COST OF IGNORANCE-

EVALUATING A LAND AND WATER MANAGEMENT PLAN

Christine M. Hill
Senior Economist

Socio Economic Assessment Unit
Department of Land and Water Conservation

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Abstract

This paper outlines the impacts of ignoring the costs to the community of increased rural waterlogging and salinity. It identifies the cost of no further action, and the costs and benefits of undertaking a land and water management plan. The processes of developing and evaluating the plan are explained. Difficulties in obtaining data, both for the community and the economist, are discussed. Data availability then shapes the range of costs and benefits that can be evaluated. The paper looks at the process and results of a case study of a Land and Water Management Plan for an irrigation district in central New South Wales. The case study demonstrated all the complexities of community and professional conflict, difficulties in data availability, budget and time constraints and a rigorous review process. Also discussed are the implications of recommendations of this Land and Water Management Plan Economic Evaluation for the community and government.

Keywords; land and water management plan, economic evaluation, salinity, waterlogging

Socio Economic Assessment Unit DLWC **PO Box 5336 Wagga Wagga NSW 2650**
Wagga Wagga **Tel: (02) 69 714 140**

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1 INTRODUCTION

The process of developing land and water management plans is littered with obstacles for all stakeholders. Often conflict arises between the need for information, the reasonable expectations of what information can be realised, and then the issues of funding. Underlying this is the historic context of the current waterlogging and salinity issues. Encouragement by governments to clear land and develop irrigation has been widely blamed. The issues now being addressed are what to do and who will pay. However, first there needs recognition that the problems are severe enough to canvass action from the local community and other stakeholders. Then comes the arduous task of gathering sufficient information on the issues - a minefield which can bring a project to a halt and/or result in considerable conflict. The questions arise as to how much information is required. Economists can readily solve this by addressing the limiting variables of time and budget, with allowance for risk. However, the community need (and often that of the funding body) to gather technical data, which is often in danger of becoming the end rather than the means, can be compounded by conflicting results and implications.

This case study of a land and water management plan (LWMP) addressed the issue of the cost of ignorance, not only in not undertaking the plan, but also in the implications of imperfect data. The difficulties in obtaining data in an economist user friendly form are outlined, as are the implications of not obtaining measurable impacts. The results outlined in the case study are preliminary, with the inclusion of final options still under discussion by the community.

The case study plan area covers 163,000 hectares in central west New South Wales, Australia. This includes an irrigation district (ID) of approximately 90,000 hectares. The balance of the area, being outside the irrigation district, is predominantly dryland with some riparian irrigation. Issues of salinity and waterlogging were perceived as the major factors affecting the environment over the thirty-year period of the plan, and the plan incorporates measures to minimise damage. While the area is predominantly agricultural land, the plan area did include a significant ephemeral lake and wetland.

2 ECONOMIC EVALUATION

The economic evaluation consisted of quantifying the benefits and costs incurred in undertaking a land and water management plan over 30 years. These benefits and costs, incurred at different stages, were then discounted to enable comparison in today's dollars and provide present value benefits and present value costs. To determine if a course of action is considered economically viable, the difference between present value benefits and costs, called the net present value, needs to be positive. A similar measure of economic viability is the benefit cost ratio, which is the present value of benefits divided by the present value of costs. A benefit cost ratio of one or greater is an indicator of economic viability.

Undertaking an economic evaluation of a plan, whether it be a large scale or small scale project, has a number of advantages apart from the obvious results of net present value and benefit cost ratio. The proponent, usually a community group, in undertaking the project, recognises the goals and likely outcomes of the plan, the limitations of mitigating actions and the often significant cost of procrastination. Also, the enormous cost of favoured capital expenditure activities is brought into perspective when benefits are actually quantified.

The evaluation did not attempt to quantify, but did identify environmental benefits from the implementation of the plan.

2.1 Methodology

A benefit cost analysis was employed in this study. The extensive land and water management plan spreadsheet model, developed by the Socio Economic Assessment Unit in the NSW Department of Land and Water Conservation, incorporated all input data for benefits and costs by option and was applied in this evaluation. Thus direct benefits and costs, option by option, were readily identified, which is particularly useful when presenting the information to the community and stakeholders. This enables the ready assessment of options and the immediate impacts of excluding the least viable options.

The plan assessed 8 options and 40 sub options, which were discussed at length throughout the technical development of the plan and further when under scrutiny of the economic evaluation. This evaluation, incorporated into the draft plan, will be reviewed and possibly revised again by the stakeholders before approaching the funding bodies. The LWMP spreadsheet model provided cashflow analysis by option in order to facilitate cost sharing discussions. As well, sensitivity analysis was included to incorporate uncertainty in key parameters.

2.2 No plan scenario

The *no plan scenario* was crucial to the evaluation exercise, as it established the base case on which the *with plan scenario* could be quantified. By definition it identified and quantified the continuing degradation of the plan area if no further action were undertaken to minimise salinity and waterlogging. However, it did recognise the continuation of avoidance measures that would occur without the plan implementation. Under the *no plan scenario* activities such as landforming, development plans, whole farm irrigation designs, recycling systems, lucerne planting along channels, bay sensors and soil tests were being carried out to some extent. The benefits and costs of these were excluded from the *with plan scenario*, otherwise the economic evaluation would be double counting. Often these adoption rates of activities such as landforming, farm planning etc were difficult for the community to recognise and itemise in this context. Underestimating current adoption rates would lead to an overestimation of benefits of the plan, but funding authorities are particularly aware of this possibility.

The *no plan scenario* looked at the costs incurred in lost agricultural production due to ongoing and increasing problems with rising watertables (Lyall and Macoun 1997) and salinity (McClintock and Jones 1995). Damage to roads over the next thirty years due to waterlogging and salinity was also costed.

In the case study, the economic evaluation of the *no plan scenario*, which represented the increase in salinity and waterlogging over a thirty-year period if the plan were not implemented, was exceedingly difficult. Insufficient data were available to evaluate the areas affected by salinity in a large section of the plan area; therefore the losses in the *no plan scenario* were underestimated. However, agricultural yield losses in the area were estimated to be at least $69 million to $73 million in present value terms over 30 years, with road damage being minimal, estimated at a maximum of $1.4 million.

2.3 With plan scenario

The *with plan scenario* consisted of quantifying and qualifying the benefits and costs of the options and sub options that constituted the plan. The purpose of the economic evaluation was to establish the economic viability of the proposed plan. Again the stream of benefits and costs were discounted over thirty years to determine the net present value.

Economic viability is indicated if the overall benefit cost ratio is equal to or greater than one, meaning that the net benefits of the plan were positive. All options in this plan were evaluated for benefits and costs, but not all options were themselves viable. However, their implementation was considered important either to the community, the environment or to the technical and economic viability of other options. Most options were planned for implementation within 15 years although the benefits were calculated over the life of the study, being 30 years.

2.3.1 Options

The economic evaluation of the land and water management plan considered the following options;

- on-farm options in both the irrigation district and outside the irrigation district
- channel seepage,
- floodway management,
- surface drainage
- vegetation strategies,
- education strategies
- implementation costs
- groundwater pumping.

Within these main options were 40 sub options which required evaluation of costs and benefits. The on-farm options included landforming, development plans, whole farm irrigation design, bay sensors, soil tests and planting improved pastures and lucerne for both within the irrigation area and outside the irrigation area. Benefits and costs were identified for every sub option. Benefits were quantified in terms of agricultural yields, accessions saved, water removed from the soil profile and/or increased irrigation efficiency.

The channel seepage option consisted of minimising accessions to the watertable by planting lucerne along both sides of the channel at a width of 20 metres, and lining the channel partially and/or completely in parts. This would be undertaken in a 5-year timeframe.

Floodway management consisted of reducing accessions by building a series of levees to isolate floodwater from soils known to be highly permeable, therefore reducing accessions.

While by itself it had a negative net present value, this option was seen to underpin the benefits of other activities to reduce accessions and lower the watertable.

Surface drainage, designed to reduce the incidence of waterlogging, consisted of 292 kilometres of drains and waterways to direct surface runoff into storages. The evaluation of costs and benefits included the impacts of;

- reduced waterlogging of soils
- reduced flooding of depressions, or ponding
- reduced incidence of salinity
- increased water available for reuse.

Vegetation strategies consisted of protecting remnant vegetation and new plantings. This option was expected to have considerable non quantified benefits. Increasing vegetation cover;

- adds to overall biodiversity
- accesses biopumping
- improves aesthetics
- reduces damage to roads from high watertables.

The education strategy included the development of research areas near the ephemeral lake to be used for regeneration trials and for monitoring the effects of grazing. The plan also proposed an interpretive centre to be built in a game reserve near the ephemeral lake. No direct benefits were quantified for these sub options, although they will add to knowledge of future management strategies and of visitors.

The costs of implementation were based on salaries and on costs for an executive officer and two scientific officers over a thirty-year period. Expenditure included lease and running costs for three vehicles. Purchase of office and field equipment was included in the first year and updated every ten years.

Some groundwater levels in the plan area were within 3 metres of the surface with groundwater shallower than 2 metres over large areas. The objective of pumping groundwater was to lower the watertable by 2 metres and create a buffer zone so that flooding would have a minimal effect on the implementation of best management practices. Costs incurred were the airlift pumping costs of bores, pipes, compressors and their operation and maintenance. Other costs included the purchase of land and construction of evaporation basins.

2.4 Results

Table A summarises the total benefits and costs of the case study land and water management plan. Benefits were measured several ways. Generally, a value was given to avoided accessions, removal of water from the soil profile and increases in water available for reuse. Reductions in salinity and waterlogging were valued by the ensuing marginal impact on gross margins. Environmental benefits were identified but not quantified. They included improvements in flora and fauna habitats as well as in aquatic habitats. From the vegetation option, environmental benefits included improvements in biodiversity and aesthetic benefits.

TABLE A TOTAL BENEFITS AND COSTS

$ '000

Option	Water Benefits	Other Benefits	Total Benefits	Total Costs
On Farm Options				
inside ID	642	76,905	77,547	32,982
outside ID	180	23,315	23,495	10,621
Channel Seepage	88	2,179	2,267	3,421
Floodway	173	0	173	349
Surface Drainage	1,464	51,315	52,779	10,913
Vegetation	11,074	3,014	14,088	13,741
Education	0	0	0	63
Implementation	0	0	0	7,658
Groundwater pumping	0	12,550	12,550	29,196
Total	**13,629**	**169,279**	**182,908**	**108,944**

ID irrigation district

Table B indicates the benefit cost ratios for each option, as well as present values of benefits and costs. The economic results indicated that the plan could be considered economically viable, based on the expectation of unquantified benefits, with a benefit cost ratio of 0.98 and a net present value of minus $1 million.

TABLE B PRESENT VALUE OF BENEFITS AND COSTS

$ '000

Option	Water Benefits	Other Benefits	PV Benefits	PV Costs	BCR
On Farm Options					
inside ID	198	24,226	24,424	14,470	1.7
outside ID	58	7,270	7,327	4,313	1.7
Channel Seepage	33	829	862	1,743	0.5
Floodway	54	0	54	193	0.3
Surface Drainage	487	18,047	18,534	6,312	2.9
Vegetation	3,382	920	4,302	6,867	0.6
Education	0	0	0	37	-
Implementation	0	0	0	3,180	-
Groundwater pumping	0	4,640	4,640	24,100	0.2
Total	**4,212**	**55,932**	**60,143**	**61,215**	**0.98**

Clearly, while the overall plan could be considered economically viable, some options did not appear so. Not all the options were independent, for example, the floodway management option maximised the success of other options in achieving impacts on salinity and waterlogging. Again the unquantified benefits need to be recognised. The unquantified environmental benefits were perceived as minimising the threat of salinity to the ephemeral lake, improving habitats and biodiversity through improved and expanded native vegetation areas, and more productive riverine habitats. Aesthetic values from increased vegetation were not quantified.

Tables A and B indicate the impacts of discounting, particularly where capital costs are incurred in the early period of the plan in order to achieve the longer term benefits. In fact the benefit cost ratio could be expected to improve given a longer period of study.

2.5 Issues in data gathering and availability

When land and water management plans such as this case study are initiated, there is an expectation that considerable technical expertise exists in the specific areas of degradation and rehabilitation. This is not always the case, and the timeframes of the studies limit the research able to be initiated. Both the funding bodies and the stakeholders need to recognise that much information is based on educated and experienced guesstimates. The use and acceptance of this resource would enable many more communities to establish indicative guidelines and evaluate the economic viability of their activities.

A focus on specific numbers and benefit cost ratios does not accommodate this lack of data. Acceptance of a range of outcomes could be more useful to assessments, as could the use of threshold analysis, particularly where non quantified benefits clearly exist. Despite an approach that desires precision, results can be robust within a range of outcomes.

2.6 Implications for funding

Cost sharing has basically been on the principle of beneficiary pays. If applied to this plan as it currently stands, there appear to be considerable benefits to landholders in altering their on-farm management practices. Water benefits included extra water available for use due to increased efficiency. Other benefits were the increase in gross margins due to reduced salinity and waterlogging in the plan area, as well as shifts in farming practice to increased areas under improved and perennial pastures. Clearly the majority of benefits were in gross margin increases except for the vegetation strategy which was significant in reducing accessions.

This outcome indicated that a number of areas facing potential losses in productivity due to salinity and waterlogging could benefit from undertaking a preliminary economic assessment, even without the expectation of extensive external funding.

3 DISCUSSION AND CONCLUSION

The case study of a land and water management plan was situated in central New South Wales and included an irrigation district as well as dryland agriculture. Issues facing the community were of salinity and waterlogging, which were having detrimental impacts on agricultural productivity, a situation that was expected to worsen under the no plan scenario. The local environment, including a significant wetland and ephemeral lake, was also at risk. The draft plan is currently being completed and will be again perused by the community before scrutiny by an external funding body.

The economic evaluation of this land and water management plan case study indicated that while the overall plan could be considered viable, there were a number of options that did not appear economic as currently presented. The LWMP spreadsheet model, which incorporated the 40 sub options evaluated, readily enables the community to reconsider the components of the plan, and more importantly, easily facilitates varying inputs in the light of expanding knowledge.

The outcome of this evaluation indicated that communities might be well advised to undertake at least preliminary economic evaluations to indicate viability of concepts and actions. Seeking perfect data can be a waste of resources given the levels of uncertainty in the technical inputs and the ability of economics to accommodate uncertainty.

The results of the case study were encouraging in that there appeared to be direct benefits to participants as well as benefits to the environment and the broader community.

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