

COST-SHARING AS A TOOL IN A SUSTAINABLE GROUNDWATER MANAGEMENT POLICY- SOME INTERNATIONAL EXPERIENCES^γ

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1 INTRODUCTION

In the recent past, water policy has become a vital issue in many parts of the world. This is evident in the countries fraught with acute water scarcity. Water policy in most countries has reflected the perception that water is not scarce. It has been underdeveloped and heavily focused on supply driven construction and free access arrangements. The free access arrangements creating local commons often end up with overallocation of water and inequitable uses with unsustainable agriculture being promoted. The millennium issues of increased population growth and unchecked exploitation, has led to ecological and environmental damage and economic losses in groundwater resources.

In Australia, neither the urban nor irrigation users have paid a price for water itself; they have merely paid a price for treatment and delivery of services. Even that amount has not been properly costed and wealthy farmers or businesses have been able to access more water for irrigation, often from deeper aquifers which are expensive to develop. The impacts of this development may adversely affect other farmers who rely on groundwater for stock and domestic purposes, and thus create inequity in access to groundwater resources. In India, some of the policies introduced to overcome this inequity include subsidised power and loans, investment on community wells and promotions of water markets. In spite of these policies, there is still a large difference between small and large farms mainly because of huge capital investments involved and the presence of skewed distribution of land holdings (Nagaraj, et.al 1999).

Global experience has indicated that some large scale irrigation schemes have often failed in achieving efficiency in water use and cost recovery due to lack of effective and sustainable institutional arrangements. The predicaments in managing groundwater resource become more pervasive when extraction exceeds sustainable yield. The aim of this study is analyse the cost-sharing scheme as a tool in sustainable groundwater management policy in Australia and to review similar arrangements in other countries and to make suggestions for improvements to the scheme. First, we provide summary of cost-sharing arrangements in USA for groundwater conservation and then we discuss Australian cost-sharing schemes in detail. Globally cost-sharing schemes in groundwater irrigation areas are minimal therefore, an attempt is made to present cost-sharing arrangements aiming to conserve groundwater resource.

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Table.1. Cost-Sharing Schemes in USA

Place	Features of Scheme	Beneficiaries
<p>Kansas (USA) Federal funding to State Governments implemented through local government units Funding from landowners, local government units and state and federal agencies</p>	<p>Groundwater Conservation Assistance Program The State program provides water conservation cost share assistance to water users in the High Plain Aquifer to certified water conservation plans Participants in higher priority areas would receive a greater level of cost share, (a) An agreement with the landowner to decrease total water usage over a five-year period that is beneath their current 5-year total water usage. (b) Provide cost share grants for conversion too more highly efficient irrigation methods. (c) Installation of water meters, and innovative programs such as water right banking in which a reduction in actual water usage is required. (d) Provide cost share grants to farmers to try innovative, environmentally friendly, and low water use cropping and livestock practices.</p>	<p>Water Users/ Irrigators Environment</p>
<p>Colorado River Basin Salinity Control Program, Colorado State, USA Federal funds for Cost-Share Assistance</p>	<p>Eligible owners or operators in approved project areas will receive cost-share assistance to treat salinity problems caused by agricultural irrigation activities. Type and Severity of Salinity Problem, p Proximity to water bodies, Onsite environmental problems, estimated cost, land use charges, seasonal nature of salinity reduction practices to be installed; applicants ability to complete practices in the shortest time practical Up to 70% of the total cost, Length of the assistance 3-10 years</p>	<p>Water (re) users for irrigation, domestic, municipal or industrial water supply or fish and wildlife habitat.</p>
<p>Columbia Basin Groundwater Management Area (GWMA), Othello, Washington State, USA Irrigation Water Management Cost Share Program,</p>	<p>Funds up to 75% or \$12 per acre to irrigator for soil moisture reporting Funds up to 50% or \$7.50 per acre for soil moisture monitoring. The GWMA will cost-share on irrigation Water Management to a maximum of \$25,000 per participant for the 2003 growing season. All irrigators in Adams Franklin and Grant counties and include agricultural operations, dairies, feedlots, golf course and spray field operations.</p>	<p>Irrigators Selected through a lottery-based drawing and availability of the funds. Environment</p>
<p>Clallam Conservation District, Washington State</p>	<p>Conservation Practice Cost-Share Policy, for Irrigation water conservation Cost sharing fund administered by District. Source of funding, Federal, State and Local governments. Uniform Cost-share policy for equitable distribution. Cost-share applicants must sign a Cooperative agreement between Callam Conservation District and Landowner. To improve water quality</p>	<p>All property owners except employees of the District,</p>
	<p>Up to 85% of cost share for irrigation water conservation practices funded through the Irrigation Efficiencies Program.</p>	<p>Irrigators Environment</p>
<p>Lower Trinity Soil and Water Conservation District, Texas, USA</p>	<p>Environmental Quality Incentives Programs, to help producers address serious soil, water, and plant and animal resources concerns. Up to 75% cost-share for installing conservation practices (eg. Land management practices), Maximum cost-share is \$50,000, with a yearly maximum of \$10,000, producers sign min of 5 years contract</p>	<p>Producers Environment</p>

2 COST-SHARING SCHEMES AS A DISPUTE RESOLUTION MECHANISM

Existing institutional arrangements in Australia are not effective in reducing disputes between irrigators and stock or domestic groundwater users arising from irrigation induced drawdowns. This is not surprising given that the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), in developing a national framework for improved groundwater management in Australia, has recommended that;

“in preparing groundwater management plans, States should ensure that efficient utilization of groundwater resources is not compromised by protection of existing users with inefficiently designed or constructed wells (particularly stock and domestic wells)”.

This indicates that wells that are not sufficiently equipped or are not drilled deeply enough should not prevent other users extracting water as long as the extraction is sustainable. It is evident that maintaining existing stock and domestic water supplies at the current depth and flow rate cannot be guaranteed through the water allocation plan (WAP) polices.

We discuss two case studies in South Australia where cost-sharing schemes have or are about to be implemented by local management groups as an innovative tool in settling such disputes. The two areas are located approximately 150km east of the city of Adelaide and are part of the Murray Basin which is a large sedimentary groundwater basin covering 300 000 km² of southeastern Australia (Fig. 1).

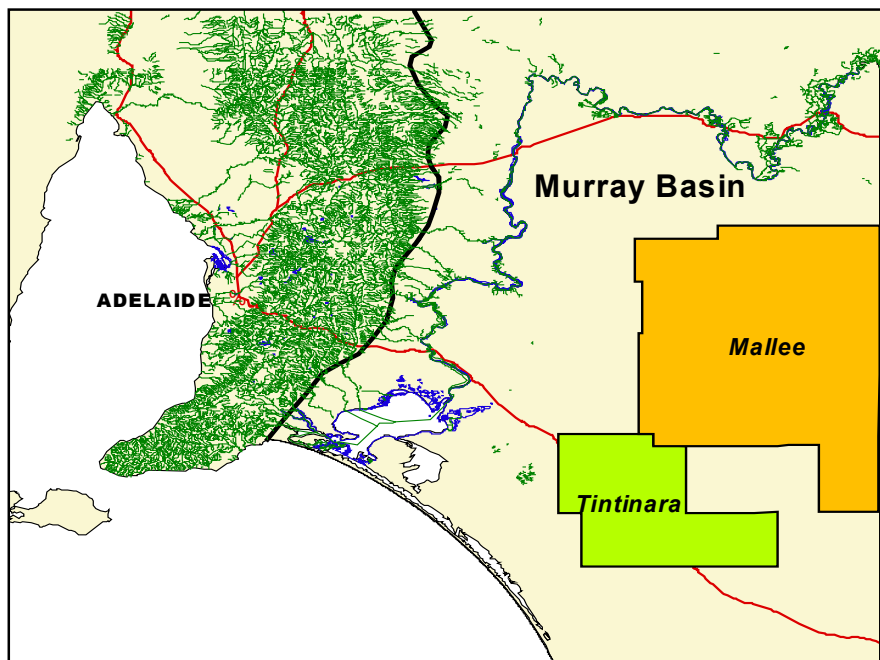


Figure.1. Murray Basin

Mallee Prescribed Wells Area

The Mallee Prescribed Wells Area (MPWA) was proclaimed in August 1983 under the provisions of the Water Resources Act, South Australia 1975. Irrigation in the Mallee region is licensed and has expanded considerably in the past few years. An extensive limestone aquifer is the only source of water in the region, and is developed for irrigation, town water supplies and stock and domestic use for individual farms. The annual sustainable yield of is estimated to be

52 800 ML, with a total allocation of 52 400 ML and actual groundwater use of about 26 500 ML. This area is therefore in a stage of moderate development, i.e., extraction /allocation is between 30% and 70%⁴.

In the area where most irrigation occurs, the limestone aquifer is confined⁵ and lies about 50 m below the surface. Most stock and domestic bores are drilled only about 5 m into the aquifer, however higher yielding irrigation bores (< 60 L/sec) penetrate over 100 m. Regional drawdowns during the irrigation season range up to 15 m which have caused some of the shallower stock and domestic bores to go dry (Fig. 2). Initially, there were some instances where compensation has been paid voluntarily by irrigators to adjoining stock and domestic users to deepen bores or lower pumps. However, as the number of irrigators increased, the precise cause of drawdown at any one place was difficult to determine.

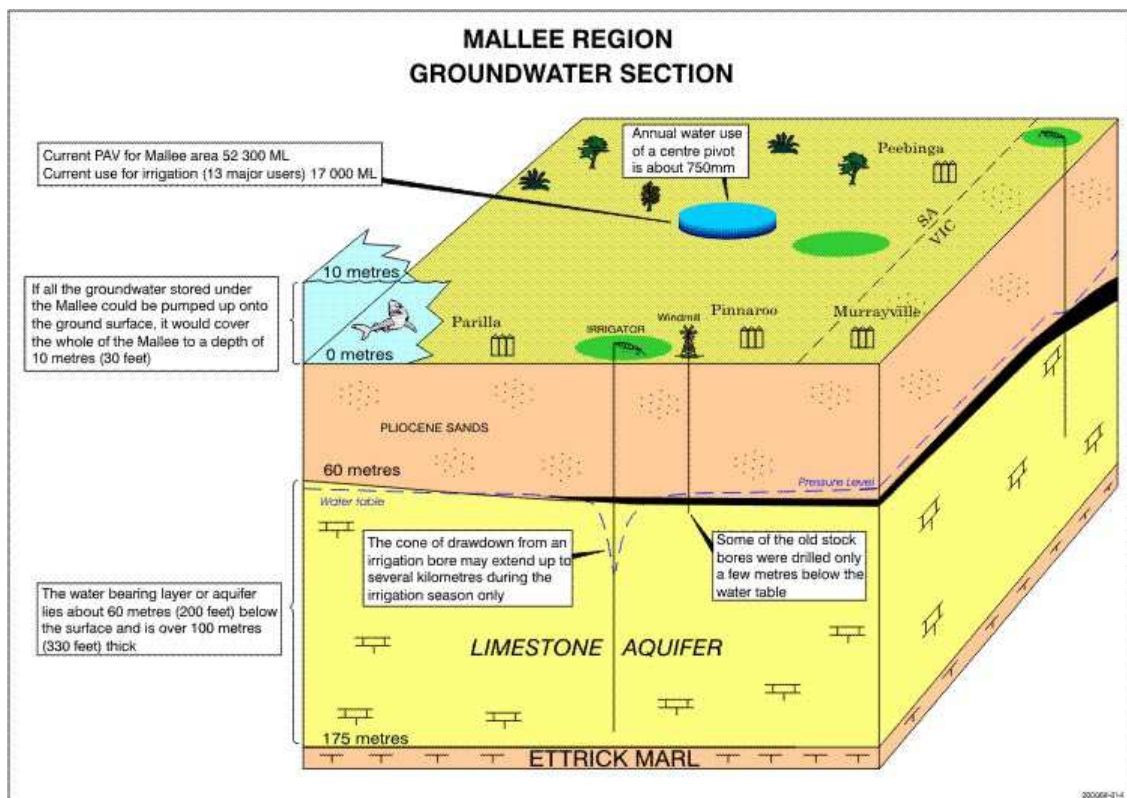


Figure.2. Regional Drawdowns in Mallee Prescribed Wells Area

As a result, the Mallee Water Resources Planning Committee initiated cost sharing arrangements to settle the disputes between groundwater users and to provide assistance to stock and domestic water users for adjustments to their wells. In addition, the Committee wished to encourage more efficient water usage by conducting irrigator-training courses, and carrying out groundwater monitoring and community education programs. The basis for funding the programs is a levy of 0.37 cents per kilolitre of annual allocation, i.e. \$3.70 / ML, raising a total of \$194 000 annually. There is a question whether it is fairer to impose the levy on the amount actually used in any one-year rather than the allocation.

⁴ Water extraction (diversion for surface water or abstraction for groundwater) and or allocation as a percentage of the sum of sustainable flow regime (surface water) and sustainable yield (groundwater).

⁵ Part of the Murray Group limestone aquifer in the Mallee Prescribed Wells Area is confined where an impermeable clay layer, resulting in a pressure level in the aquifer, overlies it. This is generally in the eastern part of the MPWA.

3 COMPONENTS OF THE MALLEE COST SHARING ARRANGEMENT

The guidelines are based on the original proposal for the cost-sharing arrangements in the neighbouring Murrayville Groundwater Supply Protection Area in Victoria, but some changes have been made for the particular situation in the Mallee Prescribed Wells Area⁶. The funds are provided for different purposes such as;

- (i) Pump lowering, if the groundwater levels have dropped below the submersible pump or windmill.
- (ii) Upgrading pumps or windmill if lowering the pump causes the yields and/or lift to be inadequate.
- (iii) Deepening existing stock and domestic wells if the groundwater level has dropped, and the well is not deep enough for the pump to operate successfully.
- (iv) Drilling new wells, if the existing well cannot be deepened successfully.
- (v) Decommissioning old wells that have been replaced by a new well, to avoid salinization or pollution of the groundwater resource.
- (vi) Changing the water distribution on a property if one or more wells need to be deepened or replaced to increase the efficiency of the water supply.

After surveying drilling contractors operating in the region, a series of benchmark costs were determined for the above operations (Table 1). The cost-sharing fund does not provide grants for repairs to pumps or windmills if parts are worn or burnt out (all submersible pumps and associated transfer pumps that may be affected by drawdown have to be fitted with cut-off and/or low-pressure switches at the stock and domestic user's expense). The benchmark costs for replacement of either a pump or a mill is based on the purchase of an adequate submersible pump, not a windmill, because the investment costs for a windmill are considerably higher.

Table.2. Benchmark costs (\$ Australian)

Drilling (new wells)	\$70 / metre
Mobilization costs	\$2 / km
Lowering Pumps	\$35/ hour (one person) \$87.50 per length of pipe (6 metres)
Travel costs	\$0.80 c / km (maximum 150 km)
Upgrading/Replacing Pumps	\$ 35 / hour (one person) 1.5 HP pump: \$ 1800 2.0 HP pump: \$ 2000
Travel costs	\$0.80 c / km (maximum 150 km)
Decommissioning (Plugging a well)	\$300 mobilization costs and removal of pump/mill \$90 / hour
Deepening established wells	\$400 mobilization costs, removal and placing back of pump/mill \$60 / metre or \$90 / hour

Given that the design life of a windmill or pump jack is approximately 50 years with good maintenance, and a submersible pump is 15 years, the cost-sharing fund will not pay for the

⁶ This is a vital aspect, as the nature of problems varies from basin to basin and obviously demanding suitable guidelines to suit the problems faced by the water users.

upgrading of pumps and mills that are beyond their design life. The eligibility to seek funds based on age of the pump and age of the mill are provided below (Table.2).

Table. 3. Eligibility for Cost Sharing Funds

Age of pump (in years)	Fund contribution ⁷	Age of mill (in years)	Fund contribution
Less than 3	100 %	Less than 10	100 %
3 to 6	80 %	10 to 20	80 %
6 to 9	60 %	20 to 30	60 %
9 to 12	40 %	30 to 40	40 %
12 to 15	20 %	40 to 50	20 %
Over 15	0 %	Over 50	0 %

4 ELIGIBILITY FOR ASSISTANCE FROM THE MALLEE COST SHARING ARRANGEMENT

Applicants for the fund must provide all the information about the work carried out as required on an application form. The cost sharing fund will only provide assistance once for each well: that is, it is not possible to apply for deepening first and replacement of the well two years later. However, the lowering for pumps may be required more than once, depending on the level of drawdown, which may change if new irrigation areas are developed. Upgrading of pumps and mills on the other hand should only be needed once and will only receive assistance once.

Stock and domestic users who have been affected by drawdown in the past, before the commencement of the Cost Sharing Arrangement, can also apply for a contribution for deepening or replacement of wells and pumps⁸ if verified records of drawdown in the vicinity of the actual location exist.

If stock and domestic users find that water levels in their well are approaching a critical level and it is very likely that water levels will drop below the level of the pump in the near future, they can decide to make adjustments to the water supply prior to the problem occurring. These adjustments are eligible for contributions from fund if the Committee has concluded that adjustment is justified.

5 TINTINARA COONALPYN PRESCRIBED WELLS AREA

Owing to the success of cost-sharing arrangements in Mallee PWA, similar initiatives are underway in Tintinara Coonalpyn PWA (Fig. 1). At the time of writing, details are still under consideration, but a scheme is highly likely to be implemented soon. The issues are similar to the Mallee PWA, i.e. irrigation-induced drawdowns due to extractions from a deep confined aquifer (by only a dozen or so irrigators). However there are important differences. There are also large extractions from a shallow unconfined aquifer by a larger number of irrigators who are not contributing to the confined aquifer drawdowns.

Again, formal institutional arrangements were not effective in reducing disputes between irrigators and stock or domestic groundwater users arising from irrigation induced drawdowns. The problem in this area is due to the confined aquifer being artesian with most of the stock and domestic wells flowing naturally before irrigation commenced. The drawdowns of only 1-2 m have stopped these wells from flowing, and because some of them are 50 years old and only 50 mm in diameter, they cannot be equipped to maintain their supply.

⁷ Contribution is a percentage of the benchmark costs or actual costs, whichever is the lower

⁸ This reflects the equity in access to benefits from the scheme to water users affected by drawdown before the cost-sharing scheme started.

6 COMPONENTS OF THE TINTINARA COONALPYN COST SHARING SCHEME

The Tintinara Coonalpyn Cost Sharing Scheme has similarities to the Mallee scheme, and will provide funds for;

- (i) Lowering pumps (100% of the benchmark cost).
- (ii) Changing the type of pump.
- (iii) Well deepening for unconfined aquifer wells (100% of the benchmark cost).
- (iv) Well replacement for 50 mm to 80 mm diameter confined wells (a maximum of \$4000 for the first well and a maximum of \$ 1000 for additional wells).
- (v) Equipping previously unequipped flowing wells.

7 UNRESOLVED ISSUES IN TINTINARA COONALPYN

There are several issues that require resolution and are the subject of robust debate amongst the stakeholders. Firstly, there are insufficient confined aquifer irrigators to provide enough funds for the required works for the affected confined stock and domestic users. Should the unconfined irrigators also contribute to the levy (perhaps at a lower rate), even though they are not contributing to the confined aquifer drawdown? Secondly, what percentage of the costs incurred by the stock and domestic users should be provided by the fund? Should 100% compensation be granted when many of the wells to be replaced are over 50 years old?

8 CONCLUSION AND POLICY IMPLICATIONS

The Key Elements of an Ideal Scheme

An ideal cost-sharing scheme should have the following key elements (Box 1)

1 Box 1 Key Elements of Cost-Sharing Scheme

1. Maintaining adequate yield to access the groundwater by making cost adjustments
2. Funds are provided for
 - (i) Lowering pump(s)
 - (ii) Upgrading pumps/mill(s)
 - (iii) Deepening existing well(s)
 - (iv) Drilling new well(s)
 - (v) Decommissioning old well(s)
 - (vi) Changing the water supply plan of a property
3. Participation of all stakeholders
4. Funds will be raised from licensees through levy on water allocation
5. All licensees should contribute to the costs of adjusting stock and domestic water supplies

9 SUGGESTED REFORMS FOR THE SOUTH AUSTRALIAN SCHEMES

The schemes have contributed considerably in settling the disputes between irrigators and stock and domestic users; and should be embedded in the regulatory framework of the groundwater policy. In the areas experiencing groundwater depletion due to intensive use, cost-sharing schemes could be of paramount importance in resolving disputes. One of the problems is that only irrigators have to pay the full cost, which is not equitable. Hence the scheme could be amended in such a way that the beneficiaries (stock and domestic users) also pay some amount because in the long run, they will reap the benefits, which are unaccounted for in the scheme. Since problems resulting from groundwater depletion vary from basin to basin, different strategies could be incorporated in the scheme like instead of “only irrigator” pay, both “user and irrigator pay” principle would be appropriate given that users get benefits from the scheme.

The scheme charges irrigators based on the licensed allocation, so we suggest to charge based on the actual volume of water used for irrigation. The question remains if it is fair to impose the levy on the amount allocated or if the amount used in any one year would be more equitable. This is important because merely paying for licensed allocation will underestimate the value of water. The administration of cost sharing should involve representatives of local water management committee instead of giving it to other agencies, which would increase administration costs (Table.4). The scheme should be sustainable, so that provision can be made if the problems persist in the future. Water that is extracted from the underground (should) be charged to reflect its scarcity value. For a successful implementation of the cost-sharing scheme, it should be embedded in the sound water policy of the concerned state and the federal government. The sustainable cost-sharing scheme demands a framework for an integrated management approach to access the scientific and technical data and information necessary to initiate cost-sharing scheme. This innovative economic tool would be useful in developed and developing countries facing acute groundwater scarcity leading to conflicts between groundwater users. Such schemes or tools should be embedded in the regulatory framework of the water policies.

Table.4. Suggested Reforms in the Cost-Sharing Scheme for South Australia

Particulars	Options		
	A	B	Regulation
Management	Catchment Board	Water Users	√
Price of Water	Groundwater + Catchment Levy	Groundwater + Catchment Levy	√
Cost-Share	Licenseses (Confined) 50% + Licenseses (Unconfined) 25 %	Licenseses (Confined) 50% + Licenseses (Unconfined) 25 %	√
	Beneficiaries 25%	Beneficiaries 25%	√
Administration	Catchment Board + Users Involvement	Catchment Board + Users Involvement	√
Regulation	Ministry for Water Resources	Ministry for Water Resources	√
Dispute Resolution	Catchment Board + Water Users + Ministry of Water Resources	Catchment Board + Water Users + Tribunal or Court such as the Environment Resources and Development Court SA	√

Note: √ = compulsory.

Water sector reforms can rely on existing legislation or can be built around new proposed legislation and authority. Hence the cost-sharing tool could be embedded in the legal framework of the water regulation. Licensing could be made compulsory to check on groundwater drawdown, which would otherwise result in unsustainable use creating several externalities, which cannot be internalised in the long term.

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