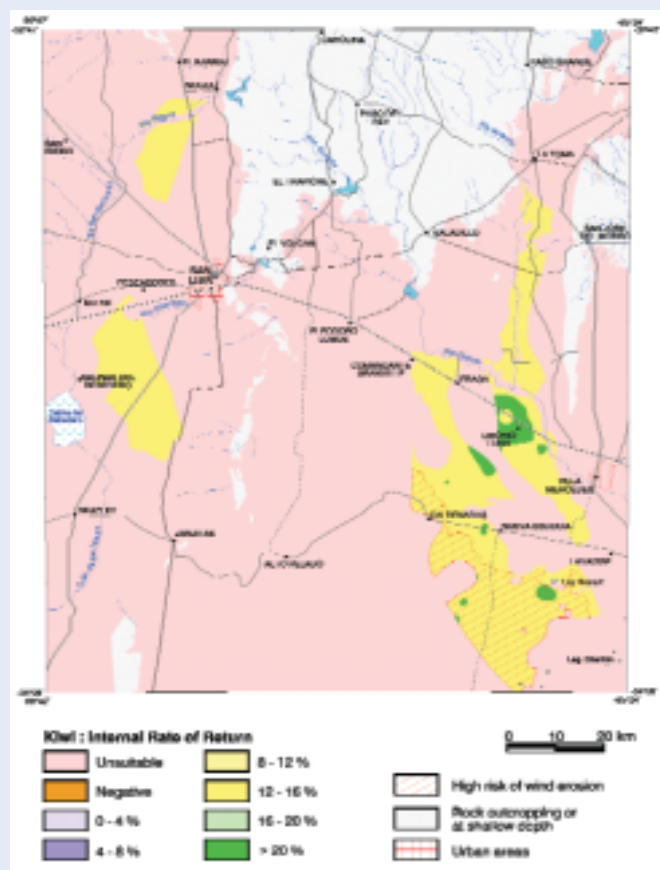
SUSTAINABLE IRRIGATION IN ARGENTINA

The Bureau of Rural Sciences (BRS) is the scientific bureau within the Australian Government Department of Agriculture, Fisheries and Forestry. BRS provides scientific advice to support evidence-based policy development and decision making by government. BRS primarily advises the Australian Government, but is occasionally commissioned by overseas governments, such as the San Luis Provincial Government in Argentina.

The groundwater resources in San Luis Province offer the potential to develop many new irrigated agriculture opportunities. The provincial government commissioned BRS, in partnership with CSIRO Land and Water, to undertake a study to identify areas that could be sustainably irrigated using groundwater, focusing on winter wheat, maize, grapes, citrus, perennial pasture, vegetables and deciduous fruit.

BRS produced irrigation maps of the province using a combination of two Decision Support Systems and a Geographic Information System to select areas most suitable for irrigation development. The system integrated spatial data on soils, crops and groundwater with agronomic information and economic analyses to produce suitability maps for specific crops.

Not only did the system show how groundwater could be used for agriculture in the region; it also demonstrated a methodology with great potential to be used elsewhere.



Physical and economic suitability, developed using the Automated Land Evaluation System, for the irrigated production of wine grapes using groundwater in central San Luis Province, Argentina. Image courtesy of BRS

SOUTH EASTERN ANATOLIA PROJECT

Sinclair Knight Merz (SKM) is a long-established, independent, professional services consulting group with a team of 3,000 people in offices in major business centres across the globe. A wholly Australian-owned company, SKM has significant resources, financial standing and technical capability, designed to provide clients with superior service.

SKM was part of an international joint venture providing specialist advice on the establishment of major new irrigation developments in south-eastern Turkey.

The *Southeastern Anatolia Project* is the biggest development project ever undertaken by Turkey and one of the largest multi-sector development projects in the world. It has been designed to develop water resources of the Euphrates and Tigris River Basins for hydroelectric power and irrigation of about 1.6 million hectares.

Ataturk Dam. Images courtesy of Kent State University



SKM used a range of in-house Australian skills to provide specialist advice on:

- The development of alternative management models for storages and river systems, carriers and distribution canals
- Institutional, operations and maintenance aspects of the management models
- The review and development of legal and operational procedures for scheme management
- The preparation of operation and maintenance manuals

The objectives of this study were to develop the region through providing guidance in the management and operation of complex irrigation systems, within the social, political and administrative context of a developing country.

Technologies

Several of Australian water companies has exported wastewater technologies overseas with the help of *AusIndustry* programs (page 132).

Earth Systems Pty Ltd are at the forefront of water quality technology development. They have developed a line of water treatment equipment employing the patented Neutra-Mill Technology, and are currently commercialising a series of water barrier technologies for passively improving water quality. In addition they have produced the Australian Water Map as a key information resource for the water and education sectors.

Thiess and Veolia (page 73) supply products to the irrigation and water supply industries and have strong international linkages. Veolia manufactures filters, deionisation and reverse osmosis systems, and is pioneering membrane technology as the next generation of filtration products.

Veolia recently constructed one of the largest submerged membrane plants in the world in Bendigo, Victoria, and

uses membrane and reverse osmosis technology systems for providing drinking water to remote areas, including the aboriginal communities of Wujal Wujal in the Daintree rainforests of Cape York, North Queensland.

New irrigation technologies enable farmers to increase the yield and quality of crops by delivering precise amounts of water and nutrients to the plants' root zone while using less water, chemicals and fertilisers. Tyco Flow Control, an Australian subsidiary of Tyco International, has developed a range of irrigation technologies for Australian and international markets.

Monitoring and mapping technologies aid water-use efficiency in precision farming (page 121) and can optimise the selection of sites for cropping. Niche companies, such as NGIS Australia (page 140) and Agrecon, use satellite data to provide resource intelligence to overseas companies, from China to Turkey. Agrilink sells water management sensors around the world, linking them in a distributed network (page 142).

Hydstra Pty Ltd specialises in the development of advanced engineering products including TimeStudio and HYDSYS systems that are used internationally. The systems are used for environmental monitoring and modelling, water supply, flood warning and flow control, and hydro and wind management.

Mindata, a division of Environmental Systems & Services, develops sensors for flow and quality measurement, including streamflow and critical warning systems for floods and pollution events.

Micromet provides a network of weather stations coupled with local controllers to determine the optimum application of water in an irrigation area.

In the poorest countries of the world, clean drinking water goes hand in hand with improved sanitation and access to power and energy. Water Recycle Group works in Asia and the Pacific Islands in the design, supply and installation of water purification, sanitation and hydropower systems (page 141).

Greywater recycling is seen in some countries as a valuable self sustaining resource. Water Recycle Group Australia (WRG), based in Canberra, has a technology based on a series of filters, vortex action and finely tuned hydraulic loading. The firm is recognised as a leader in supplying Package Greywater Reuse Systems (PGRS) within Australia, with plans for the release of an export model to serve large volume demand in the Middle East and eastern Asia. Units have been installed in residences, hostels and eco-resorts in Australia and New Zealand. In recognition of its research and development in this emerging water sector, WRG received the Knowledge Fund 2003 award in Canberra.

System design and management

Australia has developed a large range of water management systems, many of which can be used internationally. Vam Nao Island in Vietnam's Mekong Delta is subject to severe seasonal flooding, which brings water-borne diseases, and causes widespread damage to crops, infrastructure and property. The integrated water management system developed by Kellogg Brown & Root will reduce overall flood damage to Vam Nao by 95 percent. The system will also help over 50,000 farming families to extend their cropping season, plant higher value crops, and diversify production.

Prophecy International is a specialist in billing and customer management solutions for the utilities industry, with a range of Customer Information Systems (CIS) products that are used to manage regulated, transitional or deregulated water markets.

Australian companies already partner with international counterparts, extending market reach. The international company, Ondeo Services, has invested in Australian Water Services (AWS), an Australian company established in 1991. AWS draws on and contributes to Ondeo's international

capabilities in research and development, and builds and operates water systems in partnership with public authorities in Australia and New Zealand.

Information gateways

Australia is helping many countries build their water management capacities by supplying information.

The *Australian Development Gateway*, managed by AusAID and alliance partner CSIRO, provides developing countries with information from government, the private sector, civil society and academic sources. This is a joint program between Australia and the World Bank under the Virtual Colombo Plan.

CSIRO represents Australia in the Global Research Alliance, 'a global knowledge pool for the global good through global funding'. This collaboration of nine leading international science and technology institutions has adopted water and sanitation as a priority and emphasises the development of global knowledge networks for industry and industrial sectors to enhance their competitiveness. Australia is leading the project on integrated water resources management, which aims to build in-country capacity that highlights international best practice in adaptive environmental management.

Showcasing and conferencing

The Australian Trade Commission (AusTrade), established in 1986, is a commercially focused statutory authority that assists exporters in winning business overseas and promotes direct investment into Australia. AusTrade and other organisations such as the Australian Technology Showcase promote Australian products and services overseas.

For example, AusTrade promoted Australian capabilities during the reconstruction of Iraq by facilitating in-country seminars and arranging overseas delegations. The resulting

collaboration between SAGRIC International, CSIRO and US firm DAI Group will support the rehabilitation of Iraq's agriculture sector through a contract valued at \$US120 million. CSIRO has also won a role with DAI and USAID to conduct a feasibility study to remediate the Iraqi Wetlands. This project is valued at \$US30 million.

Sydney Olympic Park (page 74-75) is one of the most visible international demonstrations of Australia's capabilities and innovation as well as the strength of the partnerships that can be achieved between Australian and international companies. Leighton Holdings, Thiess Contractors and Daracon Engineering installed gross pollutant traps (humeceptors) manufactured by CSR Humes to reduce the impact of stormwater run-off from roadways and car park areas, removing up to 97.8 percent of free oils and up to 80 percent of total suspended solids. The internal high flow by-pass, patented by CSR Humes in Australia, protects creeks and rivers downstream by preventing high storm flows from scouring and re-suspending previously trapped pollutants.

Australian companies with experience from the Sydney Olympics are well placed to assist in the environmental development of future Olympic Games. The Beijing Development Planning Commission, responsible for the 2008 Beijing Olympics, will build 14 wastewater treatment plants with recycling facilities. Given their previous experience in the Sydney Olympics, Australian companies such as Leighton Holdings and Thiess Contractors are well positioned to win contracts for water treatment and recycling. Bovis Lend Lease and Telstra are among the companies to have helped Beijing with its bid. Canberra-based Kiah Environmental Designers has already won a contract to landscape the grounds of a technology park in Hangzhou, implementing environmentally sustainable development principles in water use and biodiversity into their design.

REDUCING FLOOD DAMAGE IN THE MEKONG DELTA

NGIS Australia is an independent firm specialising in Geographic Information Systems (GIS) and remote sensing. The company was established in 1993 and has offices in Perth, Sydney Canberra and Hong Kong. NGIS is the largest specialist provider of independent consulting services and solutions in Australia.

The problem

Floods in the Mekong Basin are an annual event that provide important benefits but often cause many deaths and tremendous economic damage. If the damage caused by the floods is to be reduced, people must be much better informed. Effective planning for flood preparedness measures requires a lot of accurate information, such as hazard and risk maps.

The task

NGIS was contracted to look at both traditional (surveying) and innovative (remote sensing and distributed map access) techniques for improving the content and method of delivering flood hazard and risk maps to planners in the Mekong Basin. The company's role was to provide technical experts to help improve data collection and accessibility through the use of remotely sensed data and other sources.

Datasets containing information such as flood depth, flood extent, flood duration, land use and population density were collected from a number of agencies (both governmental and non-governmental) in the four riparian countries (Laos, Thailand, Cambodia and Vietnam).

These datasets were then used to produce flood hazard and specific risk maps that will provide an important information base for planning and decision making when matching the vulnerability of a flood-prone area with an appropriate type of preparation for flooding. Real-time flood forecasting was also developed and disseminated via the MRCS website.

The results

The program succeeded in helping residents to minimise the human suffering and damage to communities, infrastructure, property and agricultural land caused by uncontrolled flooding in the Lower Mekong Basin, and in ensuring regional management of Mekong floods. The long-term outcome of the project will be reduced damage in flood-prone areas through careful planning of appropriate interventions in flood hazard areas.



Top and middle: Cambodian Water Festival on the banks of the Mekong River, 2003
 Bottom: Foreshore of the Mekong River with local transport boats, 2003
 Images courtesy of NGIS. Photographs by Mr Paul Gager

WATER RECYCLE GROUP: BRINGING POWER TO REMOTE COMMUNITIES

Tan Son Elementary School, Son La Province, Vietnam

The village of Tan Son ('New Mountain') is located south-west of Hanoi in Son La province, close to the Vietnam-Laos border. The rugged terrain makes it very isolated, and the minority peoples of Muong, Thai, H'mong, Zao as well as Viet Kinh ethnicities are far removed from the infrastructure most people expect in the cities and larger towns. The school provides elementary education to 220 children under very primitive conditions – there is an open pit toilet and no running water or electricity. The average income of the families with children attending the school was less than \$US100/year.

The 500W PowerPal micro-hydropower unit was transported to the site. Installation training was provided and the school staff and parents created the canal and installed the unit themselves in less than one day! A customised vortex canal was made from scrap materials on-site and the generator and turbine connected by a 1.2m head pipe. Bamboo poles were planted in the paddy to carry the electricity transmission over the rice fields to the school where an electronic load controller stabilises the voltage to protect electrical appliances during use. The micro-hydropower unit provides year-round power with no operating costs and minimal maintenance. According to the school principal (Mr Ha Van Cung), the expert and caretaker of the system: 'All the villagers are very envious of this power supply. So simple and easy – we all want it for our homes, but the school was the number one priority.'

Powerpal micro-hydropower generators were designed to help people living in remote areas and who are often denied the benefits of electricity, and to provide a real low-cost option to using diesel, kerosene, batteries and firewood, which are expensive and damage the environment. Water-based power is clean, free, renewable and self-sufficient. WRG designed the site flow and donated and commissioned the micro hydropower unit as a demonstration to other rural villages.



Taranaki, New Zealand

The Taranaki is a central-west area of New Zealand's North Island. An isolated Maori Maere required power for night meetings and winter heating. The cost of landline cables from the regional electricity grid was equivalent to several years' income for the community, yet every day a permanent running stream flowed nearby, fed by the melting snow and frequent rains on Mt Taranaki.

Initially, consultants suggested solar panels, but these were almost useless in winter and lacked sustained high-generating power. Water Recycle Group's local agent recommended a mini-hydro power system that could be installed within a week to provide continuous power with no detrimental impact on the environment. The site is used as a demonstration model of passive renewable power generation for other Maori communities.



Above: Micro-hydropower in action in New Zealand
Left: Tan Son elementary school and adjacent village rice paddy
Images courtesy of Water Recycle Group

WATER MEASUREMENT SYSTEMS FOR FLORIDA'S CITRUS INDUSTRY

Agrilink International is an Australian company that has been successful in selling products and services to 25 countries world wide, particularly Australia and USA. Agrilink operates a sensor and communication network and integrates the data with agronomic expertise to assist its customers. Applications include table and wine grapes, citrus, nuts, mixed berries, onions, potatoes, tomatoes and pasture.

Agrilink's core technology is AgWISE, a Windows-based, Internet knowledge collection and decision delivery platform. AgWISE is an open platform with sensors from a selection of world-leading manufactures providing data for weather conditions, water infrastructure, soil moisture conditions and plant stress, in addition to spatial technology such as remote sensing. Agrilink encourages manufacturers to use the AgWISE platform as a cost-effective mechanism to bring their own products to market.

In 2001, Agrilink moved into the Florida market through an alliance with Adcon Telemetry, which is based in Boca Raton. Initially, Agrilink provided solutions to citrus, vegetable and cane growers in South and Central Florida.

Agrilink used a wireless system to collect and transmit data that is vital to irrigation and crop management. The information was collected and transmitted automatically from in-field sensors, to be accessed through the AgWISE system. These soil moisture and weather sensors enabled the irrigators to know when and how much water to apply, resulting in effective and efficient management.



Winnemucca Farms, 2003 – Irrigation scheduling equipment installed under pivot irrigation in potatoes. Image courtesy Agrilink International

In the citrus industry in Florida, Agrilink's expertise in agricultural and environmental management provided growers, agronomists and managers with the confidence to make the most cost-effective and sustainable decisions. Agrilink also worked closely with research experts from the University of Florida and government agencies in irrigation management, plant protection and water management, to develop specific solutions tailored to the Florida region.



Summary

This last chapter described the integration across the sectors required for effective change, and the international outlook of Australians in benchmarking, partnering and networking in the water industry.

Australia already contributes to major international projects and is strengthening its position as a world-class supplier of knowledge, products and services.

Flood irrigation in northern San Luis Province, Argentina. Image courtesy of BRS

Conclusion

The context of the global water debate is the common challenge of water scarcity, caused by expanding population, urbanisation, pollution, and climate change and variability. The problem will escalate unless actions are taken now to reverse current degradation and protect future water supplies.

Australian research contributes to the understanding of global biophysical processes that underpin the water cycle and hence the prediction of flood and drought can be better managed. Australian scientists also provide approaches to measuring river and floodplain health, and link landscape management to river and stream condition. Management of catchments to protect water quality and run-off volume is a well-tested strategy in both rural and urban Australia. Consequently natural processes are used to supplement technological solutions for water and waste treatment and to avoid whatever possible the salinisation of water resources. If solutions are underpinned by a better understanding of the water cycle, there is less likelihood of the development of unintended consequences and new problems.

This 'big picture' thinking that is characteristic of the Australian approach to water resources management is also reflected in the cross-jurisdictional approach to new water policy, and to engagement of all water users in improving water use efficiency.

Innovative schemes for reducing water use are being developed for cities and towns; for irrigated agriculture; and for agencies, industries and individuals. In dryland agriculture a revolution in landscape management is proceeding as the methods for detecting and managing salinity are developed and the links with vegetative cover and groundwater flow are clarified.

Australian Governments have established a clear policy framework for accessing, allocating, pricing and

trading of water to meet the needs of all water users including the environment and have embraced the challenge of improving water use efficiency.

Governments also provide support for research and commercialisation. Scientists and engineers are providing new options for water and waste treatment that safeguard public health and the environment. Economists are exploring new kinds of markets that recognise the value of ecosystem services and which can optimise the contribution of both public and private investment. Social scientists are designing processes that involve communities and regions in finding their own solutions. Consulting firms and agronomists are helping to bring about improved practices on the ground.

The culture of experimentation and self sufficiency, of survival in harsh conditions, and experience of flood and drought, underpins Australian achievement and innovation. Much of this experience is transferable internationally, whether to advanced industrial economies or to remote villages of developing nations, as demonstrated by existing international partnerships and aid services. Australian Government and industry look forward to building on these partnerships, to sharing experiences, and to finding solutions that will safeguard water supplies into the future.

Australians have recognised the urgency of the situation and have risen to the challenge.

This progress is described in **Water Innovation: A New Era for Australia.**

Water Lily. Image courtesy of Veolia Waters

