

Paper Title	Sustainable Wastewater Reuse through Private Sector Participation - The Adelaide Experience
Author	Rajah A. Thiyagarajah
Abstract	
<p>This paper examines the conditions necessary to facilitate private sector participation in wastewater reuse schemes. It discusses the technical, financial, commercial, regulatory, policy and institutional issues relating to the development of sustainable water reuse projects. The document will give an insight into how and under what conditions, ADB's Developing Member Countries could develop similar schemes.</p> <p>The paper is supported by a showcase real life case study of a successful wastewater recycling scheme in Adelaide, Australia. The scheme, which had excellent government regulatory, policy and institutional support, was entirely built and financed, and is currently being operated, by the private sector. Located in the world renowned wine growing region of McLaren Vale, the scheme uses effluent from one of Adelaide's three large wastewater treatment plants to irrigate grape vines that produce some of Australia's finest wines.</p>	
About the Author	
<p>Rajah Thiyagarajah is a financial consultant with over 20 years of corporate/consultancy experience. He provides expert financial advice for the development of public-private partnership (PPP) projects and has been an advisor to several significant PPP projects in Australia and Asia, particularly in the water, sanitation and energy sectors. Rajah can be contacted on (618) 8431 8688 or rajah@tmpconsulting.com.au.</p>	
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“Sustainable Wastewater Reuse through Private Sector Participation - The Adelaide Experience”

By Rajah Thiyagarajah,
Director, TMP Consulting (Australia) Pty Ltd

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1. Introduction

Grape growers in Adelaide’s world renowned wine growing valley of McLaren Vale have cooperatively developed a demand driven wastewater reuse scheme that was entirely built and financed by the private sector. It has been successfully operating for the last 7 years, and still growing. The farmers have overcome technical, financial, institutional, regulatory, social and environmental constraints to launch this showcase wastewater reuse scheme that is sustainable and financially viable. This case study will give an insight into how and under what conditions, ADB’s Developing Member Countries could develop similar schemes through private sector participation.

2. The Problem – Water Scarcity

Located in the Willunga Basin of the state of South Australia, the Willunga Basin Reuse Scheme, as it is known, was initiated by grape growers in the region who were concerned with their dwindling water supplies and excessive groundwater extraction which was unsustainable. Further, the government had placed restrictions on groundwater extraction and imposed a water extraction licensing regime. The agricultural area was beginning to see declining crop yields and land values due to the drying up of the region. Water, or the lack of it, could potentially cause a decline in economic activity and destroy the livelihoods of the growers. Water had obviously become a scarce and valuable resource for the vineyards located in Basin. Coupled with its location in the Australian state that is generally recognized as ‘the driest state in the driest continent’, farmers were well aware of the value of water and were prepared to pay for it.

The situation had the essential elements for a financially viable water reuse project that could be attractive to the private sector. A committed group of growers, driven by an individual champion, got together and decided to do something about it. The Willunga Water Reuse Scheme was conceptualized, but there were numerous obstacles and constraints that needed to be overcome.

3. The Strategy

This bold venture involved tapping into the wastewater discharged into the ocean by a wastewater treatment plant (WWTP) located 15 kilometers away at the seaside town of Christies Beach. The Christies Beach WWTP services a population of 150,000 people and generates an average of 27 million liters of wastewater every day. If fully reused, it could irrigate 50 square kilometers of vineyards and yield \$150-180 million of grape production at the then prevailing prices. The effluent at Christies Beach WWTP undergoes secondary

treatment and is disinfected with chlorine. The water complies with Class B rating¹ and is suitable for agricultural irrigation if worker contact is minimized. Contact with certain crops is permitted but the water can only be used for restricted spray irrigation.²

If a viable and sustainable project could be developed to pipe the wastewater from the Christies Beach WWTP to the McLaren Vale vineyards through a private sector scheme, it would yield significant synergistic benefits to the public and private sectors. These include

- (a) reducing high nutrient effluent discharge into the sea;
- (b) diverting nutrient rich water for agricultural irrigation; and
- (c) developing a commercially viable new private water distribution business that yields significant environmental and economic benefits.

4. Situation Analysis – Issues and Constraints

The challenges were numerous and daunting but the financial, economic and environmental benefits of such a scheme motivated a group of growers to pioneer its development. Fortunately they had the public sector support at all levels, including the South Australian Water Corporation (SA Water), the corporatised state-owned entity responsible for water supply and wastewater treatment and which was committed to reducing effluent discharge into the sea.

There were several complex and interrelated issues that needed to be resolved before a scheme such as this could come into fruition. Most of the issues related to the pre-construction phase of the project, as several agreements had to be put in place and all affected parties and institutions needed to be satisfied with the arrangement. The issues can be classified into the following areas: (1) Engineering and Technical; (2) Financial and Commercial; (3) Regulatory and Policy; (4) Institutional and (5) Social.

4.1 Engineering and Technical

- a) Water on Demand: Growers preferred their water allocations to be available on demand, on a 24 hours/day-7days/week basis. The pumps and pipes were sized accordingly to allow for this.
- b) Demand management: The monitoring was sufficiently sophisticated to allow it to automatically cut off the supply to growers who take more water than their entitlement, particularly during peak (summer) demand periods.
- c) Drip Irrigation: As the state's Environment Protection Authority (EPA) guidelines did not permit the Class B water to be used for unrestricted spray irrigation, a drip irrigation system that is commonly used for grape growing was adopted by the growers.
- d) Security of supply of water: The source water supply from the WWTP was considered to be reasonably secure, given that it originates from a population base of 150,000 and the treatment plant was owned by the State's water authority.
- e) Staged Construction: A two-stage construction strategy was adopted to minimize technical and investment risk. In Stage 1 water was delivered to the shareholders of the scheme. One year later, in Stage 2, the water supply was progressively extended to third party growers.

¹ Key specifications are: Biochemical Oxygen demand (BOD) < 20 mg/L, suspended solids < 30 mg/L and E Coli < 100 organisms/100mL

² Environment Protection Authority 1996, p. 20

4.2 Financial and Commercial

- a) **Shareholdings and Costs:** The initial investment cost of USD 5.5 million for constructing a 24 kilometer trunk main from the Christies Beach WWTP and the spur mains were borne by the shareholders of the scheme, all of whom were growers. The growers were responsible for financing their share of the investment cost and for their on-farm drip irrigation system. In order to ensure technical integrity and consistency, a specialist irrigation consultant, Hydro-Plan, that designed and project managed the main pipeline, was commissioned to also design the drip irrigation systems.
- b) **Feasibility Study:** Initial feasibility studies were conducted to determine the financial (and technical) viability of the scheme. It was potentially attractive to both the land owners and the Willunga Basin Water Company (WBWC), the private sector entity that was set up to build and operate the Scheme. No government subsidy/funding support was provided for the scheme. However, WBWC was also not charged for the effluent water by the South Australian Water Corporation (SA Water) 'producing' the effluent, as it had no alternative use or value for it. It was a win-win situation with SA Water reducing high nitrogen content effluent discharge into the sea to comply with the EPA guidelines and the growers getting water that they desperately needed.
- c) **Tariff Structure:** Tariff for the reused water was based on a financially sustainable rate that maintained the long term viability of WBWC. It is about half the ground water cost, while at the same time having lower salinity and restrictions. The tariff structure comprised fixed (USD 4,500/ML of entitlement) and variable tariff (50 US cents/KL) components, or equivalent to about 65% of the potable water charge. The fixed tariff is based on allocated water entitlement and the variable tariff based on usage. (The original owners of the scheme pay a lower tariff to compensate them for the initial investment cost). There is also an unused water tariff component to serve as a mechanism to recover operating costs when revenues are insufficient. However, this charge has been waived, as the scheme currently generates adequate operating cash flows.
- d) **Contractual Agreements:** Various agreements were signed to appropriately allocate risks and to ensure that commercially sustainable contractual structures were in place. These included:
 - Shareholder agreements;
 - Water Sales Agreement;
 - Pipeline construction contracts; and
 - Water Reuse License with SA Water.

4.3 Legal and Policy

An enabling regulatory and policy framework has contributed to South Australia spawning several water recycling schemes and becoming the leading water reuse state in Australia.³

The government policy *"to phase out all sewerage discharges to the marine environment where it is economically and environmentally sustainable"*,⁴ has significantly influenced the development of water reuse programs in South Australia, where the vast majority of its population live in coastal cities. The inclusion of reclaimed water in the South Australian Government's State Water Plan 2000 further demonstrates the State Government's commitment to recycled wastewater projects.

³ The Virginia Scheme, the largest wastewater for irrigation reuse project in Australia, is also located in South Australia.

⁴ Statement of the Environment, 1995, under the government's "A Cleaner South Australia" Policy.

There were several regulatory controls that needed to be complied with, which improved the acceptability of the Scheme to the government, growers, neighboring residents and the consumers:

- a) Comprehensive Reclaimed Water Guidelines issued by the Department of Human Services and Environment Protection Authority;
- b) Compliance with Water Resources Act;
- c) Annual Irrigation Management Plans ;
- d) Approval of the Public and Environmental Health Service; and
- e) Approval of Environment Protection Authority (EPA).

4.4 Institutional

Given the favorable regulatory and policy regime in South Australia, government departments were quite proactive and forthcoming in granting approvals for water reuse schemes. Getting the approvals was nevertheless onerous and time consuming due to the government's thorough review and evaluation process. Approvals were required from various government organizations and departments including the EPA, SA Water, Health Commission, Primary Industries Department, Department of the Environment and Natural Resources, the local Council, Electricity Trust of South Australia etc.

The Major Projects Group, the government body responsible for developing major infrastructure projects, assisted greatly by serving as a focal point for coordinating and accelerating the necessary government approvals. This helped to maintain the momentum and private sector interest during the project development stage and to minimize public and private sector project development costs.

4.5 Social

Initially some growers were apprehensive that the water quality may not be suitable for grape growing and may ruin their land. Information dissemination through discussions and seminars to improve acceptability of water helped to alleviate some of their concerns. Steps to monitor and control the water quality and soil conditions also improved their comfort level. This has helped to gain the confidence of growers and increase the number prepared to sign up for the Scheme.

Appropriate safety measures such as on-farm warning signs have also been placed in the vineyards. Users are also issued with manuals on Standard Operating Procedures.

5. The Project

The initial project involved the construction of a 24 km, 500mm diameter PVC pipeline and associated spur mains that are capable of delivering the full load of 10,000 ML/year from the Christies Beach WWTP to the Willunga Basin. As demand increased, the distribution pipe length has been increased to over 70 km. Fittings are of stainless steel and ductile iron coated with nylon with a service life of more than 100 years. The monitoring and control system comprised of state of the art telemetry and instrumentation.

6. Results

The Willunga Basin Water Reuse Scheme yields significant benefits to the growers in the region and the state's economy and environment. The key results achieved from the scheme were:

- a) A technically, financially, commercially and environmentally sustainable wastewater reuse scheme;

- b) A scheme that is entirely built, financed and operated by the private sector i.e. a viable reuse project with private sector participation;
- c) Contribution to economic growth through increased grape production and job creation;
- d) Delivery of Class B rated reclaimed wastewater suitable for horticultural use.
- e) Reduction in fertilizer requirements due to the nutrient content in the reuse water ; and
- f) Reduced effluent discharge and damage to the marine environment.

7. The Future

Due to the seasonality of demand the pipeline currently delivers only 40% or 4,000 ML/year⁵ of the effluent from Christies Beach WWTP with the remainder being discharged to sea from the plant. Given that 60% of the wastewater from Christies Beach WWTP is still untapped, there is significant upside potential to further improve the economic and environmental benefits from the Scheme. There is also potential for further improvement in the effluent water quality as the EPA progressively imposes more stringent standards for effluent discharge into the environment.

The current financial viability of the Scheme is an added bonus. The Willunga Basin Water Company has begun paying dividends to the shareholders, reflecting a financially robust company that has the capacity to finance expansion schemes.

The biggest scope for expansion of the Scheme is to provide for off-peak winter storage for peak summer reuse through aquifer storage and recovery (ASR) projects or building of surface storage dams. Further increases in water supply has been and will continue to be achieved through flows from smaller wastewater treatment plants and small septic tank effluent discharge schemes (STEDS) located in the surrounding areas. As there is sufficient pent up demand, and subject to the necessary government approvals and financial viability, the geographical reach of the Scheme could be significantly increased over the next few years.

8. Key Success Factors

With a pioneering project such as the Willunga Reuse Scheme, there are some key success factors without which the scheme could not have been realized. These include:

- a) A highly motivated or incentivised core group or individual is needed to champion and drive pioneering projects such as reuse schemes;
- b) A demand driven scheme, such as the project discussed in this paper, has a much greater likelihood of success;
- c) An appropriate institutional, regulatory and policy framework is a prerequisite for the sustainability and financial viability of the scheme and to attract private sector participation e.g. appropriate groundwater charge, licensing and restrictions; and
- d) The technical and commercial aspects of the scheme must be customer oriented e.g. provision of water on demand, no major on-farm investments such as pumps and storage facilities, water supply cut-off facilities and penalties to monitor and control excessive water usage by unscrupulous growers, a water tariff that is affordable and financially viable for the growers etc.

⁵ Gransbury, John, 2004, The Willunga Basin Pipeline, p 7

9. Best Practices

The adoption of best practices in various aspects of the scheme would help to minimize the risk and ensure long term sustainability. Governments, water utilities and private sector entities that are contemplating embarking on similar water reuse schemes should learn from Adelaide's experience and consider adopting some of the following best practices:

- (a) a thorough up-front financial and technical feasibility study to establish the scheme's long-term viability and to attract private sector funding;
- (b) independent and competent design and tendering processes that ensure technical integrity of the scheme;
- (c) regular water quality monitoring and control to ensure environmental sustainability;
- (d) a tariff structure that is affordable while ensuring the financial sustainability of the project;
- (e) appropriate instrumentation and telemetry so that it is technically possible to monitor and control each customer's off-take;
- (f) commercial arrangements and agreements that allocate risk appropriately between the government, the WWTP operator, the management company and the growers;
- (g) appropriate safety measures and practices to avoid any occupational health and safety hazards;
- (h) best irrigation practice through soil surveys, review of on-farm irrigation systems and headworks, regular soil and crop management reports and seminars, backed by regular independent monitoring and audit; and
- (i) an irrigation Management Plan that is scrutinized and monitored by various government agencies to ensure the sustainable management of the reclaimed water irrigation scheme.

10. Conclusion

Adelaide's wastewater reuse scheme is a model example of a private sector, demand driven reuse scheme that is environmentally, financially, technically and commercially sustainable. An enlightened public sector, an enabling regulatory and policy regime and a commercially driven private sector can deliver a sustainable wastewater reuse project with minimal government subsidies.

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