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Pricing Water - a Tool for Natural Resource Management in the Onkaparinga Catchment

Darla Hatton MacDonald, Michael D Young and Jeffery D. Connor
Policy and Economic Research Unit

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The opinions and recommendations presented in this report have been made by the Policy and Economic Research Unit of CSIRO Land and Water and do not necessarily represent the views of the Onkaparinga Catchment Water Management Board.

In accepting the final version of this report, the Onkaparinga Catchment Water Management Board does not necessarily endorse any views or recommendations made in this report, either wholly or in part.

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Onkaparinga Gorge, Onkaparinga River National Park
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Executive Summary

Overview

This report is the second of four on policy options and market based incentives for managing the resources in the Onkaparinga Catchment Water Management Board (OCWB) area. The four reports are being produced as part of a research agreement between the Onkaparinga Catchment Water Management Board and the CSIRO Land and Water Division, Policy and Economic Research Unit. The first study provides an overview of the institutional framework for managing resources in the catchment and potential impediments to good natural resource management.

This second report focuses on pricing water to manage the catchment water resources in a sustainable manner. A key conclusion of this report is that there are significant opportunities to improve resource use through pricing policy changes. Many of the price policy opportunities outlined are challenging because they require action from State government and local agencies and can not be implemented by the Board alone. While, the Onkaparinga Catchment Water Management Board doesn't hold all of the levers to set these policies, the board can have influence with well informed and persuasive arguments. This report and the remaining reports in this series are aimed at giving the Board strategic information it can use to maximise its influence.

Report Conclusions

The main objective of the report is to identify potential opportunities to improve resource management in the catchment through price policy reform. The report identifies pricing policy reform opportunities in two categories:

- Opportunities that apply beyond the Onkaparinga catchment boundaries related to implementation of Council Of Australian Government (COAG) water price reform provisions, and
- Opportunities related to specific reticulated water and sewage disposal pricing policies in the Onkaparinga catchment.

COAG Reform Recommendations

The Council of Australian Governments (COAG) Water Reform Framework is driving change in water policy. Because not all COAG reforms have yet been fully implemented and how they are implemented will influence resource use in the Onkaparinga catchment, effort to influence implementation can have significant

local impact. Recommendations regarding three COAG provisions are summarised below.

State-wide uniform water prices by user type—Under current State policy one price for reticulated water is charge to all household water users. Yet water can be supplied at a much lower cost to Adelaide than to outlying areas. COAG reforms discourage such cross subsidisation. While the OCWMB may wish to acknowledge the importance of public investment to maintain a vital rural Australia, the Board may wish to consider advocating rural development policies that preserve the social benefits of a vibrant rural economy but do not contradict important environmental goals like water conservation.

Separation of regulatory and management roles of government in water supply—COAG reform advocates separating the regulatory and the management role of government in water provision. Essentially the goal is to open the State water provision monopoly to competition. By separating the two functions, under favourable circumstances a competitive environment can be fostered that benefits consumers who would face lower costs. However, there are potential costs of water utility privatisation including:

- high costs of regulatory efforts to research and regulate private monopoly pricing, and consequently higher water prices.
- competitors with State water utilities attempting to pick off the choice customers (large users who are relatively inexpensive to supply) by offering a lower price.

While OCWMB may wish to acknowledge that increased competition in water supply and regulation can have desirable outcomes, they may also wish to stress that such reform can have negative consequences and advocate a "go slow" approach.

Full cost recovery water pricing including environmental costs— COAG water reforms require that water prices be set so that revenues from water sales cover all operating costs, on-going maintenance costs, capital expenses necessary for ongoing operation, and costs of water use to the environment. Championing the COAG full cost water pricing concept may represent a good strategy to achieve a core OCWMB objective of maintenance of catchment water quality. The specific recommendations with respect to water and sewerage pricing below are all pricing approaches to water prices that are supported in principle by the COAG full cost water pricing provision.

Water Pricing Recommendations

Water pricing that reflects the true cost of water use is a fundamental requirement in any policy designed to encourage economically efficient and environmentally sustainable water use. There are several elements of the current water price scheme faced by Onkaparinga catchment water consumers that discourage water conservation and sewage disposal minimisation. The Board may wish to advocate the following specific water pricing reforms to encourage improved water quality and reduced water consumption in the catchment:

- Change the current reticulated water pricing system so that pricing is primarily volumetric (a function of water use level). The current system a fixed charge for a base volume and a charge for every KL thereafter. From an environmental perspective, a smaller volume offered at a fixed price and higher charges per KL would be desirable, as it would encourage conservation.
- Best estimates are that as much as 50% of residential water in Adelaide is used for watering lawns and gardens in the summer months. A price scheme that charged higher prices for summer water demand over a base volume could reduce this demand significantly.
- Another water pricing reform that OCWMB may consider advocating is a change in sewerage charges to include at least some volumetric pricing component. The current price of sewage disposal paid by households is based on property value and consequently includes no incentive to limit disposal. At least in the case of significant industrial clients, it would seem that the cost of installing sewage meters and charging volumetrically could produce benefits that exceed the additional infrastructure and monitoring cost. For households, it may also be possible to roughly relate sewerage charges to water use charges.

Pricing as one of a Suite of Policies

There are limits to controlling water use and sewage disposal with price alone.

- Even significant increases in water price sometimes barely influence demand because water expenditures still only represent a very small portion of most household budgets.
- Utilities are often concerned about revenue implications of aggressive volumetric pricing reforms because if long run response is very significant conservation, reductions in revenue can result, and utilities can be left with insufficient revenue to cover costs.

- There may also be some consumer or industry resistance to aggressive volumetric pricing or lowering of fixed charge components of current water pricing.

As a result pricing policies alone are limited. Australian and international experience shows that approaches including direct price signals, as well as, subsidy and educational approaches to encourage water saving technology adoption (i.e. low flush toilets, and irrigation timers) work best. In Report three that will follow, a broader suite of opportunities that the Board can pursue in partnership with State Agencies, the Commonwealth, Councils, catchment residents and businesses are reviewed including:

- introducing rebates to existing levies to encourage good natural resource management practices;
- using market based mechanisms like transferable property rights to complement direct regulation of water resources with water allocation plans;
- Voluntary educational and incentive approaches to encourage conservation and sewage disposal minimization.

Contents

1 Introduction

This is the second report of four on research being prepared by CSIRO Land and Water Policy and Economics Research Unit for the Onkaparinga Catchment Water Management Board (OCWMB). The first report described the institutional framework and impediments to water and land management practices that are economically efficient, fair, and achieve water quantity and quality goals. This second report examines pricing mechanisms that could be employed to improve catchment management given the information constraints and asymmetries[1] that tend to occur in a complex institutional framework, as well as the gaps in the scientific understanding of the catchment. Pricing alone is unlikely to achieve all the goals and objectives of a Catchment Water Management Board.

The key to successful management of the catchment, which balances long term sustainability with economic development, is coordinated action by multiple layers of government to line up incentives in the interests of the whole of catchment. Water pricing is one incentive mechanism and the emphasis of this report. However, as the third report outlines in detail, pricing along with other policy mechanisms form a portfolio of tools that can be used to influence incentives for sustainable land and water use. The full suite of policy tools includes:

- setting and using price signals to manage change,
- establishing environmental regulation,
- using markets to move water to highest and best use within a catchment,
- inducing land and water use change with incentives, and
- employing environmental management and accreditation systems.

A persistent theme in all four reports in this series is the fact that there are many different players in the Onkaparinga Catchment Water Management Board (OCWMB) area[2] with very different goals and authority to change institutional rules and policy. This means that the OCWMB does not have full control of all the tools to manage change.

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[1] Information asymmetries refer to a situation where a regulator and a firm have different information i.e. the firm knows more about what it cost to conserve resources, prevent an accident or other features of firm cost structure than regulators do.

[2] From this point forward in the report, the Onkaparinga Catchment or Catchment will refer to the jurisdiction of the Onkaparinga Catchment Water Management Board. More generic terms such as watershed will be used to refer to broader geographic areas.

Still OCWMB does have considerable influence. For example, it has been a leader in putting in place cross-jurisdiction agreements such as the waiver of Division 2 (property based) levies on lands in Natural Vegetation Heritage Agreements. In this report opportunities are discussed that are available to OCWMB to influence water pricing that are within their direct authority, as well as opportunities to influence higher level State policies.

2 Analytical Framework

There is no single practical economic tool suitable for managing a water catchment because of the intricate relationships between people, land and water. The water catchment is an ecosystem supporting a variety of life as well as people with their social and economic aspirations. The art of managing the resource will be devising a portfolio of tools and selecting an optimal mix in order to send signals that move the various parties with an interest in the water catchment in the desired directions.

The analytical framework that is used throughout the report focuses on the incentive mechanisms that have the potential to balance objectives and offer new ways of thinking about managing the diverse interests of the catchment or what we will call the whole of catchment management. As discussed in the first report of this series, the Onkaparinga Catchment consists of a variety of ecosystem types, economic uses, rural and urban areas, etc. all dependent on land and water. Even if the Onkaparinga Catchment consisted of a single homogenous economic use, there is more than one natural resource being utilised—namely water and land. If the focus is on maximising economic benefits of water use alone, inefficient land use can occur. Tinbergen (1950) suggested that efficient multi-objective public management requires a portfolio of tools, rather than single tools such as regulation or a tax. For example, water trading will provide efficient water use only if supported by an appropriate suite of instruments designed to generate protection against the externalities that can occur as the result of irrigation induced salinity loading.

Multi-objective natural resource problems require identifying all the possible and relevant tools that might be employed in pursuing these goals. Gaining access or influence over some tools may require a longer time frame. Alternatively waiting for the right opportunity to have input into the development or revision of new policies and legislation may be required.

The review of the *Water Resources Act 1997* that is currently underway, presents such an opportunity. Another longer term opportunity is the pricing of reticulated water, as the State government may be receptive to well put arguments concerning altering State-wide uniform water prices by customer class during the next round of policy setting. This may well fit in with the Board's strategy of capacity building and the crucial phase of scientific data collection. This will enable the Board to strive towards attaining some of its longer-term goals.

Given the variety of agencies and institutions identified in the first report of this series, one of the important issues to consider is how to get the incentives right so that everyone with an interest in utilising

the resources of the catchment has the incentive to act in a manner consistent with whole of catchment management. Grape growers, SA Water and homeowners in Christies Beach will all have different private short-term objectives. Thus one tool, even a good tool, is unlikely to produce a full set of desired results. While this report focuses on water pricing alone, the next report will examine how deficiencies in a water pricing approach alone can be addressed with other policy instruments.

3 Background COAG Water Pricing Reforms

COAG Water Pricing Reform Agenda

Much of the reform in the area of water has been motivated by Council of Australian Governments (COAG) agreements. COAG is comprised of heads of Federal (Commonwealth of Australia) and State/Territory governments plus a representative from local government. Water is one of many sectors of the economy that have come under the scrutiny of COAG. COAG has developed a national policy called the COAG Water Reform Framework for the efficient and sustainable reform of Australia's rural and urban water industries. In developing its framework, COAG adopted a position which requires a consistent approach to water reform throughout Australia.

The key elements of COAG water reforms include directives that:

1. All water pricing is to be based on the principles of full cost recovery and transparency of cross-subsidies.

2. Any future new investment in irrigation schemes, or extensions to existing schemes, are to be undertaken only after appraisal indicates it is economically viable and ecologically sustainable.

3. States and Territory governments, through relevant agencies, are to implement comprehensive systems of water allocations or entitlements. Entitlements are to be backed by the separation of water property rights from land and include clear specification of entitlements in terms of ownership, volume, reliability, transferability and, if appropriate, quality.

4. The formal determination of water allocation entitlements, including allocations for the environment as a legitimate user of water are to be undertaken.

5. Trading, including cross border sales, of water allocations and entitlements is to be within the social or physical and ecological constraints of catchments.

6. An integrated catchment management approach to water resource management is to be adopted.

7. The separation, as far as possible, of resource management and regulatory roles of government from water service provision is to be maintained.

8. Greater responsibility at the local level for the management of water resources is to be adopted.

9. Greater public education about water use, appropriate research into water use efficiency technologies, and consultation in the implementation of water reforms is to be offered.

Source : http://www.affa.gov.au/water-reform/facts2.htm (June 18, 2001)

Each State and Territory was given the flexibility to adopt its own approach to implementation depending on its own unique institutional and natural characteristics. All parties agreed that the full framework would be implemented by the year 2001. The package of diverse but interrelated requirements developed within the framework was designed to generate an economically viable and ecologically sustainable water industry in both urban and rural areas.

The requirement to meet certain targets each year over the period 1999 to 2001 in order to receive a series of Tranche payments has encouraged the States and Territories to make some progress along the path to implementation of the reforms. The progress has not been uniform across the States and Territories reflecting different political realities.

South Australia already had an institutional framework in place, the *Water Resources Act 1997,* allowing many COAG mandated reforms. The separation of title to land and water is an important feature of the Act and has facilitated trade within the State and among the States of NSW, Victoria and SA. The Act also refined the framework for putting in place Catchment Water Management Boards and allowed South Australia to satisfy items 3, 4, 6 and 8 from the list of COAG reforms on the previous page.

Implications of the COAG reforms for Onkaparinga Catchment Water Management Board

The COAG framework probably provided much needed impetus to put more control in local hands and encourage communities to become more involved in the management of natural resources. This is likely the most important outcome of the COAG framework from the perspective of the Catchment. Local influence can be asserted through the consultation process and the development of Management and Water Allocation Plans. The processes afford more opportunity for dialogue with the Department for Water Resources and communities. Finally there is considerable scope for Catchment Water Management Boards to exert some influence over the development of policies regarding penalties and levies.

Elements of the package of reforms shape the environment in which the Catchment Boards operate. For instance, the enhancement of a competitive environment through the separation of the regulatory role of government from the operational role influences how organisations such as SA Water view natural resource management and the role of conservation. More directly, the evolution of the property rights framework, i.e. the separation of the title to water and title to land affords an opportunity for using trading mechanisms to improve the efficient use of water. There are still improvements and enhancements that could be made to the property rights system. An example cited in the last report of this series is the need for a Torrens Title System for water to improve security of title. Other issues such as separating the right to a volume of water from access rights to improve efficiency in the use of land and water will be considered in the next report.

The COAG framework by devolving responsibility has also introduced the concomitant need for layers of government and agencies to better coordinate their activities. Many of these mechanisms are developing or are already in place. An example is how the Catchment Water Management Plans must be consistent with the State Water Plan—the processes must roll-up together. Other mechanisms have developed such as regular meetings of Catchment General Managers and other forums for discussion where members of different Catchment Boards meet to discuss issues.

Four Key COAG Issues

The four State-wide water policy reform issues enumerated below are discussed in detail in the remainder of this report because they are especially relevant to the Onkaparinga Catchment:

- State-wide uniform water prices by user type,
- separation of regulatory and management roles of government, and opening the State water supply monopoly to competition,
- accounting for full cost recovery in water pricing generally, and
- accounting for costs of environmental degradation in water pricing specifically.

The first three are all discussed in fairly general terms in this section of the report because while the issues are of some importance to OCWMB, policy related to these issue will primarily be determined at the State level. The final issue, accounting for environmental cost in water pricing forms a large part of the next section on water pricing because it is probably the issue of greatest direct relevance to the core mission of OCWMB. In addition the Board is well positioned to

influence at least some of the key policy environment variables related to the issue.

State-Wide Uniform Water Prices for All Users of Each Type

One contentious issue related to COAG has been cross-subsidies. A cross-subsidy occurs when a uniform price is charged but the cost of supplying differs by customer type. Under current State policy one price for reticulated water is charged to all urban water users in the State. Yet it can be supplied at a much lower cost to Adelaide than to outlying areas. For example, the AWA (2000) reports that the cost of supplying water to Whyalla is $680 per ML and $430 per ML for Adelaide. COAG reforms discourage cross-subsidies because they tend to encourage inefficient use by the 'under-priced' customer type.

Fairness as well as efficiency remain key policy drivers in the State. The State argues that State-wide uniform pricing by water user type is important for reasons of economic development outside the Adelaide area. The State has argued with the National Competition Council (NCC) that this policy is transparent as required by COAG.

The OCWMB may wish to acknowledge the social value of rural development policy. However, they may also wish to stress that reform provisions to include costs of environmental degradation in water price are essential to preserving ecosystem integrity. Consequently, the Board could consider advocating rural development policies that preserve the social benefits of a vibrant rural economy but do not contradict important environmental goals like water conservation.

Separation of Regulatory and Management Roles of Government and Opening State Monopoly to Competition

The separation of the regulatory role and the management role of government in water management and opening the State water provision monopoly to competition are additional goals of COAG that have encountered some resistance. While laudable in theory, separation of management and regulation may not always be desirable in reality. By separating the two functions, under favourable circumstances a competitive environment can be fostered. However, in industries like reticulated water where only a few firms or a monopoly tend to dominate the extraction and processing of the resource, the efficiency of such separation can be argued. A market dominated by a few firms, usually indicates that there are barriers to entry such as a decreasing cost structure (where costs falls as amount supplied increases), possession of a unique technology or process, or government franchise.

Reticulated water production costs tend to be lower for single firm monopolies (like SA Water) than they would be if there were many smaller firms. However, industries with one or few firms are not subject to the competition that insures consumer interests are protected. Public utility review boards are often set up when private utility monopolies are introduced to ensure that the public interest is not forsaken by a firm that is able exert considerable market control.

COAG induced reforms, leading to separating the roles of management and regulation, may in some instance actually be counter-productive. The essential problem is that the best alternative to the current SA Water may be a monopoly operated as a private sector firm but regulated in terms of its price. Under such circumstances the private monopoly has an incentive to conceal its cost structure from the State regulator. If anything the private monopoly has the incentive to overState its costs. The State and consumers could potentially encounter two costs from privatisation that it would not with a State run monopoly. Taxpayers would face high costs of efforts to research and regulate the private monopoly, and consumers may face higher water prices if the private monopoly succeeds in convincing the State that water prices above cost of water provision are required.

An additional issue related to encouraging competition in water supply is that the State monopoly can be faced with competitors attempting to pick off the choice customers (large users who are relatively inexpensive to supply) by offering a lower price. The result can be increasing unit cost to the existing monopoly in supplying smaller and more remote customers that private firms aren't willing to service. If the State monopoly is forced to charge such smaller and more remote customers higher prices, demand can decline further and eventually the State may not be able to develop a pricing structure that covers cost.

As with the uniform water pricing issue, OCWMB may have limited influence on the State's position on these issues. While OCWMB may wish to acknowledge that increased competition in water supply and regulation can have desirable outcomes, for the reasons outlined above the issue is not straight forward and any moves toward reform in this area need to be carefully considered. Most importantly, however, OCWMB might wish to argue for a "go slow" policy with respect to separation of supply and regulatory authority. Additionally, the OCWMB may wish to advocate that increased private sector competition should not slow down water pricing reforms that support important environmental goals.

Full Cost Recovery Water Pricing

Full cost recovery pricing has proven to be another difficult COAG reform agenda item for South Australia, as well as other States. The

State has taken minimal steps towards full cost recovery pricing. In particular little action has been taken to encourage incorporating the cost to the environment of water usage into water pricing. This is perhaps the single COAG reform agenda item of greatest importance to OCWMB objectives of preserving the integrity of the catchment ecosystem.

Progress has been slow because setting prices for essential goods creates challenges for governments who must consider competing interests and perceptions of fairness. Musgrave (2000) illustrates the nature of such conflicts well in their evaluation of the open public process taken by the Independent Pricing and Regulatory Tribunal (IPART) in NSW moving to reform bulk water prices for irrigation companies and towns.

The full cost recovery water pricing regime advocated by COAG contains five key items:

- consumption based pricing and full cost recovery should be implemented by 1998 for urban water services and by 2001 for rural water supplies,
- cross subsidies should be made transparent and where possible the cross subsidies should be eliminated,
- cost recovery should include environmental costs, the costs of asset consumption, and the cost of capital,
- positive real rates of return on written down replacement cost of assets should be included in water prices, and
- future investments in new schemes or extensions should be undertaken only after appraisal indicates it is economically sustainable.

Source: http://www.affa.gov.au/corporate_docs/publications/pdf/nrm/water_reform/coag.pdf (June 18, 2001)

The full cost of water, whether delivered to urban users through a reticulation system, or pumped from an aquifer by an irrigator takes into account:

- operating expenses—all the expenses incurred as part of normal day to day operations including the electricity required for pumping water, wages and benefits, etc.
- on-going maintenance costs—all the expenses incurred as part of the planned and unplanned repairs and replacements of capital infrastructure required to continue operating the water delivery system at current performance levels.

- cost of monitoring, research—due to the complexity of the problems associated with managing water dependent ecosystems, the collection of baseline information is crucial. Arguably the full cost of water should include the cost of research - to the extent that it is relevant and necessary. A research levy on all water bought and sold would be in line with the current levy used to fund food and agriculture research (ie. RIRDC, GRDC, PRDC use funds from this levy to leverage agricultural research).
- third party impacts or cost to the environment—water use and water disposal by one party often imposes costs on others down stream. For example, farm dam water capture can impose third party damages by reducing water in reservoirs available for reticulated water consumers, and environmental flows vital to ecosystems preservation. True full cost recovery water pricing would charge each water user the cost of any damages they impose downstream as part of the price of water.

In addition to accounting for the four costs above, full cost water pricing would require that pricing rules are forward looking, only taking into account the components of cost that affect day to day and future operations. This means that while maintenance cost should include capital expenditures necessary to continued operation of a water delivery system, repayment for initial cost of infrastructure should not be included. The reason is that these costs are "sunk" meaning that tax payers are stuck with paying for them whether or not the delivery system is operated. We are stuck with the capital costs of these systems even if new infrastructure would have lower capital costs. Consequently, it is economically efficient to only consider the cost of continuing to operate these systems, rather than to compare the amortised cost of initial investment plus operating cost of existing and potential projects.

Again OCWMB may have only limited direct influence on how reform in the area of full cost pricing evolves. Still it is important from a strategic perspective that the Board carefully monitor developments in this area, so that they can lobby against reform that works against their main objective of increased catchment sustainability. For example, in the reform process argument it may be argued that supplying water to larger industrial users is generally less costly than supplying residential users on a per KL basis. However, if the environmental cost of water use and sewage disposal by industrial users is in fact considerably greater than for residential uses the Board may find it expedient not to support lower relative water prices for industrial water without mechanisms to account for environmental costs.

4 Water Pricing Issues and Options

How water is priced is of crucial importance for setting the balance between water use and conservation, between use in urban areas, agriculture and industry. While it is natural to think of the rates that water users pay as "the price" of water, in fact the effective price of water or its cost to users is determined by three key factors that jointly determine permissible allocations and their cost:

1. Government imposed charges on water use and disposal paid either by water users or water suppliers influence water cost directly.

2. Government regulations regarding how water can be used and disposed of can either limit the range of permissible allocations or their cost.

3. Government rules defining how water rights can be traded are a particular form of regulation. They will be treated separately from other regulation in this reporting because they not only influence the cost of water in "own" use, but signal to water rights holders how the value of water in its current use compares to its value in alternative uses.

This report focuses on the issues directly related to water charges. The role of regulation and water trading in influencing efficiency, equity, and sustainability of water allocation will be discussed in the next part of this study.

Current Water Pricing in the Onkaparinga Catchment

In South Australia, the price of water is determined each year by Cabinet in early December. The Cabinet Submission, made by SA Water, contains plans for capital works and targets for dividends. Cabinet balances conflicting goals of fairness, economic development and balanced budgets. The result of this public process has been that the government has been reluctant to significantly alter uniform State-wide pricing by user type, raise the price of water or increase catchment levies significantly.

Presently, reticulated water is provided throughout the State at one price across each customer class:

- A residential customer pays a fixed component of $123 per annum and 36 cents per KL for the first 125 kilolitres and 92 cents per KL thereafter.
- Industrial and country lands pay an annual access charge of $136 and 91 cents per KL.

- The commercial sector is on an allowance system where the customer pays a property rate of 0.213% and receives an allowance based on the property rate charge divided by 91 cents a KL. The minimum property rate charge is $136.

Sewerage charges include a flat access charge based on property values. The property rate for 1999/2000 for metropolitan areas was 0.256% and the rate in country areas was 0.323%. The different access charges applied to city and country reflect the lower property values in the country. Landowners in areas with sewerage infrastructure can apply for a dispensation from the Sewerage Act and have their proposed system assessed by the Department of Human Services (formerly Health Commission). In areas that have a Septic Tank Effluent Disposal (STED) system, some councils may require an approved septic tank system and levy charges for connection to the STED disposal system.

About 74% of reticulated water in the Onkaparinga catchment goes to residential use, 6% to 9% is used by agriculture, and the remainder goes to other industrial uses (OCWMP, 2001). However, there is significant use of water from other sources by agricultural irrigators. In 1999 a total of nearly 14 000 ha was planted to crops that are typically irrigated in the catchment, with 9 294 ha in grapevines, 3 798 ha in horticultural crops and orchards, and 791 ha in field crops (OCWMP, 2001). A significant portion the irrigated crop area is within the McLaren Vale Prescribed Wells Area (MVPWA). In 1999 7378 ha and 1666 ha in the MVPWA was planted in vineyards and orchards respectively (MVPWA Background to Water Allocation Plan, 2000). The only charges for groundwater pumping outside the MVPWA are application fees for wells and a property-based levy. Within the MVPWA there is a water-based levy of 1 cent per KL.

The Challenge of Incorporating External Costs in Water Price

There are significant environmental costs associated with urban reticulated water use, capture of run-off in reservoirs and farm dams and rural water diversion for agriculture. There is also significant scope to reduce these environmental costs with water pricing policies. What is known to date, suggests that there are six main environmental costs associated with water use in the Onkaparinga Catchment:

1. Nutrient and pesticide loading and turbidity resulting from agricultural land use can lead to declines in ecosystems and fishery health.

2. Primary production and municipal irrigation can raise groundwater tables, especially in low lying areas of McLaren Vale.

3. Adverse fishery, ecosystems and human health impacts are a potential result of treated sewage pumped into the St. Vincent Gulf.

4. Flood plain ecosystem health impacts result from water management that limits episodic flooding.

5. Ecosystems health is impacted by run-off captured in Mt. Bold reservoir and farm dams.

6. Salinity loading of the river(s) effects farm productivity, public and private infrastructure for water delivery and sewage disposal, and floodplain ecosystem health.

Economists describe environmental costs associated with water using the term externality or external cost. The technical definition of an externality is a cost (or benefit) that is borne by third parties to a market transaction. The theory of environmental economics suggests that with no government policy intervention those who suffer will compensate those who cause damage in a way that improves the well being of all. However, two preconditions must exist: 1) those who create externalities and those who suffer as a result must be able to easily find each other and negotiate, and 2) both parties must have nearly costless access to the information required to quantify costs of damages. In practice, this privately negotiated solution is rarely possible because the external costs of environmental damage are spread across individuals and the landscape making it difficult and expensive to monitor pollution flows, assign responsibility for resultant damages and quantify the costs of damages. As a result, public intervention is typically the only effective approach to mitigate externalities.

Designing an effective public externality pricing policy is challenging. In theory, the externality problem can be addressed with a set of environmental levies or taxes known in the economics literature as Pigovian taxes (Pearce and Turner, 1992). In the case of water use externalities, the approach would involve charges on water use such that each water user paid the cost per unit of water delivered plus an additional charge per unit water equal to the external damage cost imposed on others. To charge each water user for the exact external cost that their actions impose on others is impractical. This would require estimates of the environmental damage in dollar terms that additional increments of water use cause for each water user and development of a set of differential charges reflecting damage costs.

Source: (Pezzey 1988)

River Murray Water Salinity Impacts in the Onkaparinga—An Illustration of the Challenge of Including Externality Cost in Water Price

In many cases water used in irrigated agriculture in the Murray River Basin is leading to rising water tables and salinity related losses of farmland productivity, and flood plain eco-systems damage. Increased salt loads in the River Murray lead to downstream impacts on the Adelaide metropolitan area and because the Onkaparinga River is used as a conduit for River Murray water going to the Mount Bold Reservoir salinity impacts on the vegetation and biodiversity surrounding the Onkaparinga River result.

Because impacts eventually experienced in the Onkaparinga have their origin far upstream in the Murray, identifying the source of damages and quantifying appropriate charges to "internalise" the externality is a major research challenge. Introducing charges that reflect best estimates of external cost may also be politically challenging because periodic updates based on new data and improved techniques could lead to an unstable pricing situation that could be unpopular with residential and industrial water users. For example, while until recently each unit increase in EC levels in the Murray was estimated to have a cost of $125,000 (in year 2000 $) to the Adelaide area. A CSIRO –Policy and Economic Research Unit project related to the National Land and Water suggests that updates of these numbers based on best available science may be much higher.

Practical Solutions to Incorporating External Costs in Water Price

While the theoretically best approach to incorporating external costs in water price, charging each user the cost of external damage they generate, is not practical, the Board does have an opportunity to advocate "second best" approaches that give the right signals. The point of practical pricing policies is to give water users, especially those who generate the largest external costs, price signals that align their personal interest with social objectives of reducing environmental damages related to their water use.

If three principles are kept in mind in design of water and sewage disposal pricing systems, key advantages of the theoretically optimal approach to incorporating environmental cost in price can be maintained in practical price policy.

1. The price system should create the greatest incentive to reduce water use for those who generate the greatest

external cost because they are charged the highest environmental levy per unit water used.

2. The pricing system should balance environmental and economic development goals by allowing water users for whom the value of water in producing "dirty" products are high to continue some production if they are willing to pay high externality charges. Likewise the pricing system should discourage those for whom the value of water in production of "dirty" products are so low that they are unwilling to pay externality charges.

3. The water pricing system should encourage innovative approaches to water use that result in lower external costs because such approaches save water users money.

Practical Approaches to Incorporating External Costs into Onkaparinga Catchment Water Prices

Review of current water pricing practices in the Onkaparinga catchment for this research identified two key water pricing policy issues discouraging water conservation that can be addressed with the practical pricing solutions:

1. Residential water pricing based on a large fixed cost component and small marginal cost of each additional unit of water creates little incentive to conserve.

2. Industrial water pricing includes relatively little incentive for conservation as the price per unit of water does not increase as the volume of water used increases.

Both issues relate to what is known as water pricing structure. Five fundamentally different water pricing structures that have been used by various water providers in Australia and worldwide. The basic concept underlying each pricing structures and a brief discussion of key advantages and disadvantages of each structure is outlined in Table 1.

At present, reticulated water for both industrial and domestic users is priced with a two-part tariff. As indicated in Table 1, two-part tariffs do encourage some conservation. The consensus from empirical research is that pricing policies that contain no volumetric component can significantly inhibit incentives to participate in any water conservation activities (Owens-Viani, 1999; Beecher and Mann, 1995). However, there is opportunity to improve conservation outcomes of water pricing.

Two possible approaches are outlined below:

1. **Reduce the fixed component of water pricing and increase volumetric charges**. This approach would address the disincentive water users currently have to consume any less than the volume of water provided at a fixed price. International experience shows that where pricing policy has been most successful in encouraging conservation, the fixed component of water charges has been minimal, and volumetric charges have been high. In Denmark, for example, large reductions in water use have been achieved with volumetric pricing at over ten times the rate currently charged in South Australia (DEPA,1999).

2. **Introduce higher volumetric prices in summer months or increasing block pricing as a form of peak load pricing**. In the South Australian summer water demand is particularly high as the result of additional garden and swimming pool demand. Best estimates are that as much as 50% of residential water in Adelaide is used for watering lawns and gardens (Allen and Pezzanti, 2001). A peak demand pricing scheme could significantly influence this demand. For example, in the water limited U.S. city of San Antonio, Texas, a 30% summer water rate increase lead to reductions in water use of 12% to 14% (Fox, 1995).

One way to implement summer peak demand pricing in the Onkaparinga catchment would involve maintaining the current two-part tariff and increasing the volumetric component of pricing in summer. An alternative way to implement summer peak demand pricing would involve switching to an increasing block structure. Water users would pay a small fixed charge for a small fixed volume of water, and one rate for additional use up to a typical household demand level in the winter. A higher price per unit of water would then be charged for summer irrigation demand in excess of normal winter use.

Table 1 Different Pricing Strategies

Pricing Strategy	Explanation	Disadvantages	Advantages
Fixed Charge	A fixed charge no matter the quantity	No relation to costs	Administratively simple
Flat rate price	A single price per unit charged—no matter the quantity	No relation to costs	Administratively simple
Two part tariff	A fixed component is paid no matter the quantity (this may vary based on user) and a variable component based	- Big users often "subsidise" the small users - Encourages entry of competitors to service the large users.	The fixed charge allows some revenue stability while encouraging a degree of conservation
Declining Block	Each block is sold at a lower price respectively reflecting lower per unit costs	- Doesn't encourage conservation - May result in losses in the long run - Small users take the hit	Encourages economic efficiency when combined with an environmental levy reflecting damages
Increasing Block	Each block is sold at a higher price respectively reflecting lower per unit costs	Encourages entry of competitors to service the large users.	Encourages conservation
Peak Load Pricing	Price is based on which season the water is delivered in*.	The price signals have to be sent in a timely manner	Encourages conservation when water is at its most valuable

** Daytime versus night time premiums would require better metering systems and might be more efficiently dealt with regulations banning daytime watering of lawns and gardens.*

Either policy would be equitable in the sense that higher prices would only be charged for consumption in excess of normal winter demand. Additionally, either policy would be consistent with the principle of highest prices to signal highest value of conservation, as benefits of conserved water to supplement environmental flows are highest in the low flow summer months.

Practical Approaches to Incorporating External Costs into Onkaparinga Catchment Water Disposal Prices

Review of current sewerage water policy in the Onkaparinga catchment for this research identified the current sewerage pricing policy as the key issue discouraging reductions in sewage water disposal. Both residential and business sewerage charges are currently based on a percentage of property value, and do not relate to the volume of sewage generated. Thus there is little incentive to reduce sewage volume. For example, no sewerage charge reductions would be experienced by a landowner who opted for aerobic systems where sewerage is available or a grey water reuse systems, even though such systems reduce sewage volumes entering the system.

Charges for use of the sewerage system based on the volume of sewage generated would encourage reductions in the volume of sewage household and businesses produce through use of aerobic, grey water systems, etc. Sewage volume based sewerage system charges would, however, only be feasible if sewage volumes were monitored, and they currently are not. At least in the case of significant industrial clients, it would seem that the cost of installing sewage meters and charging volumetrically could generate benefits that exceed the additional infrastructure and monitoring cost.

In the case of households, it may be possible to roughly relate sewerage charges to sewage disposal volume by charging for sewerage system use based on water use. The approach is imperfect in the sense that not all strategies to reduce sewage disposal result in reduced water demand. For example, while grey water reuse systems will reduce both water demand and sewage volume, aerobic systems reduce sewage volume without necessarily reducing water demand. Nonetheless, City West Water in Melbourne has taken this approach and achieved good results.

Limitation to Pricing Alone as Water Use Management Approach

The research literature leaves little doubt that pricing policy changes like reduced fixed component in water price and greater volumetric charges for water use can lead to significant water conservation. Nonetheless, there are limits to controlling water use and sewage disposal with price alone:

- Previous research findings suggest that unless radical volumetric pricing such as what has been used in Denmark (approximately ten times current South Australian per KL charges) little conservation may result. Even with significant increases in price, water expenditures still only represent a very small portion of most household budgets, so price changes barely influence demand (James, 1997; Dziegielkewski, 1992).

- Utilities are often concerned about revenue implications of aggressive volumetric pricing reforms because if the long-run response is very significant conservation, reductions in revenue can result, and utilities can be left with insufficient revenue to cover costs.
- There may also be some consumer or industry resistance to aggressive volumetric pricing or lowering of fixed charge components of current water pricing. According to the Water Services Association of Australia (1999), the volume of water that South Australians receive for fixed charge before they begin paying volumetric charges, 125KL is already less than the cut-off volume in other States. For example, Sydney Water uses a cut-off of 165KL, and in ACT the cut-off is 300KL. While community resistance to SA water price increases in 1998 were minimal, resistance that led to legal action could result in protracted legal fights as courts would have to weigh complex consumer protection, and environmental issues (Bjornland et. al., 2001).

The important implication of the finding that pricing policies alone are limited is that the OCWMB may wish to consider advocating a multi-tactical approach to encouraging water use and disposal reductions. Australian and international experience shows that approaches including direct price signals, as well as, subsidy and educational approaches to encourage water saving technology adoption (i.e. low flush toilets, and irrigation timers) work best. The potential of such an approach is discussed in detail in report three in this series.

5 Conclusions and Recommendations

This study evaluates the role of existing water pricing policies for sustain resource management in the Onkaparinga catchment. The main objective of the report is to identify potential opportunities to improve water resource management in the catchment through water price policy reform. Because the Board does not have a great deal of direct control over water prices, these opportunities generally require changes at the State level. These findings are still important because the Board can have influence with well-informed and persuasive arguments especially because in many cases the arguments for the OCWMB interest will reflect interests of other catchment boards.

The conclusions and recommendations of this study fall primarily into two categories:

- General recommendations regarding implementation of general Council Of Australian Government (COAG) water price reform provisions, and
- Specific recommendations regarding pricing of reticulated water and sewage disposal by water utilities in the catchment

COAG Reform Recommendations

The Council of Australian Governments (COAG) Water Reform Framework is driving change in water policy. The framework requires a consistent approach to water reform by all Australian State and local government. Because not all COAG reforms have yet been fully implemented and how they are implemented will influence resource use in the Onkaparinga catchment, effort to influence implementation can have significant local impact. Thus recommendations regarding how three key COAG provisions especially relevant to the OCWMB might best be implemented are summarised below.

State-wide uniform water prices by user type—Under current State policy one price for reticulated is charged to all household water users. Yet it can be supplied at a much lower cost to Adelaide than to outlying areas. COAG reforms discourage such cross subsidisation. While the OCWMB may wish to acknowledge the importance of public investment to maintain a vital rural Australia, the Board could consider advocating rural development policies that preserve the social benefits of a vibrant rural economy but do not contradict important environmental goals like water conservation.

Separation of regulatory and management roles of government in water supply—COAG reform advocates separating the regulatory and management roles of government in water management. Essentially the goal is to open the State water provision monopoly to competition. By separating the two functions, under favourable circumstances, a competitive environment can be fostered that benefits consumers who face lower water costs as a result. However, water utility privatisation has potential disadvantages including:

- The high costs of regulatory efforts to research and a private water provision monopoly, and potentially higher water prices as a result.
- Potentially increasing per unit cost in some areas as a result of competitors with State water utilities attempting to pick off the choice customers (large users who are relatively inexpensive to supply) by offering a lower price in some areas.

While OCWMB may wish to acknowledge that increased competition in water supply and regulation can have desirable outcomes, they may also wish to stress that such reform can have negative consequences and advocate a "go slow" approach.

Full cost recovery water pricing including environmental costs— COAG water reforms require that water prices should be set so that revenues from water sales cover all operating, on-going maintenance, capital expense necessary to ongoing operation, and third impact costs to the environment. Championing the COAG full cost water pricing concept may represent a good strategy to achieve a core OCWMB objective of maintenance of catchment water quality. The specific recommendations with respect to water and sewerage pricing below are all pricing approaches to water prices that are supported in principle by the COAG full cost water pricing provision.

Water Pricing Recommendations

Water pricing that reflects the true cost of water use is a fundamental requirement in any policy designed to encourage economically efficient, and environmentally sustainable water use. Some of true costs of water use are difficult and/or costly to accurately estimate, especially environmental costs. Still, existing pricing systems can often be modified in straightforward ways that create the greatest incentive to reduce water use for those who generate the greatest external cost because they are charged the highest price per unit water used.

There are several elements of the current water price scheme faced by Onkaparinga catchment water consumers that discourage water conservation and sewage disposal minimisation. The Board may wish to advocate the following specific water pricing reforms to encourage improved water quality and reduced water consumption in the catchment:

- Change the current reticulated water pricing system so that pricing is primarily volumetric (a function of water use level). The current system includes a fixed charge for a base volume and a charge for every KL thereafter. From an environmental perspective, a smaller base volume offered at a fixed price and higher charges per KL would be desirable, as it would encourage conservation.
- Best estimates are that as much as 50% of residential water in Adelaide is used for watering lawns and gardens in the summer months. A pricing scheme that charged higher prices for summer water demand over a base volume could reduce this demand significantly.
- Another water pricing reform that OCWMB may consider advocating is a change in sewerage charges to include at least some volumetric pricing component. The current price of sewage disposal households pay is based on property value and consequently includes no incentive to limit disposal. At least in the case of significant industrial clients, it would seem that the cost of installing sewage meters and charging volumetrically could private benefits that exceed the additional infrastructure and monitoring cost. For households, it may also be possible to roughly relate sewerage charges to water use charges.

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