

Adelaide





Water Supply In Adelaide, Australia

Mr. Brenton Burman, *Technical Director, Planning Policy, South Australian Ministry for Urban Development and Planning*

Water Management Arrangements for Metropolitan Adelaide. The Role of Government.

Mr. Philippe Laval, *Managing Director, United Water*

The Adelaide Contract: the Contribution of Outsourcing to Sustainability.

Mr. Jack McKean, *Head of Innovation and Business Development, SA Water*

Managing Adelaide's Water. The Role of the South Australian Water Corporation.

Prof. Steve Hamnett, *Professor of Urban and Regional Planning, University of South Australia*

Adelaide as a Sustainable City: Water Management in the Broader Context of Sustainability. ■





Water Management Arrangements for Metropolitan Adelaide. The Role of Government

Mr. Brenton Burman

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Introduction

Water is a basic necessity for life. We all use it. We all abuse it.

Before modern plumbing, the impact of water usage, wastage and pollution were obvious, causing significant and sometimes immediate impacts to the health of communities.

Today clean quality water is readily available with plumbing system to dispose of any excess stormwater or waste, making the effects of our actions less obvious and generally away from our homes.

The supply of clean quality water is not endless and the cost of providing a reliable supply is rising. Disposal of excess water through the stormwater and sewerage systems has had a significant effect on creeks, waterways, and coastal areas of Adelaide.

In the past, stormwater was seen as a nuisance that needed to be removed quickly. Today stormwater and waste water are seen as potential resources to be used as a replacement or supplement to traditional clean water supplies.

The challenge now is to use mains water and groundwater wisely making better use of effluent and stormwater. It is also time to take responsibility for the quality of our

catchments, creeks, waterways and coastal environments.

In the context of this, the South Australian State Government is working cooperatively with local government authorities, the private sector and the community to ensure the provision of a sustainable water supply for Metropolitan Adelaide.

This paper expands on this theme, covering:

- Background - Adelaide and South Australia
- The role of Government in the provision of coordinated urban water services
- Water issues facing Adelaide
- The policy framework for guiding urban services
- Key planning initiatives affecting water management
- Concluding observations

Background - Adelaide and South Australia

Adelaide is the capital of the State of South Australia. The City was first founded in 1836, being planned by Colonel William Light. The city centre of Adelaide is on the banks of the River Torrens centrally located between the foothills and the coast. One of the key legacies of Colonel Light's original plan is the Park Lands that surround the Central Business District of Adelaide and North Adelaide,



Adelaide is renowned for being a very 'liveable' city. It has a Mediterranean climate, being 34.5 degrees south of the Equator. Metropolitan Adelaide has a population of 1.1 million, representing almost 80% of the State's total population.

The city is linear in its design, being constrained in its growth by the Mount Lofty Ranges to the east and the Gulf of St Vincent to the west. Being relatively low in density, the city stretches more than 90 kilometers in a north-south direction.

Rainfall for metropolitan Adelaide is about 550 mm per year, most of which falls in the six months from May to October. The adjacent foothills to the east of the city generally receives 50% more rainfall than plains of Adelaide, forming the water catchment for the city and source of the creek system that flows across the Adelaide plains to the coast.

From its beginning, water has been a critical resource for Adelaide. South Australia has a reputation as being "... the driest State in the

driest inhabited continent ...". Colonel Light's original decision for the location of Adelaide was based on the need to ensure fresh water supply for the new settlement – this was primarily from the River Torrens. More reliable water supply was required for the growing city, with various reservoirs being established over the past 100 years in the water catchment of the Adelaide Hills. Water is also pumped from the River Murray (approximately 80 kilometers away). Such water is stored in the reservoirs until required. In an average year about 40% of Adelaide's water is obtained this way, but the proportion can rise to as high as 90% in drought years. The remaining water for Adelaide comes from the Mt Lofty Ranges catchments. On the eastern fringe of the metropolitan areas, the catchments are under pressure from urban growth, rural living, tourism and irrigated agriculture.

The role of Government in the provision and coordination of urban water services

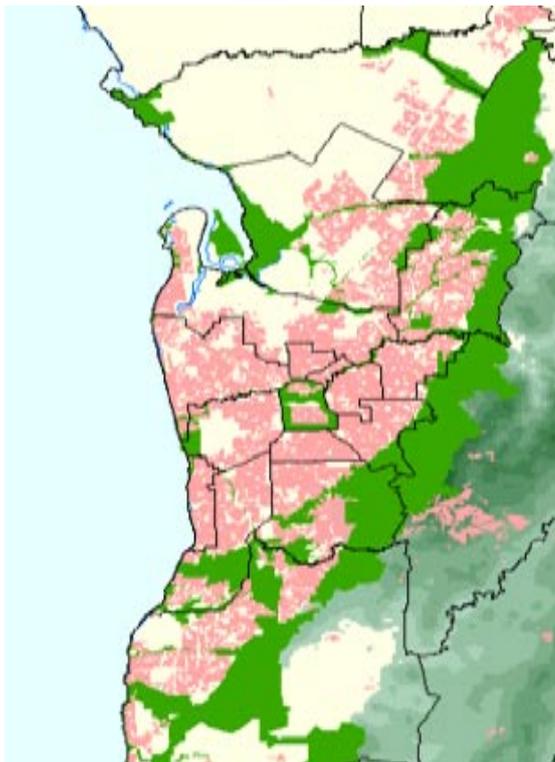
Brief overview of the political system in Australia

Australia has a democratic system of government, consisting of three tiers: Federal, State and Local Governments.





Federation of States in 1901 to establish the Commonwealth of Australia resulted in the State Governments giving specific powers to the Federal Government which affect the whole of the country. Such powers included foreign affairs, defence, trade, telecommunications, postal services, social services, monetary



policies, immigration and national highways. Any powers not given to the Federal Government in the Australian Constitution remain with State Governments.

Each State has its own State Government which is responsible for State-wide strategic planning, education, health, police, electricity and water supply, transport, main roads, ports and public housing.

Local Government is known as the sphere of government 'closest to the people'. South Australia is divided into 70 local government areas, 19 of which are contained in the Metropolitan area of Adelaide. The State Government creates the legal framework in which Local Government operates. Within South Australia, Local Government Authorities are generally responsible for waste management, local environmental management (including stormwater management), local roads, local strategic planning, planning, building and health controls, parks and recreation facilities, libraries and community services/facilities, social planning issues, etc.

The role of Government in the provision and coordinating of urban water services

In terms of water management, the responsibility of this function lies between the various levels of government in Australia.

Federal Government

The Federal Government has a coordinating policy and funding allocation role on National water initiatives and inter-government arrangements such as protection of the Murray-Darling, Great Artesian and Lake Eyre Basin systems, National Coastal Management Strategies, etc.

State Government

Since this State was founded, the South Australian State Government has assumed the responsibility for the provision of reliable water



supplies for the urban areas of the State. This involves overall water management and the provision of infrastructure for water supply, sewerage and major urban and rural drainage systems.

The State Minister for Water Resources is responsible for the administration of the Water Resources Act 1997. The Minister has two key functions under this Act:

- As a Policy-setter – establishing a State Water Plan
- As a Regulator – administering water licensing and allocation systems

The Minister is also responsible for promoting public awareness of the importance of the State’s water resources and to encourage conservation of those resources.

The Department of Water Resources (DWR) has been established as the lead State Government agency for management and administration of the State’s water resources. The Department’s role includes:

- Licensing, allocation and monitoring
- Policy advice
- Input and implementation of the Council of Australian Governments (COAG) National water reforms

Local Government

Local Government plays a very significant role in water resource management, as they are responsible for a wide range of activities in their local government area that can have a direct or indirect impact on the health of catchments and water resources.

Local Government manages urban stormwater systems. It is also responsible for over 90 septic tank effluent disposal schemes in country towns throughout regional South Australia. Those who do not receive such services must rely on private rainwater tanks, bores, dams, septic tanks and industrial waste disposal systems.

Water issues facing Adelaide

Irrigated agriculture is the largest user of water in South Australia. Approximately 80% of all water used in this State is applied to irrigated agriculture. The trend is for an increasing growth in irrigated agriculture in Australia – an example of this is the rapid growth of the State’s wine industry. Such growth will continue to place greater strain on water from the River Murray and from groundwater supplies.

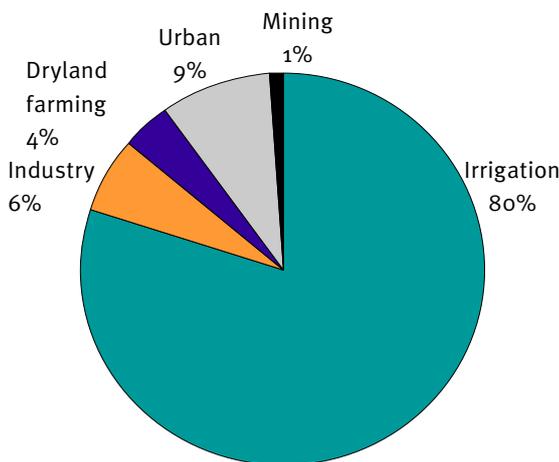


Figure 1: Water Usage in South Australia, 2000

The Mount Lofty Ranges catchment areas are a major source of Adelaide’s reticulated water supplies. Surface water quality has deteriorated in the catchment because of urban development and intensive land use activities. Rapid expansion of irrigation in the catchment has also resulted in an increase in the development of farm dams and groundwater extractions. Such issues in the catchment will affect water quality and water supply, and pollution in the associated creek systems.

Water from the River Murray is vital to the current and future development of this State (and to the Nation). The use of River Murray water is limited by water extraction caps from the Murray-Darling Basin. Recent dry years have meant minimum entitlement flows to South Australia and, on



a number of occasions, the mouth of the River Murray has been completely blocked by sand. The other major issue facing the River Murray system is increasing salt loads. Increasing salinity in the River is expected to significantly increase in the next decade, resulting in significant impacts to water quality and land development.

The level of development of many of the State's prescribed groundwater water resources is also approaching or has reached sustainable levels. In some cases, the sustainable limit has been exceeded, causing unacceptable rises in salinity and dropping water levels or pressure.

Metropolitan creeks, estuaries and coastal marine environments have also been impacted by polluted stormwater and effluent discharge to Gulf St Vincent. Also, as much of Adelaide has been developed on floodplains from the Mt Lofty Ranges Catchment areas, such areas are prone to flooding. From a community perspective, there is an expectation that household water provision and wastewater disposal will be at the highest

standard, and there is pressure for the urban environment to be flood free and for stormwater not to degrade creeks, rivers and ultimately Gulf St Vincent and our coastal environment.

The policy framework for guiding urban services

The State Legislative Framework relating to Water Management 25

South Australia has several water related laws containing specific objectives for water resource management that aim to meet the national objectives of improving water quality and sustainable water use. These include:

- Water Resources Act 1997
- Development Act 1993
- Environment Protection Act 1993

The Water Resources Act 1997 establishes a system for the use and management of water

resources in South Australia, while ensuring the well being of the people of the State, meeting the needs of future generations and protecting ecosystems that depend on water resources.

The Act establishes a water resources planning and management hierarchy, of which the State Water Plan is the highest level. The State Water Plan provides the policy framework for water resource s management and use throughout the State. Other plans prepared under the Water Resources Act 1997, such as catchment management plans, water allocation plans and local water management plans, must be consistent with the State Water Plan.

The Development Act 1993 establishes a system for “development” planning and assessment. Under the Development Act 1993, the Planning Strategy guides the development of South Australia and provides direction on how land and resources are used in ways that are socially, economically and environmentally responsible. It also provides the basis for the development assessment policies in the State and sets priorities for State Government action. These policies are contained in Development Plans and they relate to the location, type and form of development.

The Development Act and Water Resources Act are linked, recognising their different roles and their interdependencies in the protection and on-going management of our water resources.

The Environment Protection Act 1993 governs environment protection relating to the effects on land, air and water. The Act promotes principles of ecologically sustainable development, providing an on-going monitoring and management function for actions and activities which may effect the environment.

A recent initiative under the Environment Protection Act is the establishment of ‘Environment Protection Water Quality Policies’ to protect all of South Australia’s waters. Such a policy seeks to:

- Improve the management of wastewaters produced as a result of industrial, agricultural and domestic processes and seeks to protect all water systems from pollution
- Sets up a waste hierarchy, encouraging avoidance through to recycling and reuse of wastewaters.

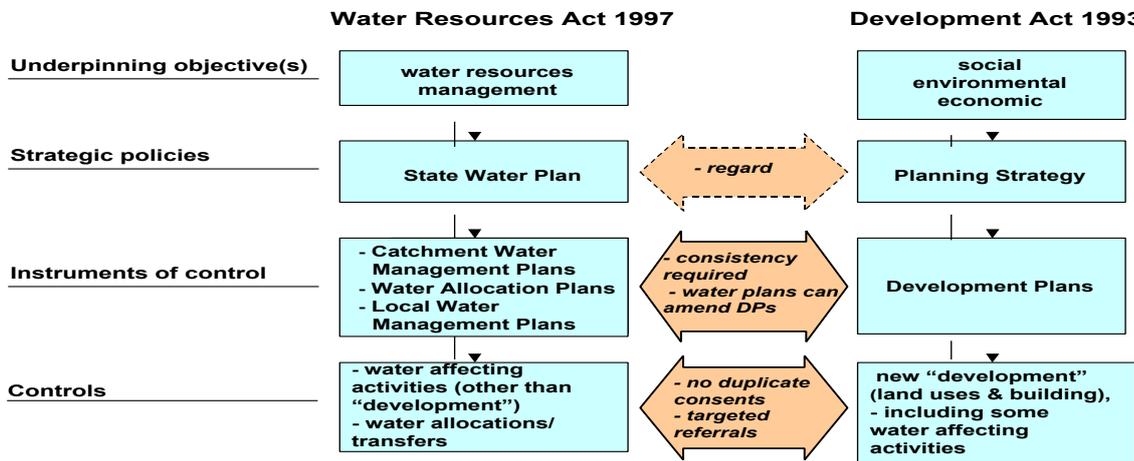
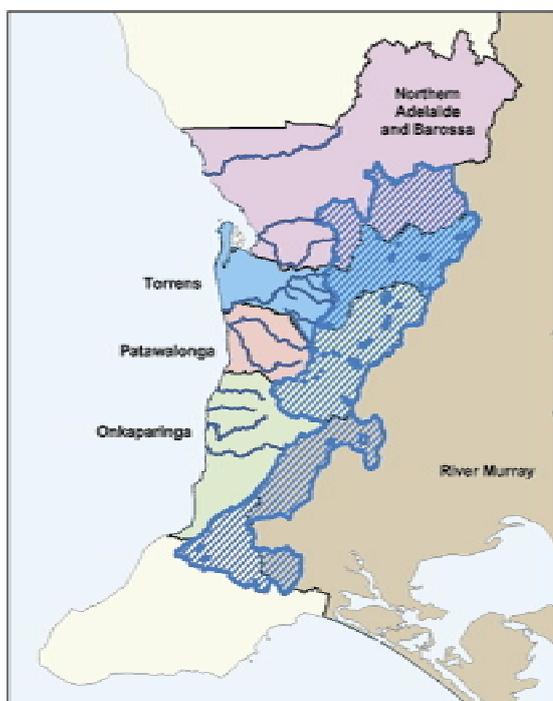


Figure 2: Water Resources Act & Development Act Linkages

Water Management Structures

Catchment Water Management Boards

The Water Resources Act 1997 provides for the establishment of Catchment Water Management Boards whose management boundaries reflect the catchment of river/creek systems. Such Boards are established to provide a coordinated approach to water management across an entire catchment. They generally cross over local government boundaries, working closely with the local government authorities within their catchments.



An important function of a Catchment Board is to develop catchment water management plans. A catchment water management plan generally aims to:

- Improve and enhance local ecology.
- Improve water quality.
- Achieve sustainable water use.
- Involve the community.

The activities of the Boards, both in establishing and implementing catchment water management

plans, are funded through a water catchment levee imposed on individual properties throughout the catchment.

Natural Resource Management Reform

The Government of South Australia is currently preparing a Natural Resource Management Policy. The Policy is intended to integrate existing institutional arrangements and provide a framework to enhance the management of South Australia's natural resources at both the State and Regional levels.

This arrangement will bring together:

- Water management and water allocation plans
- Soil conservation and management issues
- Animal and plant control matters
- Development and implementation of native vegetation, re-vegetation and biodiversity plans
- Establishment and support for 'Friends of Catchment' groups
- Salinity management

To progress this reform, the Minister for Environment and Conservation has formed a Natural Resource Management Council for the State. The Council will take a primary role in working with regionally based natural resource management groups to determine the most appropriate arrangements for NRM in regional areas of South Australia. The Council will also provide advice to the Minister regarding the implementation of the proposed new NRM institutional arrangements at both State and regional levels.

It is proposed that local government will be an important partner in ensuring sound NRM outcomes. Local government will be involved at each tier of the framework (State, regional and local levels) and would continue to have a significant role in integrating NRM with land use and development planning and decision making and delivery of on-ground programs.

Public – Private Partnerships

In 1995, SA Water changed from a Government Department to a business oriented Corporation

providing a more rigorous commercial focus for its institutional framework.

SA Water is a Corporation which owns, manages and operates South Australia's public water supplies and the collection, treatment and disposal of sewerage. The Government requires SA Water to:

- Develop and commercialise leading water and related services, including technology solutions
- Assist in promoting economic development in South Australia
- Manage the assets of the Corporation and provide agreed returns to Government
- Optimise the value of the Corporation while achieving other key requirements of Government

SA Water takes responsibility for water once it has entered its reservoirs and following its treatment and distribution. It has a duty to ensure that the reticulated water supplied to its customers is safe and suitable for drinking. Therefore, one of the Corporation's primary objectives is the challenge of ensuring South Australia's water and wastewater services are operated in a manner that provides continuous high-quality supply, which protects the health of the public and minimises environmental impacts.

SA Water is wholly owned by the Government of South Australia however in 1995 it entered into innovative and highly successful outsourcing contracts with international water industry companies.

On 1 January 1996, United Water commenced a 15 year contract to manage, operate and maintain SA Water's metropolitan water and wastewater systems. The State retains ownership of the assets and SA Water maintains overall management responsibility for the water and sewerage systems.

United Water is required to meet stringent performance targets covering such areas as treated water quality, customer service and

emergency response times as part of the contract.

Key Planning Initiatives Affecting Water Management

Key planning initiatives introduced in South Australia are best described under the following:

- Establishing the strategic policy directions
- Ensuring the provision of sustainable water resources
- Developing water use reduction strategies
- Protecting the River Murray – our 'life line'

Establishing the strategic policy directions

Three key State level strategic policy documents have been prepared:

- The Planning Strategy
- The State Water Plan
- Water Proofing Adelaide

The Planning Strategy

The Planning Strategy, prepared as a requirement of the Development Act 1993, presents State Government policy for development. In particular, it seeks to guide and coordinate State Government activity in construction and the provision of services and infrastructure which influence the development of South Australia. It also indicates directions for future development to the community, the private sector and local government.

In relation to water management, the Planning Strategy seeks to:

- Manage water resource for metropolitan Adelaide in an ecologically sustainable way.
- Protect the catchments of the Mount Lofty Ranges from inappropriate development.
- Restore water quality through the development of Catchment Plans.
- Establish integrated stormwater management systems within catchments.
- Restore creek systems to increase environmental values.

- Reduce the discharge of treated sewerage effluent on to the marine environment.
- Encourage the reuse of and onsite disposal of stormwater.
- Manage the metropolitan beaches to ensure coast protection, recreation, conservation and tourism.
- Protect and enhance the Hills Face Zone (backdrop to Adelaide) and Metropolitan open space.



The State Water Plan

The State Water Plan, established under the Water Resources Act 1997, provides the policy framework for water resources management and use throughout the State.

The State Water Plan sets out the strategic directions for the sustainable use and management of our water resources and provides a comprehensive assessment of their current use and health. Specifically, the Plan:

- Sets out policies for achieving the object of the Water Resources Act.
- Assesses the state and condition of water resources in the State.
- Identifies existing and future risks of damage to, or degradation of, our water resources.
- Sets out proposals for the use and management of water resources.
- Assesses the monitoring of changes in the state and condition of water resources – including proposals for monitoring future change.

Water Proofing Adelaide

‘Water Proofing Adelaide’ is a major study which has recently been initiated by the South Australian State Government to develop a long term ‘evolutionary blueprint’ for the effective management and sustainable use of all of the major water resources available to Adelaide and adjacent catchment areas. It will establish the strategic directions, requirements and resources needed to advance the solution for providing a sustainable water supply to Adelaide through to 2025.

The focus of the study is to better utilise the whole of the water cycle – reducing Adelaide’s reliance on the River Murray. This includes expanding opportunities for reuse of treated wastewater and collection and reuse of stormwater.

Ensuring the provision of sustainable water resources

From catchment to the coast, initiatives are being taken to achieve greater sustainability in our water resources by:

- Establishment of an **Urban Containment Boundary** around Metropolitan Adelaide to



protect environmentally sensitive/economic important areas of the State (ie the Adelaide Hills, Willunga basin, Virginia market gardens and Barossa Valley) and reducing the costs of new infrastructure headworks.

- Developing new **urban wetlands** to control stormwater flow, improve water quality, provide biodiversity habitats and improve the appearance of urban environments.



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- **Protection and enhancement of the catchment** by the establishment of the Watershed, a zone where certain land use activities are restricted, where native vegetation is protected, and where development opportunities are limited.
- Better utilising **urban stormwater** and taking action to mitigate flooding potential.

- Utilising **underground aquifers for the storage and recovery** of excess stormwater.



- Protecting and enhancing **coastal environments** through improvements to water quality flow in creeks and river systems discharging into the Gulf St Vincent, protection of remnant coastal dune systems and improvements to the quality of effluent disposal from waste water treatment plants.



Developing water use reduction strategies

A number of water reduction strategies have been developed for Metropolitan Adelaide. These include:

- **Community education**, raising awareness of the need to reduce our water supply uptake, best practice demonstration sites, establishment of Water Watch groups and other community based water management groups.
- **Pricing policies** for the provision of water supply.
- **Regulatory measures** including controlling the efficiency of household appliances (ie dual flush toilet sistens, low shower roses), mandatory provision of water tanks, etc.
- **Re-use of treated waste** water for agricultural purposes from the Bolivar Sewerage Treatment Plant and development of **'Grey water' reuse schemes** for new urban developments

Protecting the River Murray – our 'life line'

Protection of the quality and flow of the River Murray is vital for the on-going economic development and environmental sustainability of this State. All levels of government, Catchment Management Authorities, the private sector and the community are taking action to address problems of over-development, inappropriate land uses and activities within the catchment,

ensuring environmental flows are being maintained, protecting biodiversity, etc.

Separate State legislation is currently being prepared to protect the River Murray.

Concluding Observations

The framework has been established, a hierarchy of plans is being developed. Strong links have been established between the State's water and planning systems.

The State Water Plan encourages a 'holistic management approach to water'. Lower order plans and implementation strategies are under preparation.

The challenges for water management in Adelaide (and for South Australia as a whole) relate to:

- The on-going protection of our water assets.
- Further development of water reduction and re-use strategies (to reduce our reliance on the River Murray).
- Increasing water use efficiency through education, physical measures and economic instruments (ie pricing policies).

'Water Proofing Adelaide' will provide the appropriate framework for the effective management and sustainable use of such water resources.

The challenge for South Australia's outsourced metropolitan water and wastewater delivery system is for SA Water to manage our State's water assets in a sustainable manner and to ensure that United Water meets the stringent performance targets established in its contract. ■





The Adelaide Contract: the Contribution of Outsourcing to Sustainability

Mr. Philippe Laval

Managing Director, United Water

Introduction

In the early to mid 1990's, the Government of South Australia adopted a very proactive and rather innovative strategy to reshape its water industry. The Engineering and Water supply department was abolished in 1995 and SA Water was formed to take over its functions. In 1995, the operation and maintenance of water and wastewater services in the Adelaide metropolitan area were outsourced to United Water, a consortium between Vivendi Water, Thames Water and Kinhill. The contract became effective on 1st January 1996, with the assets remaining the property of the State through SA Water.

As part of its contractual obligations, United Water was also required to play a key role in the development of the State Water Industry and in promoting an extensive research and development programme.

The partnership built with SA Water over the last 8 years has brought together the private and public sector, combining world class expertise

in water and waste water management with local knowledge and appropriate contractual arrangements to achieve the effective delivery of sustainable water services.

This paper reviews the benefits derived by the State of South Australia from the outsourcing contract and the essential role played by United Water in reducing operation and capital costs, improving services to customers, reducing the impact of operations on the environment, and generally contributing towards greater sustainability.



Fig 1: Adelaide, the River Torrens



Background

The Process for Contracting out

In early 1994, the South Australian Commission of Audit made a series of recommendations to improve the performance of the then “Engineering and Water Supply Department (E&WS)”. The South Australian Government substantially endorsed the recommendations by the Commission and in particular that:

- The E&WS should be corporatised; and
- Metropolitan Adelaide water and wastewater operations should be contracted out.

The Government set two clear strategic objectives in seeking proposals for contracting out water and wastewater services for the Adelaide metropolitan area, being:

- The introduction of international best practice water and waste water services in Adelaide and substantial cost savings for South Australia, and
- Substantial economic growth in South Australia through the development of a viable export orientated private sector water industry

The qualification process to short list proponents commenced in November 1994 with hand over of operations to the successful contractor scheduled for 1 January 1996.

Three principal criteria were established for qualifying and short listing proponents. These stated that proponents should:

- Be physically and financially large on a world scale, having regard to the size, scope and complexity of the outsourcing project;
- Have demonstrated successful operation overseas in projects of similar scale and scope to minimise the risk for South Australia;
- Have a substantial and successful presence in infrastructure markets in the Asian and Pacific

region to maximise opportunities for South Australian exports.

Following a comprehensive global search for suitable companies, four international companies were short-listed and invited to participate in the contractor selection process. Having regard to the complexity of the project and the desire for innovation in relation to both operations and maintenance and economic development, a request for proposal process was adopted rather than a conventional tender process.

The request for proposal process differed in two major ways from a request for tender:

- The request for proposal document was less prescriptive. It was written with the view to provide the proponents with the greatest possible opportunities for submitting innovative proposals to meet the objectives of the project
- The contract was not awarded on the basis of the initial proposal. Evaluation of the initial proposals was followed by an intensive period of clarification and parallel negotiations to ensure that the best outcome would be achieved.

The request for proposal document was issued on the first of May 1995. There followed a 14 week period for the preparation of proposals during which the proponents were required to carry out due diligence. Final proposals were submitted in August 1995.

As part of the tender process for the Adelaide outsourcing contract in 1995, United Water International was established with two principal shareholders. Vivendi Water and Thames Water, hold 47.5% each, and Kinhill (KBR / Halliburton) has a shareholding of 5%.

Vivendi Water is the world’s largest water company, providing water and waste water services to over 110 million people in more than 50 countries.

Thames Water is the world's third largest Water Company and the biggest in the UK, providing services to over 30 million customers and represented internationally in more than 20 countries.

Kinhill, now owned by the global engineering company, Halliburton, is recognised as a leader in engineering, planning and project construction management throughout Australia, Asia and the Pacific.

On 17th October 1995, United Water was announced as the preferred proponent for the final negotiations. The contract was signed on 18 December 1995.

The contract period was for 15.5 years ending on 30th June 2010.

Two fundamental aspects of the relationship between SA Water and United Water were incorporated in the contract:

- United Water was required to manage, operate and maintain Adelaide water and waste water systems for SA Water. SA Water would continue to retain ownership of all infrastructure assets managed by United Water, set service standards, and implement the government pricing policy. As the asset owner, SA Water maintains control of all asset investment decisions for rehabilitation, renewal and infrastructure augmentation. SA Water also exercises responsibility for management, operation and maintenance of country water supplies and waste water systems; raw water supply to metropolitan and country regions; long term infrastructure planning; and customer services, including billing and revenue collection.
- United Water was required to lead the development of the South Australian Water Industry.

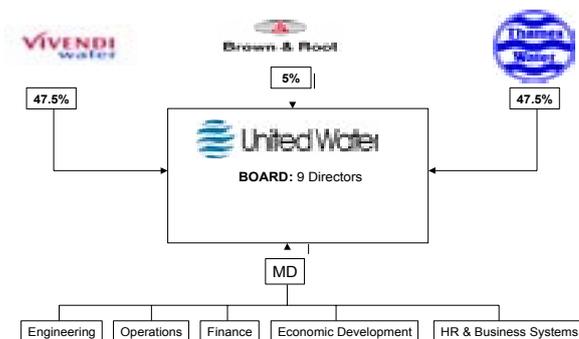


Fig 2: United Water structure

SA Water and United Water worked closely together during the transition phase from mid October to the end of December 1995 to enable hand over of the operations on 1st January 1996 as planned. During this time, transfer of nearly 400 employees and minor plant / equipment from SA Water to United Water was effected.

A seamless transition was achieved on that date.

Operations and Maintenance Requirements

Scope of services

The scope of the project embraces management, operations and maintenance of metropolitan Adelaide's water treatment, water network, wastewater network and wastewater treatment and disposal systems within the geographical area of metropolitan Adelaide. This area covers approximately 1.1 million people.

The scope also includes management, operations and maintenance of all upgrades, replacements and additions to the managed assets during the contract term. United Water is responsible for developing and managing the capital works program for works within the contract area, including design and project management for the delivery of these capital works. The capital works program is approved and funded by SA Water.

The following map shows the area currently operated by United Water.



Fig 3: United Water contract area for metropolitan Adelaide

Performance Standards

The contract specifies 180 individual standards of performance that must be achieved by United Water on a continuing basis throughout the life of the contract.

The standards relate to treated water and wastewater quality, water pressure and flow and response to customer problems such as bursts, overflows, sewer chokes, and odours. All standards are higher than those achieved by SA Water prior to the commencement of the contract.

United Water's performance is measured and reported on a regular basis. Substantial financial penalties are applicable under the contract on an annual basis if United Water fails to meet these standards. These penalties are calculated using

a formula that takes into account the seriousness and criticality of each failure and the number of times particular failures occur.

The standards are summarised in the table below.

Asset type	Number in asset grouping	Performance categories	Performance criteria	Number of performance criteria
Water treatment plants	6 plants	11	13	78
Water network	1 network	14	39	39
Waste water network	6 sub-network	3	4	24
Waste water plants	1 network	5	21	21
- Bolivar	1 plant	3	4	4
- Others	3 plants	3	5	15
Total		39	86	181

The contract requires United Water to perform all services in accordance with good operating, design and construction practices. The terms are defined in the contract and include the requirement that United Water obtain quality assurance certification.

United Water is also required to use best practices to improve service continuously throughout the term of 15.5 years but without detracting from the primary objectives of cost savings. These best practices are drawn from Vivendi Water and Thames expertise with the purpose of making Adelaide a showcase for efficient operations.



Fig 4: Anstey Hill Water Treatment Plant

Asset Management

As part of the contract requirement, United Water is required to produce detailed Asset Management Plans for consideration by SA Water. Major emphasis is placed on getting the right balance between maintenance and capital expenditure and all assets are subject to regular review for condition and serviceability. All projects proposed in the plan are subject to whole of life costing in order to demonstrate the financial benefits of capital expenditure against maintenance.

United Water prepares 1 year, 5 year and 25 year Asset Management Plans covering the following categories: replacement / rehabilitation, environment, growth, water quality, safety, business improvements.

The plan is developed in consultation with SA Water, and finally validated by SA Water who may decide to vary the plan depending on available funding and spending priorities.

Capital Works Management

All decisions and approvals regarding the allocation of capital funds for asset rehabilitation, renewal and augmentation remain with SA Water. United Water manages the capital program in accordance with capital plans approved by SA Water.

United Water prepares designs and tender documentation in consultation with SA Water and individual capital works contracts are competitively tendered. As project manager, United Water manages approved contracts on behalf of SA Water and is responsible for ensuring that projects are completed on time and within budget.

Environmental Management

United Water is required to operate the water and wastewater treatment plants in accordance with

the EPA licence conditions, as negotiated by SA Water.

United Water prepares, implements, and updates environmental management plans that comply with applicable laws and best environmental management practices on an annual basis. United Water (with SA Water input) also prepares and manages programs to control and minimise odour and wastewater overflows problems.

Compliance with these programs is subject to SA Water audit.

Pricing

There are 3 key elements to the price structure:

- An annual lump sum to cover general management functions, defined operating functions, some maintenance costs, corporate overhead, and profit;
- Reimbursable costs (primarily maintenance related costs and consumables) which are to be reimbursed by SA Water. Annual target levels for these costs have been set and savings or overruns of these costs are shared between United Water and SA Water. The annual target is set as the rolling average of the previous 3 years;
- Other fixed rate or variable charges for design, project management services and contract management of capital works and construction of minor extensions and connections to the network systems.

The contract includes provisions for price redetermination every 5 years to take account of changing operating conditions.

Economic Development Requirements

As part of its contractual obligations, United Water is required to lead and facilitate the development of a viable, export focussed, vigorous water industry in South Australia.

Performance is measured by the growth in exports overtime.



United Water has made contractual commitments which include:

- A\$628m of net exports from South Australia to interstate and overseas over the first 10 years of the contract;
- using its best endeavours, to achieve an additional A\$852m of net exports over the first 10 years of the contract.

This commitment is met by operating as a service provider and as a facilitator for the marketing of services and equipment provided by South Australian companies.

As a facilitator, United Water has worked with water industry businesses, and provided support to develop and grow business opportunities for the water industry locally, nationally and internationally.

United Water has played a vital role in establishing the Water Industry Alliance, a collaborative initiative aimed at supporting and nurturing the cluster of businesses which are developing the water industry in South Australia.

Benefits to water industry include:

- Access to market information and opportunities;
- Assistance in the formation of strategic alliances to approach those opportunities; and
- Access to relevant education, training and awareness programs

38 This collaborative “Cluster Process” is a vital component in the development of a self-sustaining, export oriented, private sector water industry in South Australia.

Experience to Date

Costs and Operational Performance

The cost reduction objective was met immediately upon contract commencement with United Water’s costs of operations dropping by an

estimated 20% when compared to SA Water’s historical costs. This represents over the term of the contract, a saving for SA Water and the public of South Australia in excess of \$160 million.

In addition, a large proportion of United Water’s remuneration (reimbursables) includes an incentive mechanism whereby additional efficiencies are shared equally between United Water and SA Water, thus creating a “win-win” environment.

As explained in a previous section, a key element of the contract concentrates on specific performance criteria to be met by United Water in relation to both water and wastewater effluent quality and customer services. These standards are supported by on-going reports and regular audits and have been the subject of further development over the term of the contract to keep pace with changes in public health, environmental and community standards and improvements in technology.

United Water has achieved more than 99% of the 180 discrete performance standards set as part of the operation. The meeting of these criteria by United Water currently provides the community with a level of service never experienced before.

For example, a significant improvement has been made in the microbiological quality of the drinking water delivered to customer taps, with performance rising from below 90% in 1995 to more than 99%.

The following graph shows the reduction in turbidity leaving the Water Plants since operations started.

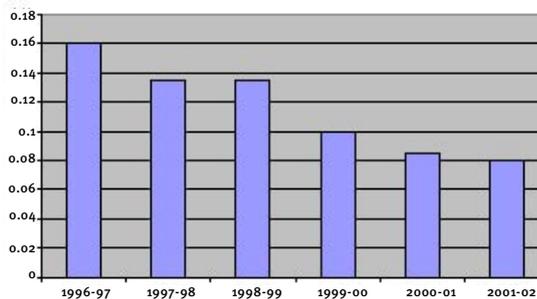


Fig 5: Average Turbidity of Water leaving the plants

Similar improvements have been made on the operation and maintenance of the water network as illustrated by Fig 6:

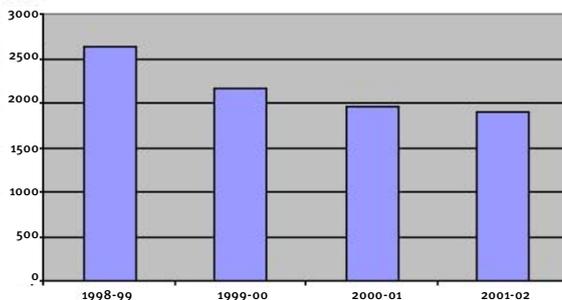


Fig 6: Reduction in burst water mains

In terms of services, the contract sets response times for meeting both customers needs and responding to emergencies which are significantly more onerous than before. Last year, we responded to over 100,000 calls, of which approximately 80% required a United Water team to attend on site. Of those, more than 99% were attended to within the time specified in our contract.

By August 1998, United Water had successfully obtained accreditation under the International Quality Standard ISO 9000 series for all water and wastewater operations, and environmental standard ISO 14001 for the operations of all the wastewater treatment plants.

Operational performance has had also clear benefits on the environment, including a significant reduction in the number of environmental incidents, in the number of chokes and overflows, and in the pollution discharged to the environment. This last point was the result of the combination of efficient operation and upgrading of all wastewater plants.

The following graph illustrates the reduction in Nitrogen discharged to the environment over the last 6 years, resulting from improved operation (up to 2001) and upgrade of the wastewater plants (2001-02).

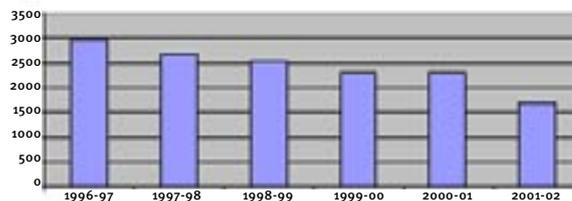


Fig 7: Nitrogen Discharge (T/annum)

The following graph shows the reduction in sewer connection chokes over the last 4 years.

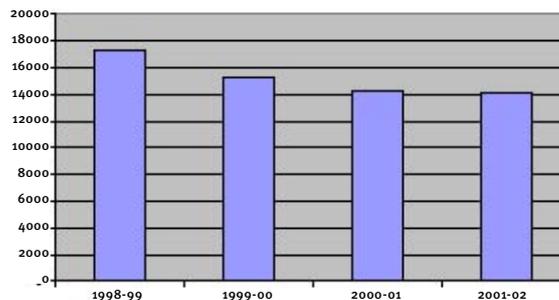


Fig 8: Reduction in connection chokes

Employees

Perhaps the most significant achievement in the young life of United Water was the successful transfer of 400 employees from the public sector to the private sector. The transition was seamless and no impact on the service provided to customers was experienced.

A true culture has been developed within United Water, supported and facilitated by a proactive human resource strategy. Family friendly policies were introduced in the 2001 Enterprise Bargaining Agreement including 6 weeks paid maternity leave, 46 weeks unpaid leave, the establishment of a sick leave bank, and a number of other policies.

In 2002, United Water participated in a work / life balance benchmarking study which examined 195 Australian companies and the balance they provided for their employees between work and family life. United Water was ranked 21st and one of only two utilities ranked in the survey.



The company is also committed to providing employment opportunities for South Australian graduates. A total of 21 graduates have been recruited since the company started operations. A graduate development program has been established, providing opportunities for rotation throughout the organisation and for overseas assignment to Thames Water and Vivendi Water. Several of these graduates are now in management positions within United Water.

It is also significant to note that there has been no time lost due to industrial actions since operations started.



Fig 9: Operation of a jet rodder by United Water

Public Perception

All surveys show that customers are generally very satisfied with water and wastewater services in metropolitan Adelaide and results have gradually improved since United Water started operations.

The following graphs show the results of the customer surveys carried out by United Water in the last 4 years. All surveys are carried out by an external company using approved statistical methodology.

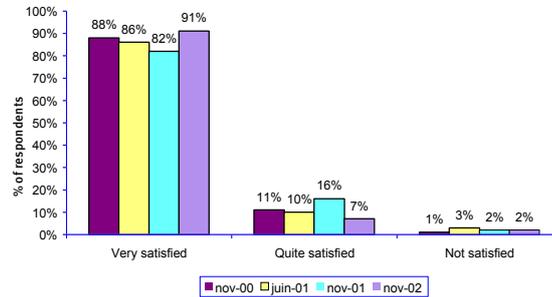


Fig 10: Overall telephone service provided Over Last 4 Surveys

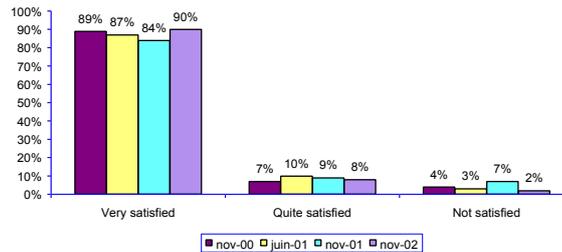


Fig 11: Overall service provided by the Grew Over Last 4 Surveys

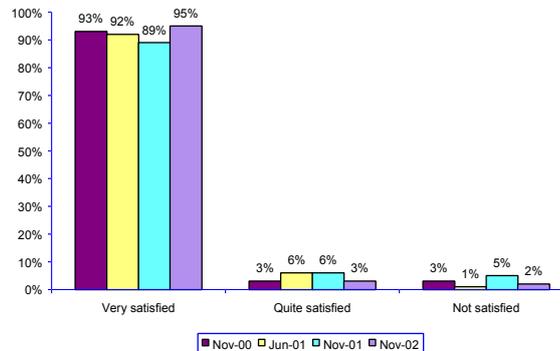


Fig 12: Professionalism of the Grew Over Last 4 Surveys

However, despite these excellent results, a large part of the community still believes that SA Water's assets have been privatised and sold to United Water. This may be due to the broad scale of the outsourcing contract which has made activity very visible to the public and the level of relative misinformation carried out by the media.

The concept of private sector involvement in the provision of water and waste water services was relatively new to Australia in 1996, and the Adelaide contract remains unique in its current form.

Water Industry Development

Leading the development of the local Water Industry was one of the most challenging objectives assigned to United Water in the contract. The Asian economic crisis which followed 1996, made this obligation ever more difficult to meet, reducing potential for exports from South Australia.

United Water's achievements today, are acknowledged as one the most significant in the economic history of South Australia.

Export orders for South Australian services and goods have increased from some \$20m in 1995 to more than \$329m in 2001. This is in excess of United Water contractual target by \$100m. The following graph shows the actual net exports as measured against the contractual obligation.

The Water Industry Alliance was formed in 1998 under United Water leadership. It grew out of an industry cluster group comprising large and small South Australian companies, United Water and public enterprise stakeholders including SA Water and the SA Centre for manufacturing, part of the SA Department for Industry and Trade.

The Alliance became an incorporated body in July 1998 and was charged with providing commercial support to its members. More than 160 companies are now part of the Water Industry Alliance.

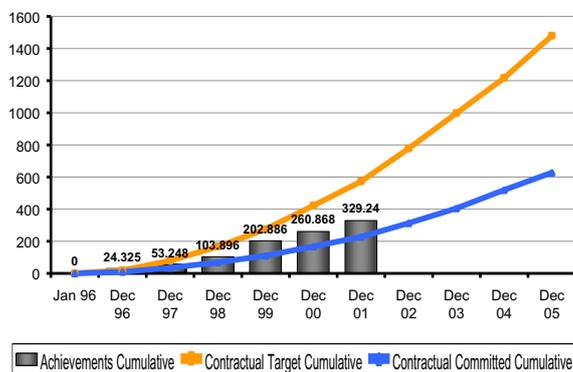


Fig 13: Actual net exports against contractual targets

Whilst this initiative has been very successful in the last 5 years in spite of the Asian crisis, it must be recognised that the contractual arrangements may place undue risk on the contractor.

United Water is clearly able to support local companies and facilitate contacts for overseas markets through its parents, Thames and Vivendi Water. United Water may however not have the required expertise to provide the most effective advices on competitiveness or marketing. Managing water and waste water services is a very different business indeed to that of manufacturing.

Research and Development

The benefits of establishing geographically dispersed Research and Development centres are increasingly recognised by global companies. Through its parent companies, United Water has implemented this approach in Australia with the establishment of a joint research and development node in Adelaide.

The original R&D node concept relied on the commitment of parent companies to relocate specific business driven research projects based on warm weather climate technologies. Through this node, United Water is contractually committed to facilitate a minimum of \$50m of research activity throughout the 15.5 year contract duration.

Since operations started, United water has invested in significant projects including filter optimisation studies, aquifer storage and recovery using effluents, the use of ozone and carbon to control algal taste, toxins and odours and membrane treatment. Many partnerships have also been implemented with universities and research organisations.

Several research programs are underway to investigate water quality improvements. In particular international parent company links have been instrumental in funding and establishing a joint AWWARF (US), AWQC and United Water

project studying the destruction of algal toxins by ozone/GAC. This is a key emerging scientific issue for Australia and a very important one for the future reliability of treatment processes.

SAWater's Environmental Improvement Program (EIP) includes upgrading metropolitan Adelaide's wastewater treatment plants to achieve more stringent discharge standards. This provided the platform to transfer parent company expertise in real-time monitoring, to biological nutrient removal pilot plants at Bolivar, Glenelg and Christies Beach Wastewater Treatment Plants.

Aquifer Storage and Recovery (ASR)

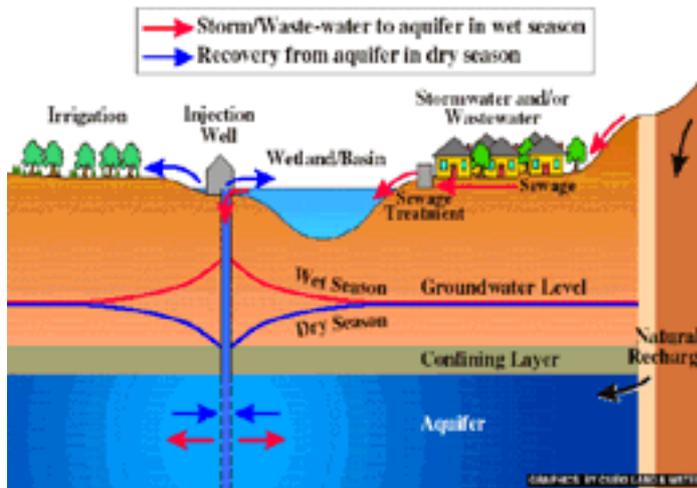


Fig 15: Principles of Aquifer Storage Recovery

In addition, United Water designed and project managed the successful introduction of a 120ML/day Dissolved Air Flotation and Filtration plant at Bolivar to provide

research agencies, with United Water contributing to a \$3 million Aquifer Storage and Recover (ASR) research project using treated effluent from the Bolivar Wastewater Treatment Plant. This project will showcase Australia's capability in sustainable management of water resources.



Fig 14: The DAFF plant at Bolivar

reuse facilities to the associated Virginia Pipeline Irrigation Scheme in the North Adelaide Plains. This award-winning project is the direct result of United Water's ability to transfer parent company expertise into South Australia.

Another significant area of collaboration has been the establishment of a research consortium across South Australia's government and



Fig 16: Sprinkler system for reuse

Recent and Future Initiatives to Contribute to Sustainability

Integrated Water Resource Management is recognised as the only sustainable solution to meet increasing water demand whilst preserving the environment. Fresh water is finite, vulnerable, and essential to sustain life, economic development and the Environment.

The most effective water development and management requires a participatory approach involving users, planners, policy makers, operators, public and private sectors.

The initial objectives of the outsourcing contract were to attract international expertise to Adelaide and to promote the development of the South Australian Water Industry. These objectives have been met beyond expectations by United Water. The partnership with SA Water has been extremely effective in delivering value to South Australia through lower costs, improved standard of service, innovation and economic development.

It is believed that these achievements provide the platform for future sustainability.

South Australia faces new challenges, and in particular it needs to plan ahead to ensure that resources will be available to meet demand in the next 5, 10, 20 years and beyond. The deterioration of the river Murray needs to be included in this strategy as it may not be a sustainable resource for future generations.

Additional resources will be mostly derived from existing available resources such as stormwater and treated effluent. South Australia has been leading the industry on sustainable reuse projects and some of the most significant projects have been implemented in Adelaide. SA Water's target is to achieve a 30% effluent reuse ratio by 2005 and 50% in the long term, a significant step from the current level of 15%.

This is a challenging but achievable target. It will require technical innovation, good planning and effective management. The effective partnership built between SA Water and United Water provide sound foundations to move forward and make metropolitan Adelaide a show case for best practice in reuse.

Research and development will continue to provide the required expertise to undertake the next stage of the sustainability strategy. Key topics of international interest are currently being investigated, including aquifer storage recovery, desalination of effluent and the coordination and animation of the sustainable reuse network, bringing together Vivendi Water, Thames Water, their respective research entities and universities and public research organisations. The climatic conditions prevailing in South Australia, the driest state, and the current problem of the River Murray make it an ideal place to develop these expertises.

Water-Proofing Adelaide was launched by the Premier, Mike Rann, on 11th February 2003. The purpose of the study is to reduce the reliance on the River Murray as a resource to meet future water demand in the Adelaide metropolitan area, and to find innovative solutions to reuse part of the 130 gigalitres of stormwater and treated effluent discharged in the Gulf St Vincent every year.

As part of this initiative, SA Water and United Water have set up a working group to review opportunities for reuse of stormwater and treated effluent within the metropolitan Adelaide area, drawing on Vivendi Water and Thames Water expertise and references around the world.

As the basis for the study, it was established that there was significant demand within Adelaide and surrounding areas for water of non-potable standard. Such demand include those for irrigation, industrial and recreational uses.

11 projects have been identified ranging from reclamation of treated effluent from Glenelg



Waste Water Plants for irrigation of the parklands in the city, to reuse of stormwater to supply industrial sites in the southern part of Adelaide.

These 11 options are currently being evaluated financially and economically.

Conclusions

The South Australian water industry has been through a major restructuring in the last 10 years. This included the involvement of the private sector to provide water and waste water services in the Adelaide metropolitan area. The outsourcing contract let to United Water has resulted in significant improvements in the efficiency of water and wastewater services and better services to customers.

United Water has led the development of the local Water Industry and facilitated the creation of the Water Industry Alliance in 1998, regrouping more

than 160 companies. Overseas and interstate exports by South Australian companies have significantly increased as a result.

Technical innovation and the introduction of world best practices were paramount to United Water contractual obligations. This was delivered through the creation of the research and development department, a very significant node within the Thames Water and Vivendi Water research networks and the establishment of strong partnerships with local universities and research organisation.

Efficient water and waste water services, strong technical innovation with a particular focus on sustainability, and a very effective partnership built with SA Water, provide the demonstration that the outsourcing contract is very successful and delivers clear benefits to South Australia. It brings together private and public sector, combining world class expertise with local knowledge and appropriate contractual arrangement to achieve an effective delivery of sustainable water services. ■



Managing Adelaide's Water. The Role of the South Australian Water Corporation

Mr. Jack McKean

Head of Innovation & Business Development
SA Water Corporation

Introduction

The South Australian Water Corporation (SA Water) is a State Government owned corporation responsible for the provision of water and wastewater services to a population of around 1.4 million. The majority of the population reside in the urban area of Adelaide, the state capital, with around 400,000 people living in rural towns and communities spread across the state's 1,000,000 square kilometres.

This paper will review the organisational arrangements, which have been put in place to manage, operate and maintain the public water supply. This includes the role of other organisations, which either regulate or interface with SA Water in the overall hydrological cycle.

It also details the current water supply systems utilised by SA Water to provide water for domestic, industrial and irrigation purposes and outline some of the sustainability issues facing the organisation.

By way of example the paper discusses three current initiatives, which have been put in place to promote sustainable development whilst assisting in the economic development of the State of South Australia. The basis for the initiatives together with the structure of the associated pricing mechanisms is covered.

In addressing the sustainability issues of water supply and use SA Water recognises that it is still early days in the development of an overall solution and the next steps are likely to be incremental rather than a revolution. To this end SA Water has commenced a feasibility study to identify further opportunities for water cycle efficiency, working jointly with one of its key suppliers. This project together with a broader whole of Government initiative will be described.



The Management of Water Services

In 1994 the South Australian Government announced that it planned to Corporatise the then Engineering and Water Supply Department and also to outsource the operations and maintenance of Adelaide's water and wastewater treatment plants, and the sewerage and water networks. This would leave the corporatised entity, SA Water, to manage the outsourced contract and to operate and maintain the non-metropolitan assets.

The goals of the proposed outsourcing were to achieve:

- International best practice water and wastewater services in Adelaide and to achieve substantial cost savings for South Australia.
- Substantial economic growth in South Australia through the development of a viable export focussed private sector water industry in South Australia.

To achieve these goals a Request for Proposal was sent to four pre qualified international companies. In adopting the request for proposal approach the proponents are encouraged to be innovative in their offers and it also allows parallel negotiations with the proponents to illicit improvements to the initial submissions.

In October 1995 a consortium of Vivendi (formerly Compagnie Generale des Eaux), Thames Water and Kinhill Engineers were selected as preferred proponents and following further negotiations operations were handed over on 1 January 1996.

The partnership between the consortium, known as United Water, and SA Water has now been in operation for some six years over which time improvements in service delivery and capital project delivery have been achieved, together with significant economic benefits for the State.

The management of the water resources available for public water supply remains with SA Water,

which operates under water allocations given by the Department of Water, Land, Biodiversity and Conservation. However, the management of water catchments is quite complex with Local Councils, Catchment Management Boards, and the Environment Protection Agency all having either inputs or specific roles to play in the interfaces between land use and water quantity and quality.

The Environment Protection Agency is also responsible for the licensing of discharges to the water environment whether that is marine or freshwater.

The number of organisations involved in water management, all of whom have their own objectives, can cause confusion and delay in the implementation of projects and schemes, however the good working arrangements generated by the individuals involved has led to South Australia being able to develop some world class examples of the sustainable use of water.

The Water Supply Systems

SA Water basically has three major water source categories, Surface water, Groundwater and the River Murray, however developments in a fourth area, recycled water, have progressed in recent years. The following highlights the main issues relating to each of these categories.

Surface Water

The main surface water catchment areas are in the Mount Lofty Ranges, which form a natural watershed around the eastern side of Adelaide. Increasing urbanisation and changes to agricultural practices are adversely impacting both run-off volumes and quality. Whilst quality issues can be addressed through enhanced treatment facilities this adds to the cost of potable water.

The growing move from pasture or cereal crops to the more valuable areas of viticulture and olives in the MT Lofty Ranges is increasing the need for irrigation and has led to the growth in on farm storage of stormwater run-off. This stormwater has traditionally flowed into the Water supply reservoirs and reduced the reliance on the River Murray as a source of supply.

Further pressure on the quantity from local surface water catchments is coming from the proposals to provide environmental flows to Creeks and Rivers. Most of the streams and creeks in the Adelaide area are now significantly affected by both the construction of dams and reservoirs and also by urbanisation. In many cases the residual flows are not considered sufficient to maintain the health of the natural ecology. It is therefore proposed to develop schemes to return environmental flows to the affected watercourses, however it is still to be established as to how this water will be provided and who bears the cost of its provision.

Groundwater

Whilst South Australia has considerable groundwater resources, much of this water is of marginal quality, or located significant distances from current demands. In areas of significant groundwater use there are indications of increasing salinity, and in some cases high concentrations of iron and other compounds. Although these quality issues can be addressed by treatment processes, it will give rise to costs generally well in excess of the current market price of potable water.

In the key water resource areas for the city of Adelaide the use of groundwater is not strictly controlled, this has resulted in some areas seeing declining water tables, whilst in other places there is concern that irrigation has caused rising groundwater levels. These rising groundwater tables have also shown increasing salinities causing damage to infrastructure, property and agriculture.

The management of groundwater salinity and the effects of increased irrigation are one of the major challenges facing the organisations charged with water resource management in South Australia.

River Murray

The Murray-Darling Basin covers about 14% of the landmass of Australia and supports around two million Australian's. South Australia sits at the downstream end of the basin and includes the estuary for the River Murray.

The River Murray supplies water for irrigation, stock, industrial and domestic supplies in South Australia. Whilst SA Water's share of South Australia's total River Murray usage is relatively small (approximately 10% of the entitlement flow) fifteen of the states nineteen water supply systems get at least some water from the resource and hence the River is of vital importance to the water supplies for South Australia and Adelaide in particular.

The proportion of metropolitan Adelaide's supplies derived from the River Murray can vary between 35% in a wet year to 90% in a drought year such as 2002/03.

There is evidence that the River is in trouble. Poor water quality, loss of native plants, animals, fish, forest and wetlands, and an increase in pests such as carp are all pointing to a river in decline.

One of the main causes of the decline is the amount of water taken from the river system, both within South Australia and upstream throughout the Murray-Darling Basin. A key outcome of the abstraction from the river and the changing land use patterns within the basin is the increasing salinity of the water.

Salinity Management

A key aspect of the water supply systems serving South Australia is the maintenance of water quality in the River Murray. Between 1990 and the



year 2000 salinity levels at the key monitoring point of Morgan exceeded 800 EC units for 10% of the time. 800 EC is the World Health Organisations desirable limit for salinity in Drinking water supplies. If the activities within the Murray Darling basin continued unchanged it is estimated that by the year 2050 the 800 EC limit would be exceeded more than 50% of the time. In 1988 the then Engineering and Water Supply Department of South Australia, together with the Murray Darling Basin Commission commenced a salinity and drainage strategy with the aim of reducing the salinity at Morgan by 80 EC.

The strategy had the following elements:

- Salt interception schemes, large-scale groundwater pumping schemes to intercept, both natural and irrigation induced groundwater flows.
- River flow management, to provide more water to achieve dilution of saline inflows.
- Broad scale forestry and revegetation to reduce rainfall recharge of groundwater.
- Improved irrigation efficiency.
- Dry land farming practice changes to reduce recharge of groundwater.
- Conservation of existing native vegetation.

Salt interception schemes are seen as the initial primary defence against increasing salinity in the river as they can be implemented relatively quickly and are able to remain in operation for many decades. However, they are only buying time to allow the other, more permanent arms of the strategy to be implemented. The disposal of the saline groundwater from the interception schemes allows the salt to remain in the catchment and it will, after many decades, or maybe hundreds of years, return to the river by way of the groundwater system.

To date the schemes implemented have achieved a reduction of 53 EC compared with a target of 48.9 EC. In their initial stages the two main operating schemes removed 350 tonnes of salt per day from the river system, these schemes

have now reached an equilibrium state and are yielding around 35 tonnes per day.

The success of the original schemes has led to a further stage being commenced with an anticipated spend of \$60 million over 7 years and a target of a further reduction of 61 EC at Morgan.

These salt interception schemes are essential in the strategy of South Australia to achieve sustainable water use, as they maintain the input salinities to drinking water at acceptable limits and hence assist in ensuring that the salinities in re-use water derived from sewerage systems is also appropriate for irrigation purposes.

Virginia Scheme

The objective of the Virginia Pipeline Scheme is to create a commercially viable and economically sustainable project for the distribution of recycled water for irrigation of the Northern Adelaide Plains and potentially beyond.

The scheme provides an alternative outlet for effluent produced by Adelaide's largest Wastewater Treatment Plant located at Bolivar. The normal disposal route for effluent from the Bolivar Plant is by open channel to the marine environment of the Gulf St Vincent. There is some

Virginia Reuse Scheme



circumstantial evidence that the marine discharge of the nutrient rich effluent has caused some degradation to an area of some 1200 hectares of sea grasses and loss of density in the mangrove swamps in the area of the discharge.

A private consortium developed the Virginia Pipeline Scheme on behalf of the Virginia Irrigation Association. To enable the effluent from Bolivar Wastewater Plant to be used for irrigation of market Gardens it was necessary for SA Water to construct a \$30 million Dissolved Air Flotation Filtration Plant to treat the effluent to a standard, which met the requirements for recycled water. Under the terms of the agreement the whole scheme will return to the ownership of SA Water in 2019.

The scheme provides recycled water to approximately 250 irrigators who use about 15,000 Ml/annum, which is 30% of the Bolivar throughput. Further expansion of the scheme is dependant on two factors, firstly the development of further areas of agriculture/horticulture and the associated infrastructure and secondly on the ability to store winter flows from the wastewater plant.

To ensure that the irrigation of the agricultural land is sustainable an Irrigation management plan has been developed and responsibility for reporting against the plan lie with the consortium, which also has the supply contracts with the irrigators. The Virginia Irrigation Association has the responsibility for managing an education programme for growers in relation to the use of recycled water and the impact of the enhanced nutrient levels on soils and natural groundwater and also for monitoring the effects of the recycled water on the soils.

The overall responsibility for ensuring that all environmental legislation is complied with and for approving and reviewing the irrigation plans on an annual basis lies with the Environment Protection Agency.

The irrigators are charged for their water on a

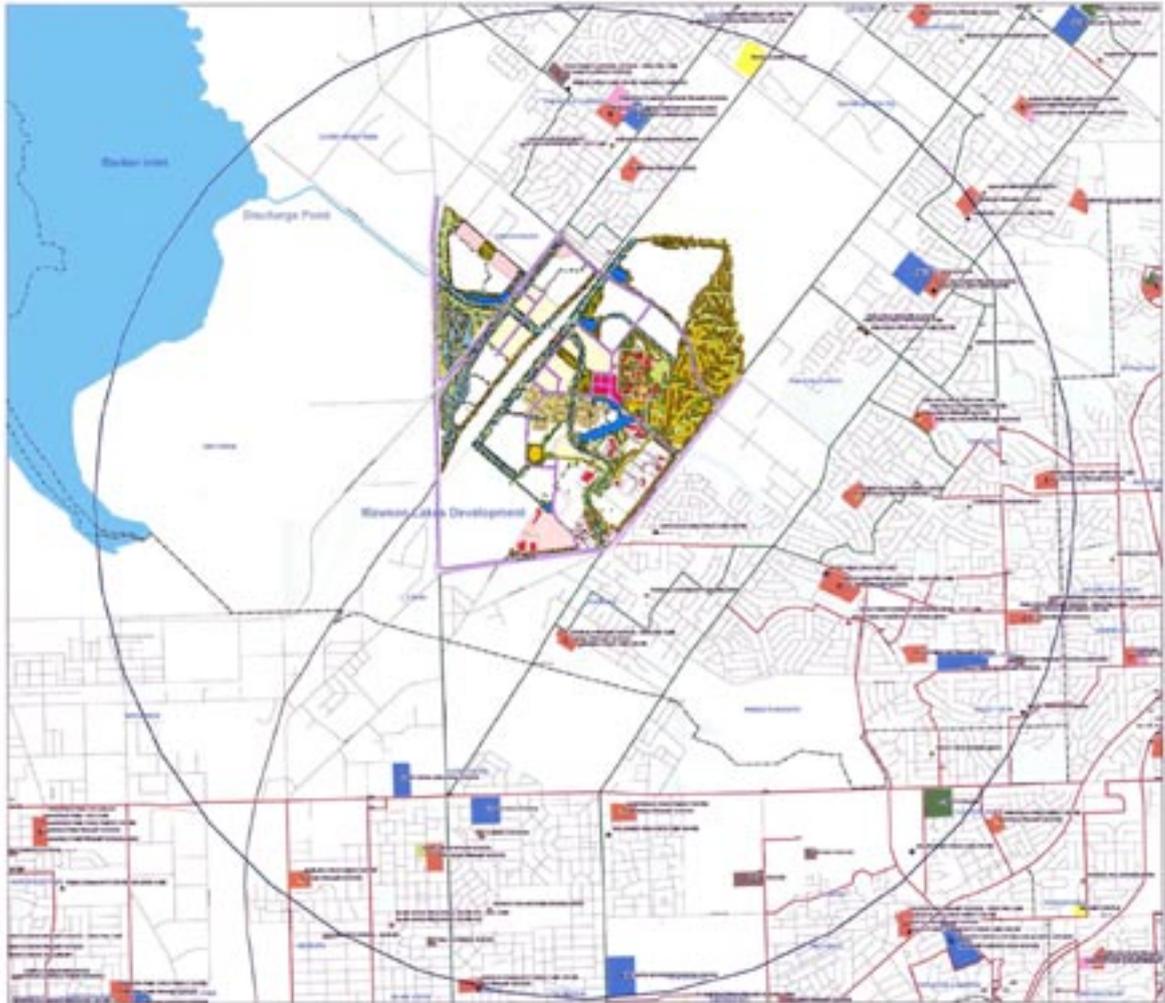


Brassica crop, which can be eaten raw, spray irrigated with Class A reclaimed water.

usage basis with a three-part tariff, which is related to the time of year at which they take their water. Summer water is charged at 11.02 cents per kilolitre, Autumn and Spring water at 8.7 cents per kilolitre and winter water at 5.8cents per kilolitre. In addition to these payments irrigators are required to pay an annual supply charge of around \$900 and to provide some on property storage. All of the contracts with the irrigators are on a take or pay basis.

Development of the Virginia reuse scheme has reduced the level of groundwater abstractions in the area from an estimated two to three times above the sustainable yield to close to the sustainable level. The reuse scheme has also assisted with the reduction of nutrients being discharged to the marine environment and combined with other improvements made in the treatment process will see around an 80% reduction in nitrogen discharged.





Mawson Lakes Locality Plan

Its vision is to secure the creation of:

- A model of conservation of the natural environment and resources
- A model of environmentally sustainable development
- A model of equitable social and economic development in an urban context
- A national focus for economic, scientific and technological development of international significance
- Leading centres of innovation in science, technology, education and the arts
- A focus for international investment in new and emerging technologies
- A model of productive interaction between industries and research and development, educational, community and other organisations and of the use of advanced information and communication systems for that purpose
- An international centre of innovation and excellence in urban development and the use of advanced science and technology to serve the community

Project Description

Mawson Lakes is a joint venture between the South Australian Government and Delfin Lend Lease Consortium (Mawson Lakes Economic Development Joint Venture). The joint venturers have contracted to implement the Mawson Lakes vision under the terms of a Commitment Deed.

The development is for 8,000 to 9,000 residents in 3,200 dwellings, and includes a town centre and commercial properties. It is integrated with the University of South Australia Levels Campus and Technology Park and will create 4,500 permanent jobs. One third of the total 620 ha site is to be open space. Completion of the development is scheduled for 2009.

A joint working group has been formed to discuss all issues relating to the provision of potable, and irrigation water together with sewerage and sewage treatment. The group have challenged many aspects of traditional design to enable a cost effective system to be constructed.

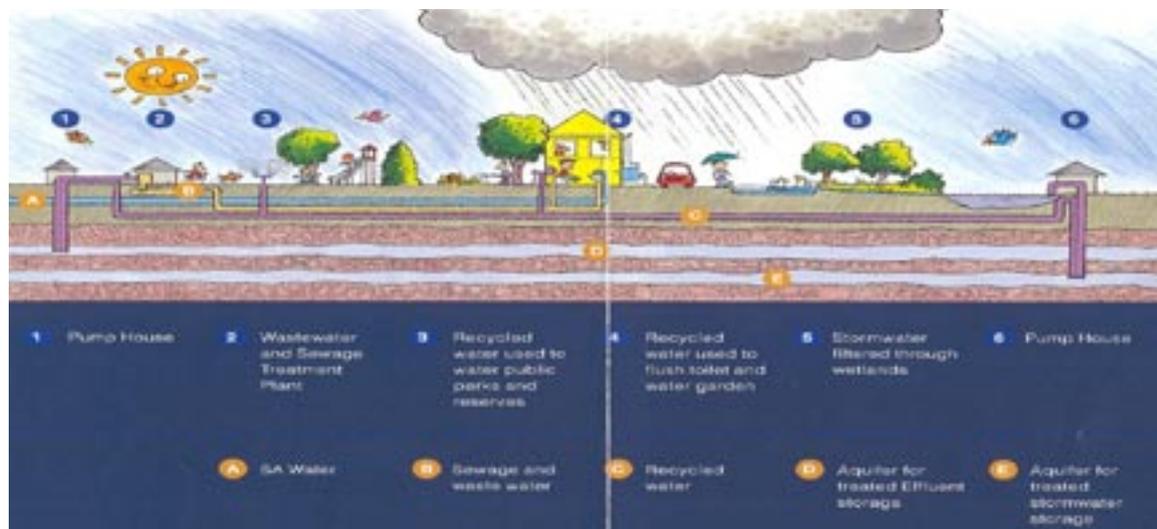
Water Cycle

A key component of the conservation and environmental objectives is to create a reclaimed water supply system that will reduce household potable demand by at least 50% by providing reclaimed stormwater and wastewater for outdoor domestic and municipal irrigation.

Stormwater and wastewater from the development is collected and treated to a high standard for distribution to houses and parks as reclaimed water. Stormwater runoff from roofs, paths, roads and the general area is harvested and treated in wetlands prior to storage in groundwater aquifers for reuse. Wastewater from the sewerage system is treated in a wastewater treatment plant and also stored in groundwater aquifers for reuse.

Houses have potable mains water connection and a reclaimed water connection. The reclaimed water is used for toilet flushing, garden watering and car washing. Public open space is also irrigated with reclaimed water.

The Mawson Lakes Water Cycle Management System demonstrates a holistic approach to urban water recycling involving stormwater harvesting, stormwater renovation in wetlands, wastewater reclamation, aquifer storage and recovery systems, and the use of reclaimed water by households for non-potable requirements and for irrigation of open spaces. The integrated system forms an educational focus on the urban water cycle for primary and secondary schools, universities, technical colleges and the community.



Wastewater Treatment Plant

The existing SA Water Bolivar Wastewater Treatment and Dissolved Air Flotation and Filtration (DAFF) plants are to be utilised to produce reclaimed water to Class A quality as defined under the South Australian Reclaimed Water Guidelines (Treated Effluent). It will also meet requirements for discharge to an aquifer storage and recovery system. Secondary treatment (activated sludge) occurs in the wastewater treatment plant while tertiary treatment occurs in the DAFF plant.

Stormwater renovation

Stormwater is to be harvested from the 620 ha development site plus an equivalent area of adjoining industrial land.

An established wetland adjacent to the development will augment the proposed new system and provide additional storage for the harvested stormwater. Prior to entering the wetland system the stormwater will be screened by a combination of gross pollution traps and wetland basins.

Aquifer storage and recovery (ASR)

Groundwater is present under the site but has a salt content of around 2,000mg/L, which is above the tolerance level for good quality irrigation water. Hence, it cannot be used for the development.

Stormwater flows occur mainly in the winter and spring and wastewater occurs fairly constantly over the year. However, the main irrigation requirements occur in the hot summer and autumn period with little or no irrigation in the other months. The ASR system stores the reclaimed water in a situation, which eliminates the normally high evaporation losses of 1.0 to 1.5 m per year from surface storages.

Several trials have been conducted to demonstrate the feasibility of injecting the renovated stormwater and reclaimed wastewater into the aquifers where the water will be stored for future use.

It is understood that at each injection point the reclaimed water forms a large bulb of good quality water within the high salinity native groundwater. Very little lateral movement of the injected water takes place over a year. Recovery of the underground reservoirs of injected water is via the same wells using standard submersible well pumps. The arrangement of the well field depends on hydrodynamics of the aquifer system.

Management Arrangements

SA Water will own both the public water supply system and the recycled wastewater system, whilst the stormwater system and wetlands will be owned and operated by the local council. An agreement between SA Water and the Local Council will allow for the purchase of treated stormwater for use in the recycled wastewater system and also set a transportation charge to be paid by the Local authority for recycled water used to irrigate public open space. In this way the costs to the local authority for irrigation are minimised, whilst maintaining a commercial basis for the provision of recycled water to households and industrial customers.

To enable the overall scheme to meet the objective of not only reducing the use of potable water but also reducing the overall cost to the customer a different approach was taken to determining the price of reclaimed water. The reclaimed water is priced on a marginal cost basis, having regard only for those costs incurred to treat the recycled water from a quality acceptable for discharge to the ocean to the quality required to satisfy the requirements of a Class 1. To this cost was added the cost of pumping and maintenance of the necessary infrastructure. This has resulted, in this case, in a cost to the customer for reclaimed water of approximately 65%-70% of potable water.

Mini Hydro Schemes

SA Water is a major contributor to the South Australian Government's financial position and accordingly our continuing economic



performance is of vital importance to the State. Consequently, the Corporation is pursuing economic and environmental objectives through the implementation of a renewable energy strategy.

The renewable energy strategy currently involves the development, in conjunction with a joint venture partner, of mini-hydro facilities that generate power from energy within the water supply system. This energy is currently wasted through the use of dissipater valves.

The target mini-hydro projects generate a rate of return in excess of the Corporation's weighted average cost of capital and hence are economically attractive. The electricity generation provides SA Water with an opportunity to reduce greenhouse gases, a key environmental issue due to the long distance pumping undertaken across the State. There may even be some water quality improvements created within the system, due to improved circulation within existing facilities.

Two mini-hydro developments are currently underway and will generate approximately 11GWh pa - enough power for 1700 homes. Further projects are in the feasibility and concept stages.



The Future Direction

SA Water recognises that its water resources are not infinite, even if the option of Desalination is adopted to provide some of South Australia's needs. It is not just a case of providing an endless supply of high quality drinking water, but a need to provide sufficient water at appropriate quality to sustain both man and the environment.

Whilst social, environmental and economic factors have previously been considered individually during the preparation of 5 year strategic plans, the Corporation through its recent decision to pursue sustainability is undertaking to ensure that the combined environmental, social and economic effects of each of its decisions and activities are considered. During 2003, a Blueprint for Sustainability is to be developed to guide SA Water's attainment of this goal.

As part of a move to a more sustainable approach to Adelaide's water supplies, the South Australian Government has announced in February 2003, a \$1.8million study into the alternatives for some or all of the supply to Adelaide. This study will look at the feasibility of increasing the harvesting of stormwater, which is currently channelled out to the sea, increasing the use of recycled water both within households and from wastewater treatment plants and to more water sensitive urban design. SA Water will be playing a leading role in this initiative.

In July 2002 SA Water and United Water commenced a joint study of the metropolitan area to identify opportunities for recycled water, harvesting stormwater and improved utilisation of the existing assets. This project is currently only at the feasibility stage, but it has identified about 12 opportunities which merit more detailed investigation. The project is a clear example of partnership between the two

organisations and is in line with the first of the original objectives in the outsourcing process.

The next steps for the project team are to establish closer links with the Local Councils and as a precursor to this the project was outlined to a forum of Government Ministers and senior executives of Local Councils in March 2003.

Finally SA Water is commencing a process of evaluating project options utilising an analysis of the total “green” footprint of the solution. Utilising this technique it is possible to establish the overall impact on the environment of adopting any particular solution. A trial of the technique on a recent major capital project suggested that the solution was only marginally better for the environment than the situation existing before implementation.

Conclusion

SA Water has already established some credentials in the development of sustainable water systems, either in its own right, or by working in partnership with both Local Councils, and the private sector. In moving forward it is essential that the need for collaboration is not forgotten and that a common objective is developed which encompasses both the needs of man and those of the environment. ■





Adelaide as a Sustainable City: Water Management in the Broader Context of Sustainability

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Adelaide in context

It is important to acknowledge, in a series of seminars which encompasses countries at different stages of development around the Pacific Rim, the inter-relationships which exist between issues of sustainability in these countries.

The term 'sustainable development' has been employed to denote alternatives to traditional patterns of physical, social and economic development in both developed and developing countries – alternatives that can mitigate environmental problems such as pollution, exhaustion of natural resources, overpopulation, loss of biodiversity, destruction of ecosystems and the deterioration of human living conditions.

But there is also a long-standing tension between developed and developing country priorities in relation to sustainability. Brundtland's famous definition of sustainable development identified the importance of considering the needs of both present and future generations. However, one might observe that some of the things which are seen as 'needs' in a rich Australian city like Adelaide might be regarded as extravagant luxuries in Jakarta or Manila.

Most people would now acknowledge the importance of demonstrating global responsibility.

Rich nations should not over-exploit the resources of poorer countries, nor should the environmental costs of one country's activities be displaced or 'externalised' to another. Despite some decades of international concern, however, there remain substantial differences between the priorities of rich and poor countries. Poverty in less-developed countries influences people's ability to conserve resources.

In recent years mainstream approaches to sustainability have tended to adopt an optimistic perspective. It is assumed that the ecological crisis in both rich and poor countries can be managed by developing technical solutions to environmental problems and more efficient institutions for environmental management and control (Hajer 1996). The market economy is seen as the most efficient way of achieving the objectives of sustainability. The market will promote the economic growth that is seen as the precondition for providing the resources necessary to tackle environmental problems. The relationship between state and market is complementary rather than conflicting. Market and state, public and private are seen to have mutual interests expressed in notions of complementarity, partnership and negotiation. And, as an extension of partnership, consensus-building proceeds through attempts to involve citizens in the development of ideas and policies. These notions are widely accepted in



developed countries and underpin contemporary governance arrangements in an Australian city like Adelaide. They assume certain conditions, however – “economic prosperity, an efficient market, technological advancement, an enabling state and a plural, inclusive society” (Blowers and Pain, 1999). In a less developed country many of these conditions are often missing. Problems of poverty and environmental degradation can be overwhelming and governments generally lack the institutions of civil society which are required to enforce environmental regulations.

Where social sustainability is considered, it is related to a perceived need for economic growth to raise living standards in less developed countries to be on a par with those of developed countries. “The surest way to improve your environment is to become rich”(Beckerman, cited in Ekins 1993:267). Thus, the Brundtland Commission argued for continued economic growth in both developed and developing countries, anticipating a five to tenfold increase in global industrial output by the time world population growth slows during the 21st century. The idea that less developed countries will eventually solve their problems by following the path of industrialization marked out by developed countries is generally referred to as ‘developmentalism’. This notion is not without its critics, however, who argue that, in the event that developing countries do pursue a similar path to developed countries, the consequences are unlikely to be sustainable. Rees, for example, a pioneer of the ‘ecological footprint’ approach to studying cities, has suggested that “Extrapolation of the present North American lifestyle to the entire world population of 5.7 billion would require about 24 billion hectares of ecologically productive land... Since there are only 8.8 billion hectares of such land on the planet, we would need at least two additional Earths to bring just the present human population up to North American ecological standards. These data provide some measure of both global ecological limits and North-South inequity” (1999:36).

It seems patently obvious that it would not be sustainable for the citizens of the megacities of the developing world to live at the levels of consumption currently enjoyed in Australian cities. Adelaide is a low-density city of only 1 million people, but it extends for about 100 kilometres from north to south. It is a car-based city and, like other Australian cities, levels of per capita consumption are very high when viewed in global terms. The admirable, innovative and leading-edge developments described in the earlier papers about Adelaide need to be viewed in this context.

Sustainable Cities

My fields of expertise are urban and regional planning and transport planning and I have a particular interest in ways of redesigning the physical fabric of the city in order to encourage greater resource efficiency. Unsustainable cities are typically seen as those where low density and sprawling development have increasingly separated where people live from where they work, shop, go to school or engage in leisure pursuits, requiring considerable consumption of land and also energy for travel. Traditional land-use zoning practices, which sought to locate places of residence away from polluting factories, led to a general policy tendency towards ‘monofunctional’ zoning, adding to heavy car-reliance. Australian cities have grown with the support of energy-inefficient cars, homes and offices; and water-hungry industrial processes, domestic appliances and patterns of consumption. To tackle these interrelated problems many planners have advocated fundamental redesign of the city, seeking to enable people to become less car-dependent – in particular through attempts to increase urban residential densities, to concentrate development around key public transport routes and nodes, and to encourage a move back towards more mixed land uses within the city. The approach also lays much emphasis on improving the individual components of the

physical infrastructure of the city. In addition to the provision of public transport and more energy efficient buildings, these include approaches to water conservation which go under the general heading of 'water-sensitive urban design'. Some of these physical design solutions are common to a number of approaches to sustainability which vary in other respects along economic or ideological lines. For example, 'light green' approaches to sustainability seek to address urban environmental problems through altering market mechanisms. This form of analysis interprets the problems of cities as being largely ones of market and regulatory failure. Trading with distant places is seen as essentially unproblematic, provided that major market externalities are addressed. More radical 'deep green' approaches, by comparison, emphasise a combination of a more sensitive approach to nature with a decentralised, grass-roots politics, and a preference for community activism over state-led bureaucracies. This more 'nature-centred' lifestyle has a preservationist stance to natural resources which seeks to minimise urban impacts on natural assets of all kinds, including a general commitment to reduce impacts on external areas – that is, to reduce the 'ecological footprint' of the city. 'Bio-regions' such as river catchments become the appropriate planning areas under this approach, with the intention of gearing development to the bio-region's resources rather than importing materials or exporting waste (Haughton and Hunter, 1994). The emphasis tends to be on self-sufficiency -small-scale production systems for local need, rather than large-scale production for global export markets and using locally produced appropriate technologies, rather than imported, expensive, high-technology, capital-intensive production systems. Growth is focused on environmentally benign products and services, whilst efforts are made to reduce or phase out environmentally damaging types of economic development. Adelaide has articulate proponents of both more and less radical approaches to the attainment of urban sustainability and its evolving mix of policies and governance arrangements illustrates this.

¹ Adelaide
Advertiser,
20 September
2001

Observations on the Adelaide Experience

The three preceding papers which comprise the Adelaide case study are detailed and merit careful consideration. In these brief observations on the Adelaide experience, I should like simply to draw out a number of key elements from recent practice and current proposals relating to sustainable water management which seem likely to be of wider interest and relevance to other participants in this series of seminars.

The practice of contracting with private firms for the provision of public services is a long-established one in Australia. The historian Manning Clark has observed, for example, that the early transport of convicts from Britain was undertaken primarily by private contractors (Clark, 1962). The papers by Jack McKean and Philippe Laval both describe very clearly the process whereby the former state water supply agency was corporatised as SA Water in the 1990s and the operations and maintenance of Adelaide's water and wastewater treatment plants, together with the sewerage and water networks, were outsourced to the consortium of international and local partners known as United Water. SA Water manages the outsourced contract and remains responsible overall for the management of water resources for public water supply. These arrangements have been in effect for about six years now and McKean suggests that, over this period, there have been demonstrable improvements in service delivery and capital project delivery, together with significant economic benefits to the State. The State government estimated that savings to the Government from the contract would be \$66.7m for the period 1 January 1996 to 30 June 2002¹. Laval's paper records also the impressive achievements of United Water in the other key role required under the contract – the development of the South Australian water industry, and particularly, the development of an export focus. Laval notes, however, that the subtleties of the contract, and its benefits, are not always well-understood by the wider public, many of whom

think that the state's water assets have been fully privatized and sold to United Water. Critics of the contract – and of privatization and outsourcing in general – also question the claimed benefits and tend to focus on the difficulty of evaluating such claims because of limited access to information for reasons of commercial confidentiality (Spoehr, Quiggin, Wilson and Purse, 2002). Validation or rejection of such criticisms may need to await comprehensive and independent audit of the contract arrangements and achievements at the end of the contract period in 2010.

On the politics of water management, all three papers note the heavy dependence of Adelaide on the River Murray, which can provide between 35 per cent of Adelaide's water in a wet year and 90 per cent in a drought year. A major issue increasingly recognised in recent years has been the amount of water taken from the river system, both within South Australia and upstream throughout the Murray-Darling Basin. National and inter-state collaborative arrangements are required to manage the entire Murray-Darling Basin effectively and sustainably but, to date, the competing interests of different states have made a satisfactory political agreement elusive. Reducing dependency on the Murray is a major priority for water managers in South Australia.

All three papers identify a number of current initiatives which have been put into place to promote more sustainable use of water supplies while assisting also in the economic development of South Australia. The Virginia Pipeline Scheme provides an excellent example of a commercially viable project which also contributes to environmental sustainability. It takes treated effluent which would otherwise have been discharged into the sea with detrimental impacts on sea grasses and fish-breeding grounds and pipes this to the Northern Adelaide Plains where it is used for irrigation in an important market-gardening area. A private consortium developed the Virginia pipeline, while SA Water constructed the Dissolved Air Flotation Filtration Plant, drawing on United Water's parent company

expertise, to treat the effluent to a standard which met the requirements for recycled water. The whole scheme will eventually return to the ownership of SA Water. Development of the Virginia reuse scheme has reduced the level of groundwater abstractions in the area from an estimated 2 to 3 times above the sustainable yield to close to a sustainable level. The reuse scheme has also assisted with substantial reductions in nitrogen discharge and in the reduction generally of nutrients to the marine environment. The Willunga project has a similar purpose – the provision of effluent for irrigation purposes to relieve stress on groundwater reserves – but differs in its financing arrangements, with all finance coming from the private sector.

The Mawson Lakes project is a new urban development for about 9,000 people some 12 kilometres north of the Adelaide CBD. It had its origins in an ambitious joint Australian-Japanese initiative in the late 1980s to construct a 'Multi-Function Polis' in Adelaide which would be a city of the future, designed to showcase leading edge developments in information technology, new environmental technologies and sustainable urban form and design appropriate to the society of the 21st century (Hamnett, 1995). The development of Mawson Lakes overall has taken the form of a joint venture, common in South Australian urban development, whereby the government provides the land and establishes certain development objectives and then enters into a partnership with a private consortium which carries out the greater part of the development. Mawson Lakes incorporates an existing university campus as well as Adelaide's Technology Park. Key water management objectives include a reclaimed water supply which will reduce household potable demand by at least 50 per cent by providing reclaimed stormwater and wastewater for outdoor domestic and municipal irrigation. Stormwater is harvested and treated in wetlands prior to storage in groundwater aquifers for reuse. Wastewater from the sewerage system is treated in a wastewater treatment plant and then also stored in groundwater aquifers. Houses have potable

mains water connections and reclaimed water connections. The reclaimed water is used for toilet flushing, garden watering and car washing. Public open space is also irrigated with reclaimed water.

The Mawson Lakes Water Cycle Management System demonstrates a holistic approach to urban water recycling involving stormwater harvesting, stormwater renovation in wetlands, wastewater reclamation, aquifer storage and recovery systems, and the use of reclaimed water by households for non-potable requirements and for irrigation of open spaces. The integrated system also forms an educational focus on the urban water cycle for primary and secondary schools, universities, technical colleges and the community.

The management arrangements involve co-operation between SA Water and the local council of Salisbury. SA Water will own both the public water supply system and the recycled wastewater system, whilst the stormwater system and wetlands will be owned and operated by the local council. An agreement between SA Water and the local council will allow for the purchase of treated stormwater for use in the recycled wastewater system and will also set a transportation charge to be paid by the local authority for recycled water used to irrigate public open space. In this way the costs to the local authority for irrigation are minimised, whilst maintaining a commercial basis for the provision of recycled water to households and industrial customers. McKean's paper indicates that the cost to the customer for reclaimed water will be approximately 65 per cent-70 per cent of the cost of potable water.

The Mawson Lakes wetlands form part of a more extensive network of wetlands in the City of Salisbury which represent a particularly interesting example of innovative and sustainable management of water resources in metropolitan Adelaide. Salisbury's first wetland was developed in the 1960s as a flood-mitigation measure. The area attracted bird-life and was used by the local community for recreation. But it was also found that the slow-moving water allowed heavy metals

picked up from the streets to settle as sediment; reed beds planted along the banks effectively filtered the nutrients; aquatic micro-organisms decomposed organic matter and the action of sunlight and oxygen through the shallow water effectively removed biotic pollutants. In a short time the stormwater was substantially cleansed.

From those origins, the City of Salisbury now has some 36 wetlands totalling approximately 250 hectares in area and costing in excess of \$16 million². Stormwater, traditionally regarded as a problem, is now harnessed and utilised. All new residential subdivisions in the last ten years have been required to install wetlands to contain stormwater on site as much as possible, while large industrial developments have been actively encouraged to develop wetlands for the same reason, and in order to contain potential industrial spills on site. Collectively, these initiatives have dramatically reduced flood risk in an otherwise flood-prone area, and have led to significant increases in the quality of the habitat for wildlife. The recycling of stormwater through wetlands also reduces the amount of polluted water discharged into the sea. Salisbury is also involved in the process of aquifer storage and recovery (ASR) - the process of injecting water into a suitable underground aquifer for storage and later reuse as described by McKean and Laval. Aquifers can store large quantities of water without losses from evaporation and with reduced risk of contamination, both of which are problems associated with surface water storage areas such as reservoirs.

One outcome of the City of Salisbury's experience is that the City is now pumping more water into the aquifer than it needs to extract for its own purposes. It has therefore sought potential customers for its excess water. Early customers were a wholesale nursery, glad to have access to a water supply with less salinity than mains water, and at a lower price; and a major salt manufacturer, which used the water to dissolve its salt. More recently, two major projects have demonstrated the enormous potential of these

² The description of Salisbury's wetlands experience draws primarily on Hains (2003)



approaches to water recycling to combine economic benefits with the attainment of environmental sustainability goals – the Parafield Airport project; and the Edinburgh Parks project.

The company of G.H. Michell and Sons is Australia's largest wool processing company. The company's process involves the consumption of significant quantities of mains water to wash the wool (approximately 1 billion litres per year) and it generates similarly large quantities of effluent and sludge wastewater. Following a trial developed and monitored on the Michell site, it was demonstrated that the wastewater could be readily treated through natural wetlands, and a concept was developed for a commercial alternative to mains water supplies. The concept developed by the City of Salisbury involved diverting stormwater from existing drains to a system of constantly-flowing reed bed ponds on the land of the busy Parafield Airport, where it is filtered, cleansed and

supplied directly to users, with the surplus water injected into underground aquifers for storage and extraction during dry periods. Nutrient and pollutant loads are designed to be reduced by up to 90 percent. The residency period of the water in the treatment ponds prior to being pumped direct to users, or stored in the aquifer, is between seven and ten days, depending on inflow water quality.

In the first stage alone, 1.1 billion litres (1,100 mega litres, or 1,100,000,000 litres) of water that was being pumped annually from the River Murray to supply the Michell plant and other users will stay in the river. These users will rely instead on the high quality harvested stormwater from the Parafield Airport catchment.

A further by-product of this process is now under consideration as it appears that sludge from the plant, which represents a significant proportion of sludge going to Adelaide's major sewerage



Kaurna Park Wetlands

plant at Bolivar, can be combined with green waste collected from residential properties to produce a high quality fertilizer grade compost for the horticultural and wine industries. A plant to produce some 55,000 tonnes per annum at very competitive costs is presently under consideration.

The Edinburgh Parks project, a major industrial development project in an area formerly used mainly for defence purposes, is also the site of a scheme to collect, filter and cleanse stormwater presently flowing through the site through an elongated wetland, complemented by a major wetland at Kaurna Park to the south of the nearby Edinburgh Air Base. The cleansed water will again be stored underground via a series of ASR bores on site and then reticulated on demand to the range of on-site users. Principal users will be General Motors Holden, who will use the water in their Paint Shop; and an expected 35 component supply firms, all of whom will have a recycled water supply main to their factory. Subsequent stages are also expected to supply the Defence Science and Technology Organisation and the RAAF base, both of which have indicated considerable interest in taking the water, which will be charged at a rate less than mains water charges.

Conclusions

Much of South Australia is desert and an over-used cliché describes it as “the driest state in the driest continent on earth”. Access to good quality water at affordable prices is a critical issue facing the further development of the State. But Adelaide and its surrounds do not have a particularly low rainfall by international standards and it has been calculated that enough water falls on Adelaide each year to satisfy its annual consumption requirements. Yet, in the past, at great expense, governments have channelled most stormwater and sewerage effluent to the coast, where it has damaged the marine

environment, while pumping water from the River Murray, a river that is undergoing an ecological crisis through over-use and mismanagement. The three papers comprising the Adelaide case study illustrate the progress which has been made in recent times in attempting to change this situation and to place the city’s water supplies on a more environmentally-responsible and sustainable basis. The papers bring together a number of technological innovations, institutional arrangements, inter-governmental collaborations and public-private partnerships which are already beginning to transform water management in the city and which have the potential to move Adelaide significantly in the direction of more sustainable urban services. This concluding section draws these initiatives together and returns to a consideration of Adelaide’s overall patterns of consumption.

The effectiveness of public-private partnership in water provision is indicated in the papers by McKean and Laval. While, as noted earlier, a full assessment may need to await an independent audit and evaluation at the end of the present contract period, there is significant evidence provided in these papers of the achievements of the contractual arrangements to date in relation to greater efficiency, the development of a substantial export focus and the collaborative pursuit of sustainability objectives, drawing on expertise made available in part through the private partners’ global resources.

The Virginia Pipeline and Willunga Basin Schemes demonstrate different types of successful partnership, between SA Water and private consortia, concerned to provide recycled water for irrigation purposes in market-gardening and viticultural areas. The Mawson Lakes Project overall illustrates South Australia’s long-established and successful approach to joint ventures in urban development between government and private developers. In respect to water management, it demonstrates effective collaborative arrangements between SA Water and the local council, the City of Salisbury. As



noted earlier, SA Water will own both the public water supply system and the recycled wastewater system, whilst the stormwater system and wetlands will be owned and operated by the local council. An agreement between SA Water and the local council will allow for the purchase of treated stormwater for use in the recycled wastewater system and also set a transportation charge to be paid by the local authority for recycled water used to irrigate public open space. In this way the costs to the local authority for irrigation are minimised, whilst maintaining a commercial basis for the provision of recycled water to households and industrial customers.

Salisbury's experience with wetland development is of particular significance and, in its sale of recycled stormwater from wetlands and aquifers to industrial users, it provides an excellent practical example of how economic development and environmental sustainability can go hand in hand. Challenges which still exist are to forge a non-competitive alliance between the local authority, in its provision and pricing of recycled water, and SA Water, in its oversight of mains and sewerage systems generally. There are also challenges to the state's regulatory processes which follow from these innovative developments – the challenge to environmental approval processes, for example, from the adoption of aquifer recharge techniques; the need to align licensing arrangements for Aquifer Storage and Recovery with the long-term contractual needs of industry; and the 'ownership' of groundwater reserves supplemented by water injected into the aquifer.

Burman's paper noted the recent shift to the establishment of catchment management boards under the Water Resources Act of 1997, consistent with a more 'bio-regional' approach to urban management. Catchment management principles and spatial development plans are now also better linked.³ Burman also noted the importance of an integrated approach to overall metropolitan management, in the course of which water supply issues are considered as part of broader considerations of urban development and incorporated in a metropolitan

spatial strategy which also addresses issues of urban form, housing density, energy efficiency, public and private transport, as well as the social and cultural development of the city. This horizontal integration of policies at state government level needs to be complemented by the vertical integration of policies between state and local levels of government. Adelaide has also made some significant progress in this regard, particularly in its central city area. In 1996 a Capital City Committee was established as a partnership between State Government and the Adelaide City Council. The purpose of these new arrangements was to move beyond previous tensions in state-city relationships and to create a new collaborative partnership which would assist in shaping strategies to position the city in the new era of competition and global change. A key element of this is a Capital City Committee which includes key decision-makers from both State Government and the Adelaide City Council. Last year the Capital City Committee adopted the notion of making Adelaide a 'Green City' as its first priority for action and has identified a series of projects which will move Adelaide towards greater sustainability. The intention is to place issues of sustainability at the centre of all decisions and actions. The Green City program is to be a focus for the many sustainability initiatives already under way, as well as the stimulus to new short and longer-term projects. The encouragement of 'joined-up' thinking between governments at various levels and other key private and community stakeholders is central to this initiative.

There is a great deal of encouraging progress to be discerned in the Adelaide case studies, therefore. South Australia already achieves the highest per capita level of water recycling in Australia and is a world leader in some aspects of sustainable water use, including aquifer recharge and the recycling of stormwater through wetlands for commercial purposes.

There are also some substantial challenges ahead. McKean has noted that there is still

³ The State Government recently adopted a 'Stormwater in Urban Areas Plan Amendment Report' to this end.

scope to streamline the number of organisations involved in water management – state agencies, catchment boards, local councils and more - all of whom have their own, occasionally conflicting, objectives. More fundamentally, as noted at the outset of this paper, Adelaide’s citizens consume resources at the profligate levels typical of Australian cities, and of developed cities in general. Reducing consumption and increasing the conservation of resources is an essential but daunting task. Technology can help, as demonstrated by some of the examples provided above, and through the progressive adoption of more water-efficient appliances and fittings. Changing attitudes and behaviour is also vital, however. It is certainly possible to envisage a considerable reduction in resource use and waste generation by middle-and upper-income households, without diminishing their quality of life and in some aspects enhancing it. The work of the Rocky Mountain Institute in the US (amongst many others) has shown how resource use and waste can be cut within prosperous economies, without compromising living standards (see, for example, Lovins and Lovins, 1991). But there is still much to accomplish in practice. Figures from the State Department of Environment and Heritage (Fleming, 2002) indicate that some 67 per cent of Adelaide’s water in 2000-2001 was used for residential purposes and, of this, some 51 per cent went to water garden beds and lawns. Using precious supplies of potable water for such purposes is not sustainable under any conceivable circumstances. These figures indicate the vital importance of increasing substantially the amount of recycled water available as part of a strategy of providing water of a quality appropriate to its needs. At present no more than 20 per cent of the huge resource represented by stormwater and wastewater is used by any Australian city (Syme and Nancarrow, 2002), although Laval notes that SA Water has set a 30 per cent reuse ratio by 2005. Ways of increasing the harvesting of stormwater, increasing the use of recycled water, both within households and for irrigation and industrial purposes, and extending more widely the principles of water

sensitive design will be key elements in the next phase of South Australia’s water planning. A significant component of this will be the recently announced ‘Waterproofing Adelaide’ initiative, a major study which is intended to take a strategic approach to the effective management of the whole water cycle and the sustainable use of all water resources available to Adelaide and its surrounding areas.



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(Footnotes)

1 Adelaide Advertiser, 20 September 2001

2 The description of Salisbury's wetlands experience draws primarily on Hains (2003)

3 The State Government recently adopted a 'Stormwater in Urban Areas Plan Amendment Report' to this end. ■

