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THE ECONOMICS OF SALINITY CONTROL IN THE SHEPPARTON REGION OF NORTHERN VICTORIA

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1. INTRODUCTION

The Shepparton Irrigation Region is located in Northern Victoria and covers some 0.5 million hectares. There are 100,000 people in the region, and the region produces $2,600 million in output each year.

The high watertable problems being experienced in the Region occur as a consequence of the major change in the hydrologic cycle of northern Victoria which commenced with the clearing of the forests of the middle and upper watersheds from the 1850s onwards. The change was exacerbated with the subsequent introduction of irrigation.

High watertables now underlie some 188,000 ha. (36%) of the Region and are projected to extend to 274,000 ha (55%) of the Region within the next 30 years. The physical impacts of these high watertables on the social, environmental and economic characteristics of the Region will be substantial.

The Shepparton Land and Water Salinity Management Plan was drafted in 1989, the aim of the plan being,

> "To manage the salinity of land and water resources in the Shepparton Irrigation Region in order to maintain and, where feasible, to improve the social wellbeing, environmental quality and productive capacity of the Region" (Salinity Pilot Program Advisory Council 1989).

In the course of developing the management plan, a number of economic studies were undertaken to assess the economic benefits of groundwater control through sub-surface drainage (Dwyer Leslie 1989, 1988a, 1988b, 1987). This paper has been prepared as an overview of those studies on the benefits of groundwater control.

In order to estimate the benefits of groundwater control, detailed information was obtained on farm and farm family incomes on the effects of salinity and salinity control on farm family incomes and on the effects of salinity and salinity control on the regional economy.

Environmental benefits were also examined and these are discussed in the Shepparton Land and Water Salinity Management Plan (Salinity Pilot Program Advisory Council 1989).

2. THE FARM SOCIO-ECONOMIC SURVEY

The first step undertaken in assessing the economic benefits of groundwater control was a detailed farm survey. This was necessary because available data were either incomplete or strongly biased in relation to the structure of farm operations, outputs of farms and the costs of operating farms.

For example, in the case of dairying, good data were available from factories on outputs of individual properties and the RWC had data on water use on those properties. However, there was only limited data on industry structure and costs data which comes from DARA's Dairy Farm Management Survey for which the pre-qualification was the possession of 80 milking cows with a sample of only about 25 farms in Northern Victoria.

Available information on grazing enterprises and various other mixed grazing and cropping enterprises within the region (making up some 40% of all enterprises and using about half of the total land) was virtually non-existent.

In the farm survey undertaken by Dwyer Leslie a random sample of 158 farms was selected from the RWC "Land Register" for each irrigation area. Some 49 farmers did not wish to participate further during the initial telephone contact. The reasons were various and valid and nothing much could be inferred from refusals. A further 15 farmers refused to participate after they had seen the questionnaire, especially the requirement for detailed financial records.

Finally, three surveys were deficient in a respect which made them unsuitable for further processing, leaving a total of 91 detailed surveys (110 farm households) to be processed and analysed.

Data were collected in relation to:

- areas operated by type of activity by enterprise type
- demographic and educational data by gender
- water use by source, enterprise, and crop type
- groundwater pumping
- utilisation of re-use systems and conditions of releases therefrom
- tree planting
- farm relayout: extent, benefits, costs, problems
- perceptions of groundwater problems and potential solutions
- production, income from all sources for all members of the household and costs.

3. THE FUTURE RURAL HOUSEHOLD INCOME MODEL

A forecasting model was designed which allowed the estimation of future rural household income in the Shepparton region. The anticipated changes in production as a result of groundwater control could then be used in the model in order to compare estimates of future incomes with and without salinity control.

The model was created to meet the following requirements:

(i) It allowed for future change in all of the following major determinants of farm household income:

A.	prices received	-dairy output
		-(weighted average) for "other" outputs
B.	input costs	-dairying
		-(weighted average) for "other" activities
C.	exogenous changes in farm productivity	
D.	exogenous changes in off-farm incomes	

(ii) It allowed for the effects of salinity on farm output and farm household income.

(iii) It allowed for the effects of structural change including farm amalgamation and estimated the consequential off-farm migration.

(iv) It estimated the distribution of farm household income in all the above circumstances and hence provide an absolute measure of rural poverty as well as more meaningful urban: rural comparisons.

(v) It estimated changes in total regional agricultural output and total regional input costs and these were inputs into a model of the regional economy.

(vi) It estimated the benefits of groundwater control on a regional basis.

The model was constructed as a spreadsheet with appropriate linkages and sub-routines to handle all of the above requirements. Input factors (namely prices, costs, productivity, off-farm income and salinity effects) were varied and re-calculations performed.

An important feature of this model, which formed the basis for all future work, was that each individual property - all 91 of them - continued to operate as an individual property. For each set of calculations each property had its input costs, output prices etc. changed in accordance with factors appropriate to the case being estimated. The vital features of this approach were:

- Modelling was done using actual farm property and household data. Usually, in analyses of this type an "average" dairy farm or an "average" mixed farm is produced and such hypothetical farms form the basis of the analysis.

- Estimations of current gross margins for an "average" or "typical" farm were not required as the actual gross margins of the surveyed farms were used throughout the analysis.

- It was not necessary, as is usually the case, to create an abstract world where everything except the two variables being used (in this case salinity and "gross margin") were held constant. In other words the dynamics of the real world can better enter the estimation procedure.

The Without Salinity model was run with each of the input values (price, costs, productivity and off-farm income) allowed to take best, estimated (most likely) and worst values in each of the forecast years. The best, estimated and worst indices for each of the input values were based on existing time series data. For example, in the case of the cost indices, the worst case index was obtained from an exponential trend line based on Australian Bureau of Agricultural and Resource Economics (ABARE) Prices Received Indices for 1970/71 - 1986/87. This regression indicated a continued upward trend. The estimated case index was based on the assumption of a continued increase in farm costs until the year 2000, followed by a reduced rate of increase in the light of lower rates of tariff protection and the anticipated removal of central wage fixing. Finally, in the best case index it was assumed that prices remained constant.

Table 1 shows selected forecasting values used in this work. The data shown are from the "as estimated" case. The high and low cases are not reported here.

Incomes were forecast for two time periods, the years 2000 and 2025, and the model was run for every combination of input values resulting in (3^4) 81 scenarios or cases in all. For each of the 81 cases a result was obtained for all of the sample farm households (110 in all). Household incomes were then averaged for each of the 81 cases. For each of these a probability was calculated based on the probability of outcomes shown in Table 2. This gave a distribution of probable incomes.

The distribution of farm incomes obtained was then compared to future distributions of farm income estimated for a "do nothing about salinity" case. In the "do nothing" case measures to overcome salinity were restricted, on a public scale, to extension work only (i.e.:- no new surface or sub-surface drainage works) and, on a private scale, to on-farm works and water re-use systems for use on individual properties only.

The "do nothing" case is discussed in more detail in the next section.

TABLE 1: SELECTED FORECASTING INDICES: Estimated Case

YEARS	PRICES RECEIVED a.		PRICES PAID b.		PRODUCTIVITY c.	OFF FARM INCOME d.
	DAIRY	OTHER	DAIRY	OTHER		
1984	1.00	1.00	1.00	1.00	1.00	1.00
1990	1.03	1.00	1.09	1.09	1.05	0.96
2000	0.96	0.95	1.38	1.31	1.29	0.94
2010	1.03	1.06	1.44	1.37	1.59	0.98
2025	1.15	1.23	1.44	1.37	2.16	1.18

a. based on BAE Indices of Prices Received
b. based on BAE Indices of Prices Paid
c. based on DARA (various issues) Dairy Farm Management Study
d. based on ABS (various issues) Average Weekly Earnings State and Australia
Source: Dwyer Leslie (1988) Future Rural Household Incomes

TABLE 2: SELECTED PROBABILITY VALUES

	Worst Case (1)	As Estimated (2)	Best Case (3)
(A) Prices received	0.3	0.5	0.2
(B) Prices paid	0.3	0.6	0.1
(C) Productivity	0.1	0.5	0.4
(D) Off-farm income	0.4	0.5	0.1

Source: Dwyer Leslie (1988) Future Rural Household Incomes

This work was an intermediate step in the task of estimating what the effect of salinity will be. In the simplest terms the model estimated that the most probable outcome was an average increase in real household income of 2.75% per annum over the longer term forecast period (to the year 2025), assuming that there was no further effect from salinity. In the medium term (to the year 2000) the most probable outcome was estimated to be an average annual increase in farm household income of only 0.45% per annum.

4. ESTIMATING THE EFFECTS OF SALINITY

4.1 INTRODUCTION

Estimates on the effects of salinity on production and the subsequent effects of production losses on farm incomes and the regional economy were obtained from the following sources:

(i) From the Victorian Department of Agriculture and Rural Affairs: estimates of the relationship between root zone salinity and the productivity of perennial, annual and dryland pastures

(ii) From the Victorian Rural Water Commission: estimates of increases in soil salinity over time and forecasts of future high watertables.

(iii) From Dwyer Leslie: estimates of agricultural losses based upon the estimates in (i) and (ii) above, the data set obtained in the farm survey and the modelling procedure developed in the "Future Rural Household Income Model". Dwyer Leslie also measured the impacts upon regional output, employment and income (wages and salaries) of the "Do Nothing" case.

(iv) From the Department of Conservation, Forests and Land: descriptions of the environmental impacts of the no-intervention option.

4.2 THE PASTURE YIELD DECLINE CURVE

The essence of items (i) and (ii) above is a yield decline versus time relationship for pastures in the Shepparton region. It can be described in the following data set.

When watertables reach 2m from the surface the loss =	2.84% of production
After 20 years losses will be	20.91% of production
After 40 years losses will be	29.84% of production
After 60 years losses will be	33.46% of production

4.3 THE DWYER LESLIE ESTIMATES OF AGRICULTURAL LOSSES

Estimates of agricultural losses from salinity were made using price, cost and productivity variables described previously and the pasture yield decline curve given above.

The procedure required an estimate of when farms became subject to high (hwt) watertables or when they would become subject to high watertables. Based upon the known location of the surveyed farms and the known extent of high watertables at specific points in time the following categorisation of properties was used.

		No.	Cumulative Total
(i)	Farms in the hwt zone by 1960	5	5
(ii)	Farms subject to hwt between 1960-1980	13	18
(iii)	Farms subject to hwt between 1980-1986	20	38
(iv)	Farms subject to hwt between 1986-2000	10	48
(v)	Farms subject to hwt between 2000-2020	11	59
(vi)	Farms with no problem by 2020	12	71
(vii)	Farms in areas of insufficient watertable information - treated as category (vi)	20	91

The farm household income models described in Section 3 were re-run with specific salinity factors which are a function of the time (years) from the onset of high watertables to the "current" year (1986, 2000 and 2025 were the years used). The salinity factor was applied directly to farm production.

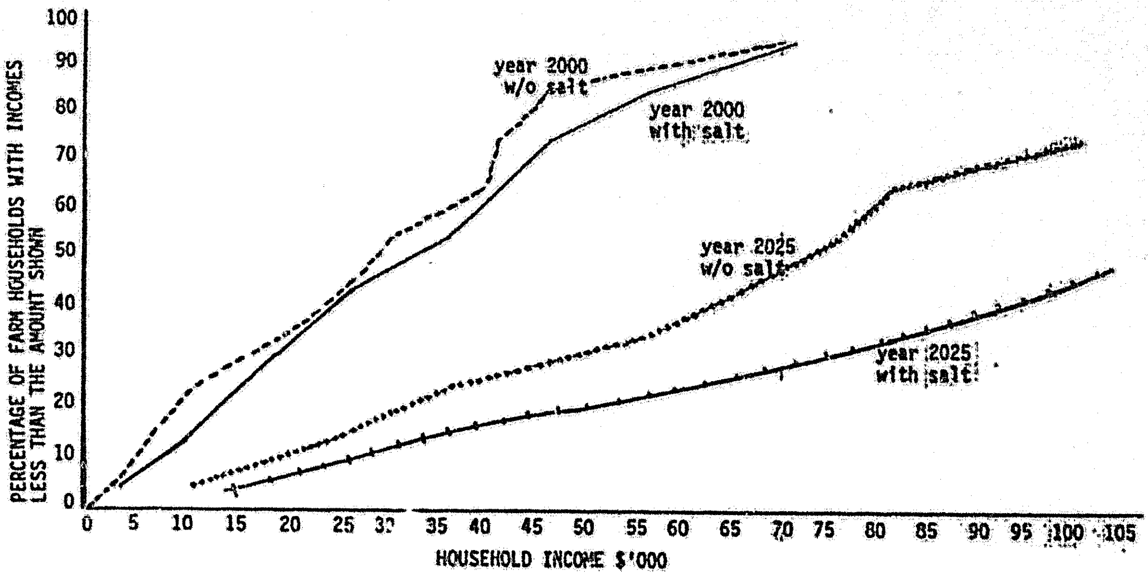
The procedure required rules for when farmers were deemed to be insolvent (and thus left the property) and what subsequently happened to the property. The following rules were adopted.

- When total household income became negative, that farm was removed from the list of 91 farms.
- The gross farm income of insolvent farms was re-distributed to the remaining farms in direct proportion to the forecast gross farm income of the particular remaining farms. The rationale is that either the land remains in production with a new owner, or the new owner transfers the water, the limiting factor of production, to other land thus maintaining production. Either way, regional gross farm income is maintained, but at a reduced level because of the salinity effects.
- The farm costs of each remaining farm were increased by a factor which was 2% less than the factor applied to additional gross farm income. This takes into account the improved efficiency of the new managers.

The result of running the model with the above data and rules, in any given year, is a new distribution of incomes among the farm families who remain in the industry.

A comparison of the with salinity and without salinity farm household income distributions is given in Figure 1. A comparison of these cases provides a measure of the losses associated with salinity.

FIGURE 1 : RURAL HOUSEHOLD INCOME DISTRIBUTIONS 2000 AND 2025



Source: Dwyer Leslie (1988) Future Rural Household Incomes.

5. AN ESTIMATION OF REGIONAL INDIRECT BENEFITS

The pecuniary effects of salinity can be divided into those effects stemming directly from high water tables, namely the income loss to farmers, and those arising indirectly, namely the income losses to the remainder of the regional economy. Potentially, those who provide inputs to the farm business and farm household and those who process and handle farm output could be indirectly affected by salinity as well as the industries that, in turn, service those businesses.

Whether this potential loss becomes an actual loss depends on first, whether the demand for inputs or for the processing of outputs is altered by salinity and, second, whether any change in demand due to salinity in the region can be offset by finding alternative sources of demand.

Turning firstly to the supply of farm business and household inputs, the evidence suggests that the demand for recurrent farm inputs remains constant in the face of higher watertables with the exception of feed costs which may well increase due to the need for supplementary feeding. There are also likely to be changes in capital purchases with a switch in capital expenditures from non-salinity control related (e.g.:-milking equipment and buildings) to salinity control related (e.g.:- groundwater pumps and surface channel improvements). Those who provide capital items to the farming industry will also have to restructure in the face of this changing demand.

Aggregate farm household expenditure in the region will be influenced by changes in income in the absence of salinity control and also by changes in the farm population. It would seem likely that over the long term farm size in some areas will have to increase if herd size is to be maintained.

The other link to be considered is that between output from the farm sector and the processing and handling of that output. As little is known about how salinity will effect the sales of livestock and other non-milk farm output the focus is on milk output. Milk sales accounted for almost 90 per cent of Victorian dairy farmers cash farm income in 1988/89 (Greenaway 1990) and almost all of the milk produced locally is processed locally. The information on the effects of salinity on pasture yields (refer section 4.2) was adjusted to give an estimate of the effects on milk yields.

The loss of income to the suppliers of inputs and the processors of outputs from salinity can be estimated using input-output methods (Jensen and West 1986, Hewings 1985). To represent better the effects of salinity on the Shepparton economy it was assumed that the fall in production occurred in the dairy processing sector (as almost all milk produced locally is processed locally) and that dairy farm business costs would remain constant with salinity.

Using input-output methods the regional household income multiplier was estimated at 0.314 and the gross operating surplus multiplier (representing returns to capital, land and management) at 0.363, giving a total effect on regional value added of 0.677 for every dollar (1.000) change in the value of output of the dairy processing sector (Lynn 1989). Using the agricultural gross value of production loss estimates given in Table 4 of $119 million per annum (based on a butterfat price of $4.60/kg), losses in the dairy processing sector would amount to $99 million in the year 2000, rising to $2[illegible]4 million per annum in the year 2025. By applying the relevant multiplier the fall in regional household income, annually, is estimated at $92 million in 2025. When the fall in gross operating surplus is added the annual regional loss becomes $171 million in 2025.

The sectoral incidence of this change is illustrated in Figures 2 and 3. It is estimated that 30 per cent of the decline in regional income would occur in the dairy processing sector, 30 per cent in the dairy farming sector and 40 per cent would occur in other sectors in the economy, particularly retail trade and manufacturing. The estimates of income loss to dairy farmers using input-output methods results in an estimate considerably lower than that obtained from the future rural household income model given in Table 4. This would be due mainly to the linearities in the input-output modelling procedure.

These production loss figures incorporate future productivity growth, thus use of these figures assumes that the dairy processors are able to process the increases in milk production associated with productivity increases under the same cost and price structure as they presently operate. Historically there has been a trend among the dairy factories in Shepparton Region to amalgamate in order to have larger volumes of milk processed in the remaining factories, thus permitting economies of scale. It is realistic to assume that the trend toward larger volumes within factories will continue.

The final question to be addressed is whether the losses to the regional economy calculated using multipliers can be classed as benefits if salinity control prevents those losses. The legitimacy of including secondary impacts as benefits has been discussed in Wesney and Woolcock (1978), Bottomley (1980), Chalmers and Threadgill (1981) and Olson (1983). In short, these losses (change in regional value added) can be classed as benefits if there are no alternative uses for the resources, thus giving them a zero opportunity cost. There is evidence in the Shepparton regional economy that suggests

Figure 2
Income Distribution Due to Salinity Control: Shepparton Region.

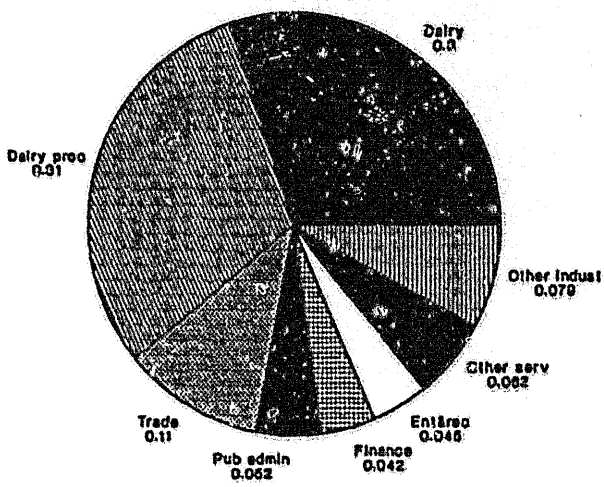
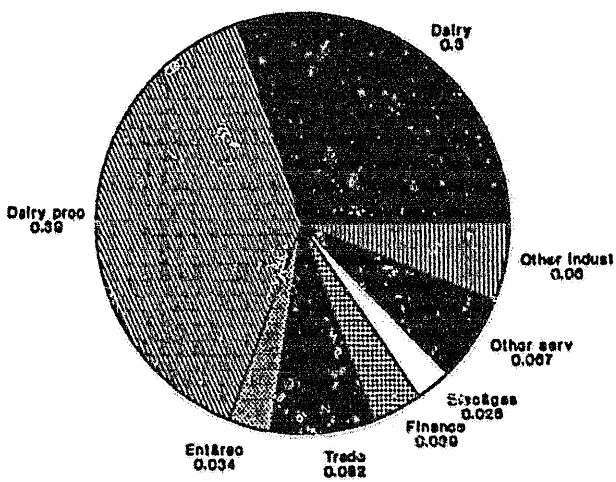


Figure 3
Value-Added Distribution Due to Salinity Control: Shepparton Region.



there would be few alternative uses for many of the resources involved in supplying inputs or handling the outputs of the dairy farming sector. This evidence is summarised below:

(a) Unemployment rates are high relative to the rate for non-metropolitan Victoria and for Victoria as a whole (Greater Shepparton Development Committee 1987). The continued decline in the agricultural and agricultural processing industries in the region will further exacerbate this unemployment. The mobility of those people losing their jobs due to salinity will be limited by factors such as age, skills and home and business ownership.

(b) Discussions with those involved in dairy processing in Shepparton revealed the importance, due to lower transport costs, of obtaining milk locally. Thus it seems unlikely that the processors could maintain profitability if milk had to be obtained from outside the region. Further there are few alternative uses for the fixed capital associated with dairy processing as evidenced by the closed dairy factories in the smaller towns of the region.

(c) While Shepparton's strength as a regional centre and as a horticultural processor may obscure the effects of reduced growth in the dairy industry, the smaller towns in the region, which are more reliant on dairying and far more vulnerable. These small towns as well as having dairy factories (Stanhope and Tatura) also provide many of the recurrent farming inputs and farm capital repair services.

6. THE BENEFITS AND COSTS OF GROUNDWATER CONTROL IN THE SHEPPARTON REGION

A comparison can now be made between the benefits and costs of groundwater control based on the benefits estimated by the procedures described in this paper and the costs estimated in Salinity Pilot Program Advisory Council (1989).

The Shepparton Salinity Management Plan recommended a program of activities having the following costs. The program costs include all on-farm and off-farm costs, both public sector and private sector.

TABLE 3: SHEPPARTON SALINITY MANAGEMENT PROGRAM COSTS

	Capital Costs $million	Capitalised Annual Costs $million	Total Capital and Annual Costs $million
Farm activities	202	92	294
Surface Drainage	223	26	249
Sub-surface drainage	83	115	198
MDBC costs	10	9	19
Environmental works	33	n/a	33
Extension & support	20	0	20
Research & Investigation	75	0	75
TOTAL	646	242	888

Source: SPAAC (1989)

The annual benefits of groundwater control for the direct beneficiaries (i.e.:-farmers) are given in Table 4. The Economic Guidelines Case refers to the figure obtained when following the directions given by economists working for departments within the Government of Victoria. The Preferred Case is as estimated by the Salinity Pilot Program Advisory Council (1989) using the methods described in this paper.

TABLE 4: ECONOMIC VALUE OF AGRICULTURAL OUTPUT ($M)

	ECONOMIC GUIDELINES CASE (Victorian Government)		PREFERRED CASE (SPAAC)	
	2000	2025	2000	2025
A. WITHOUT SALINITY				
Gross Farm Output	210.85	210.85	368.99	619.58
Farm Costs	129.04	129.04	132.82	132.82
Net Farm Surplus	81.81	81.81	236.17	486.76
B. "DO NOTHING" CASE				
Gross Farm Output	185.04	171.50	322.09	499.69
Farm Costs	123.03	114.11	132.74	132.74
Net Farm Surplus	62.01	57.39	189.35	366.95
ANNUAL SALINITY LOSS	18.92	23.54	46.82	119.81

Source: SPAAC (1989)

In summary the Preferred Case estimates indicate that:

- If the above net farm losses are calculated over 50 years, assuming zero benefits in 1990, rising to maximum benefits in the year 2025, then discounted to net present values at 4 per cent, the most likely benefit from control of all high watertable areas within the Shepparton region (or Study Area) would be $1,320 million.

- The upper and lower quintile points of the range of probable outcomes are $2,100 million and $720 million respectively.

- The above figures are based upon some 274,000 ha being subject to high watertables to the year 2020. Should the area protected be less than 274,000 ha a proportionate reduction in benefits would occur.

On the basis of the above figures, the sub-surface drainage program, costing $198 million would seem to be justified by available benefits of the order of $1,320 million (a B/C ratio in excess of 6). If indirect or regional benefits are "streamed" over 50 years and discounted to net present values, the benefits of the project rise by $1960 to approximately $3220 million.

7. THE ECONOMIC GUIDELINES CASE

Economists working for departments within the Government of Victoria, however, reduced the total sub-surface drainage program benefit to $353 million (27% of the above).

This reduction in the value of benefits was achieved using the following three steps:

(a) The Effect of Productivity Change

Productivity change was included in the Preferred Case model through the estimation and weighting of best, as estimated and worst case scenarios for future productivity change.

Advice was issued by the Victorian Government that productivity change had no place in economic analysis. The effect of this on the amount of direct benefit can be seen by comparing Figure 4 with Figure 5. In both these figures it is assumed that farm costs remain constant over time.

(b) Farmers Responses to the Onset of Salinity

Anecdotal evidence points to the fact that when farmers first experience salinity they increase their inputs in an effort to compensate. Work done in the neighbouring Campaspe district indicates that "dairy farmers compensate for reduced pasture growth by substituting higher cost feed inputs to maintain production" (Department of Agriculture and Rural Affairs pers. comm.). Similarly, a comparison of farm costs for those farmers who considered waterlogging to be a problem with those who did not from the Dwyer Leslie farm survey, indicated that only feed costs differed significantly. Mean feed costs were 50 per cent higher for those farms where waterlogging was considered a problem. Average farm incomes and farm costs for the surveyed farms is given in Table 4. These figures indicate that higher gross incomes on land subject to high water tables are only achieved at significantly higher cost.

Figure 4
Production With and Without Salinity
(Productivity Included)

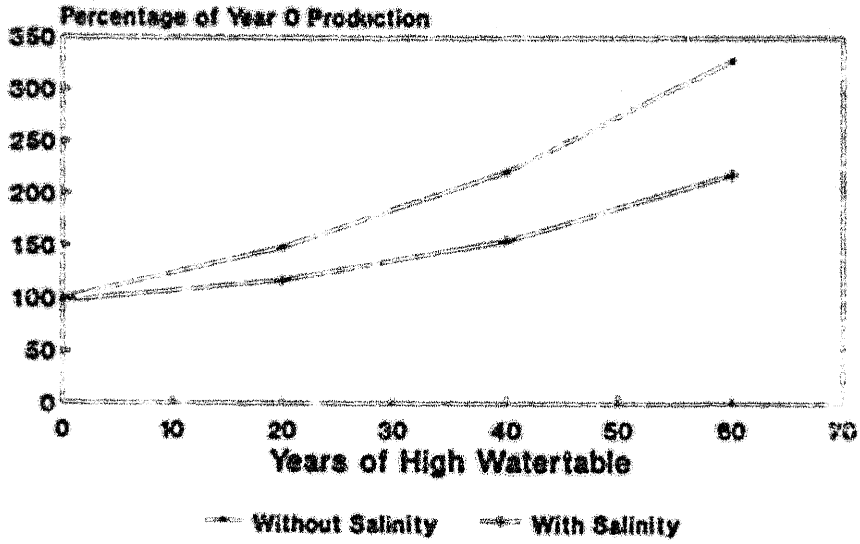


Figure 5
Production With and Without Salinity
(Productivity NOT Included)

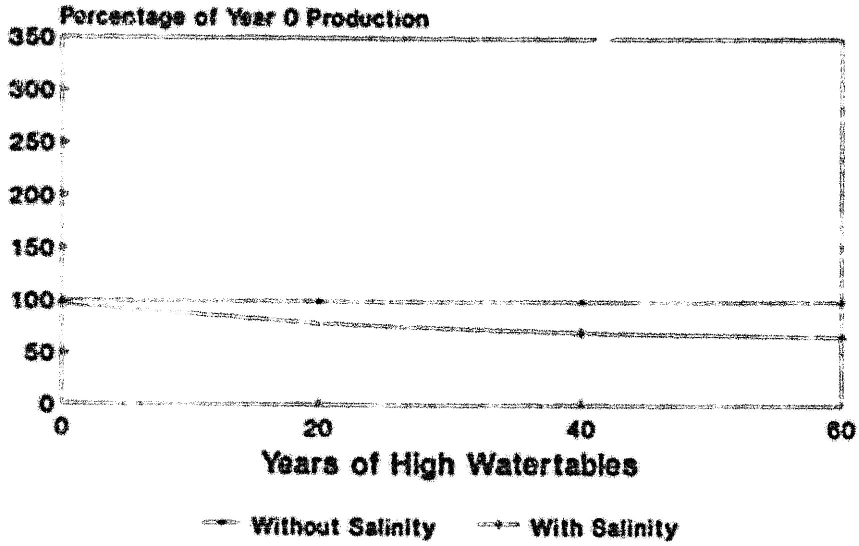


TABLE 4: RESPONSE OF DAIRY FARMERS TO HIGH WATERTABLES (HWT)

	GROSS FARM INCOME	FARM COSTS	NET FARM INCOME
	$/ha	$/ha	$/ha
Dairy Farms in hwt areas (average of 26 farms)	889	586	303
Dairy Farms without hwt problems (average of 26 farms)	851	497	354

In the light of this evidence the Salinity Pilot Program Advisory Council (1989) assumed that farm costs would remain constant, thus resulting in the preferred case estimates given in Table 4.

However, government economists in Victoria advised that, after a lag period of five years, farmers will reduce their farm inputs - both fixed and variable - by the same rate as their gross income was declining. The effects of this on the total benefits obtained from salinity control is illustrated in Figures 6 and 7.

(c) The Economic Value of Butterfat

The correct price for butterfat for use in an economic analysis is its long run marginal price for the person for whom the analysis is performed (ABARE pers.comm.). Any additional butterfat production in Shepparton is most likely sold on the export market, thus the correct price from the farmer's point of view is the long run export price at the farm gate. Therefore, the correct price from the State or Nation's point of view is the long run export price from the port (f.o.b). Which of the many export prices f.o.b is appropriate for an analysis of the benefits of salinity control is largely a matter of opinion.

The value used in the analysis reported here is the average of GATT actual minimum f.o.b. prices over the 10 years 1980 to 1989. These f.o.b. prices were translated to farm gate prices after estimating long run marginal economic costs of transport, handling and processing for the Shepparton region which has a very large and very efficient dairy processing industry. The result was an economic value of butterfat of $4.60/kg. This was held constant into the future for all analyses.

Government economists in Victoria started with GATT declared minimum prices and then assumed that the long run marginal economic costs for handling, processing and transport within the Shepparton region could be represented by short run average financial costs for Australia as a whole. Naturally, these types of assumptions produced a lower butterfat value of $3.20/kg.

It should be noted that GATT declared minimums are essentially political prices which rise and fall as the market price rises and falls. According to the World Market for Dairy Production 1988 (GATT 1988), "minimum export prices must not be considered as market prices, but merely the floor price levels which the participants agreed to observe".

Figure 6

Change in Net Farm Income Due to Salinity: Constant Costs

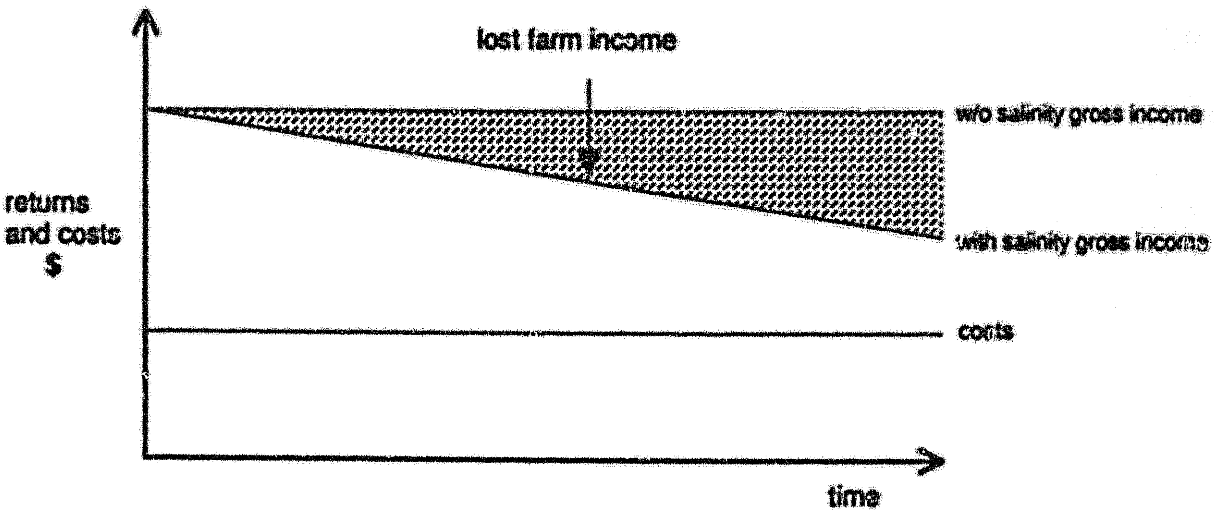
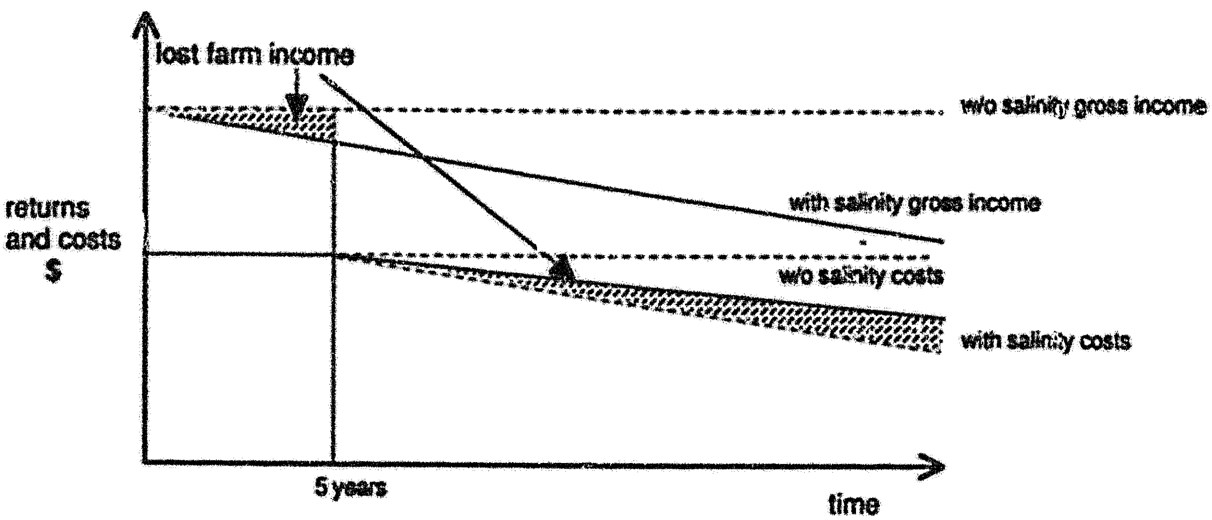


Figure 7

Change in Net Farm Income Due to Salinity: Declining Costs



Note: in the with salinity case gross income and costs are declining at the same percentage rate

Certainly as a lower bound declared minimums would appear appropriate however the actual minimums more closely approximate the market price.

(d) Regional Economic Issues

The Victorian Government concluded in its Victorian Government Support for Salinity Management Plans (1990) that:

> "Primary beneficiaries are expected to meet their full share of costs. Regional and local communities, as secondary beneficiaries, may contribute to the cost of salinity control measures on a voluntary basis."

Suffice it to say not too many regional or local communities have volunteered.

8. CONCLUSION

The net present value of the economic benefits of groundwater control through sub-surface drainage in the Shepparton region was originally estimated to be in the order of $1320 million if changes in farm incomes alone were considered. The estimation of changes in farm income was done using a model based on actual farm data as opposed to average farm data and future changes in the key variables were based on probability estimates.

If economic returns to resources in the region affected indirectly by groundwater control are include that figure rises to $3220 million. The indirect benefits were estimated using input-output methods but taking into account the opportunity costs of the resources in those sectors of the economy affected indirectly by salinity control.

The benefits compare favourably with a cost of $198 million.

Subsequent advice from the Victorian Government resulted in a reduction in benefits to $353 million.

Clearly, in the estimating of benefits there can emerge wide divergences of opinion. These differences of opinion occur with regard to the practical application of economic theory, as in the case of which butterfat price best approximates long run marginal returns, with regard to farmer's responses to salinity, as in the case of the appropriate long run cost structures for farms with salinity, and with regard to economic theory, as in the cases of whether productivity should be included in the analysis and whether the economic flow-ons of salinity control have a place in the analysis.

In examining the relevance of the economic flow-ons of an activity to a region it may be the case that communities are further ahead than economic theory. Local and regional communities are quite prepared to fight to maintain their major industries because they are aware of the implications for their own businesses, for their employment and for the value of their capital and land assets of a shut down in a major industry. The local governments in the Shepparton Irrigation Region have expressed a willingness to contribute to the operating costs of the drainage program and to the cost of salt disposal to the Murray, thereby offsetting the cost to irrigation farmers (Government of Victoria 1990).

If economic theory is to provide useful guidelines for the apportioning of benefits between direct beneficiaries and their reliant regions more empirical work must be done on the regional benefits of projects.

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