

Director General's Office

SPECIAL REPORT NO. 19

• *Salinity*

MARCH 1993

Subject Interest

PROPERTY OF

Russell Walker

VICTORIA

Auditor-General
of Victoria

SPECIAL REPORT No. 19
SALINITY

Ordered by the Legislative Assembly to be printed

MELBOURNE
L.V. NORTH, GOVERNMENT PRINTER
1993

ISSN 0818-5565
ISBN 0 7306 3414 0

March 1993

The Honourable the Speaker
Legislative Assembly
Parliament House
Melbourne, Vic. 3002

Sir

Under the provisions of section 48A of the *Audit Act* 1958, I transmit a Special Report on Salinity.

Yours faithfully


C.A. BARAGWANATH
Auditor-General

PREVIOUS SPECIAL REPORTS OF THE AUDITOR - GENERAL

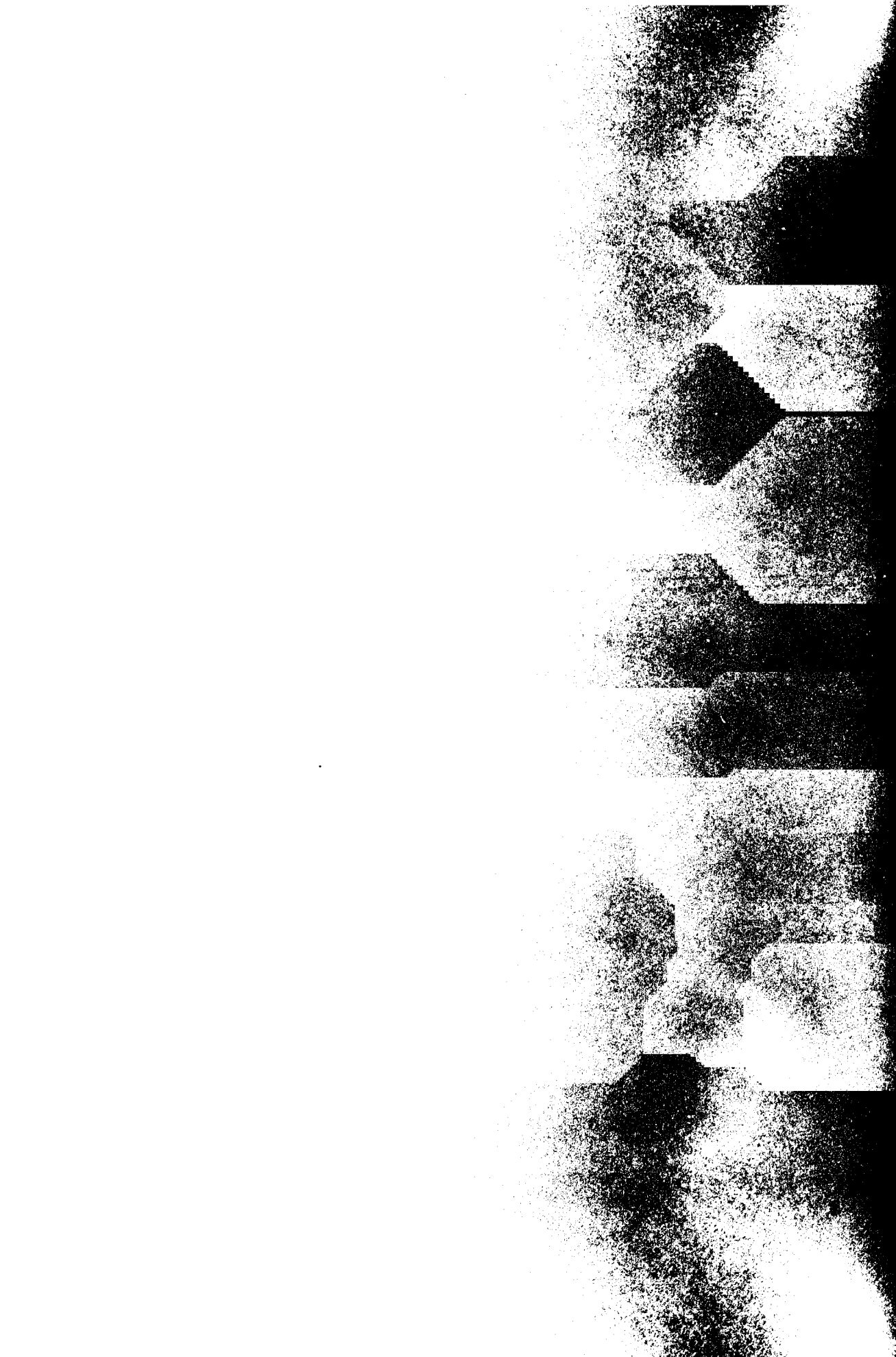
<i>Report No.</i>	<i>Title</i>	<i>Date issued</i>
1	· Works Contracts Overview - First Report	June 1982
2	· Works Contracts Overview - Second Report	June 1983
3	· Government Stores Operations · Department Cash Management	October 1984
4	· Court Closures in Victoria	November 1986
5	· Provision of Housing to Government Employees · Post-Project Appraisal Procedures within the Public Works Department	December 1986
6	· Internal Audit in the Victorian Public Sector	December 1986
7	· Motor Vehicles	April 1987
8	· Foreign Exchange	November 1987
9	· Land Utilisation	November 1987
10	· Utilisation of Plant and Equipment · Youth Guarantee	November 1988
11	· Financial Assistance to Industry	March 1989
12	· Alfred Hospital	May 1990
13	· State Bank Group - Impact on the financial position of the State	May 1990
14	· Accommodation Management	October 1990
15	· Met Ticket	November 1990
16	· Fire Protection	April 1992
17	· Integrated Education for Children with Disabilities	May 1992
18	· Bayside Development	May 1992

CONTENTS

PART 1	EXECUTIVE SUMMARY	1
	1.1 Foreword	3
	1.2 Overall conclusion	7
	1.3 Summary of major audit findings	11
	1.4 Overall comment from managing agency	23
PART 2	SALINITY OVERVIEW	29
	<i>Description of salinity</i> 31	
PART 3	CONDUCT OF THE AUDIT REVIEW	41
	<i>Objectives and scope</i> 43 • <i>Processes followed</i> 44 • <i>Description of salinity management plans examined by audit</i> 45	
PART 4	GOVERNMENT APPROACH TO SALINITY	47
	<i>Formulation of policy on salinity</i> 49 • <i>Funding, expenditure and status of plans</i> 53	
PART 5	IMPACT OF DECISIONS OF PREVIOUS GOVERNMENTS ON SALINITY LEVELS	57
	<i>Overview</i> 59 • <i>Tree clearing and irrigation</i> 61 • <i>Implications of other specific government decisions</i> 67 • <i>Compensation claims</i> 78	
PART 6	SOCIAL, ENVIRONMENTAL AND ECONOMIC RAMIFICATIONS	79
	<i>Assigning values to social and environmental factors</i> 81 • <i>Land restructuring and land retirement at Kerang Lakes</i> 86 • <i>Continued use of evaporation basins</i> 98	
PART 7	COST-SHARING	111
	<i>What is cost-sharing?</i> 113 • <i>Benefits received by local industries</i> 114 • <i>Obligations of upstream communities - polluter pays principle</i> 115 • <i>Tree planting and drainage programs</i> 119	
PART 8	CENTRAL MANAGEMENT OF THE STRATEGY	123
	<i>Performance measurement</i> 125 • <i>Salinity register of land and water bodies</i> 130 • <i>Salinity Bureau</i> 131 • <i>Research and investigation</i> 133 • <i>Accountability for environmental performance</i> 134	
PART 9	SALINITY MANAGEMENT PLANS	137
	<i>Pilot program</i> 139 • <i>Community-based planning approach</i> 140 • <i>Regional approach to planning</i> 150 • <i>Integration consultants</i> 151 • <i>Salinity control measures - Goulburn dryland plan</i> 152 • <i>Overall viability of Goulburn dryland salinity management plan</i> 156	
Appendix A	Glossary of terms	159
Appendix B	List of individuals and groups that were consulted during the audit review	165
Appendix C	Bibliography	171

PART 1

Executive Summary



FOREWORD

In recent years, Special Reports to the Parliament have mainly related to topics concerning resource management issues, often with a financial and accountability theme as the prime focus. In today's age with the environment assuming a key dimension in the eyes of the general public, I decided to examine the significant environmental issue of salinity and the processes implemented by government to address this problem. The magnitude of the current agricultural losses attributable to salinity, which are estimated to be up to around \$230 million a year, and the prospect of such losses escalating if the situation is not effectively controlled, were also crucial factors prompting the audit review.

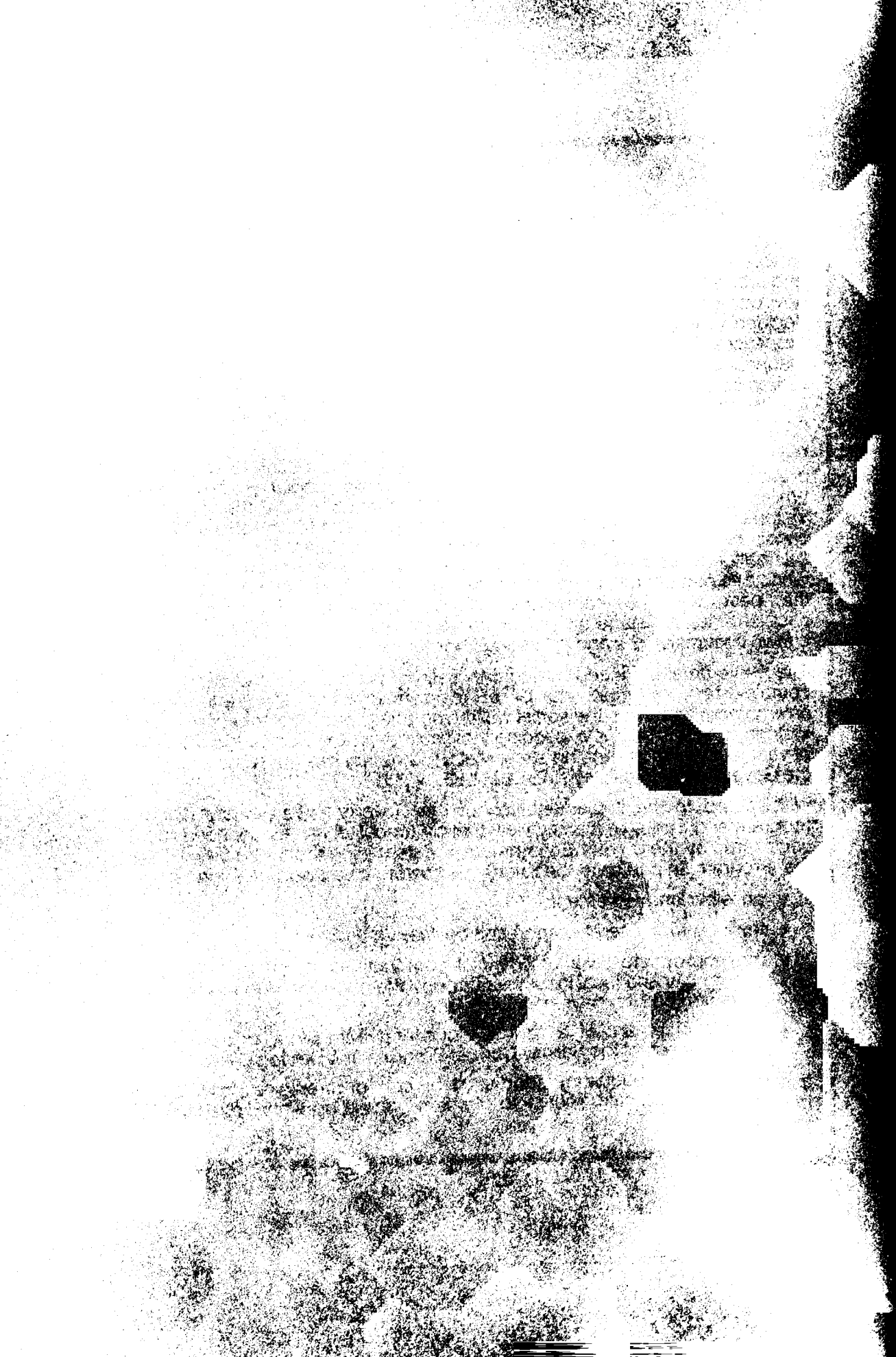
Past government decisions on land development dating back to the previous century have focused on economic and social considerations. While significant benefits have accrued to the State and the people of Victoria as a result of these decisions, it is ironic that such actions have in certain regions contributed to an environmental problem in the form of the salinisation of land and water which now threatens the economic and social fabric that has been built up over many years. Although decision-makers of the past were environmentally naive compared to their modern counterparts, decisions of the past were made in good faith based on the known circumstances and prevailing knowledge.

The Government, in addressing the salinity problem, is faced with the complex task of improving or at least maintaining the state of the environment as well as the social well-being and productive capacity of rural Victoria, a task which is exceedingly difficult given the competing agendas of various interest groups. In excess of \$150 million has been expended by the Government on salinity since 1984-85.

With regard to the implementation of the Government's Salinity Control Program and Strategy, it is my view that a number of issues will need to be considered by the current Government in determining the future direction of the Program. In particular, decisions will need to be made in relation to:

- ▶ possible land retirement;
- ▶ the long-term use of evaporation basins;
- ▶ the appropriate level of financial contributions to be made by the community and local industries through the adoption of the beneficiary pays and polluter pays principles; and
- ▶ the development of a central monitoring framework to assess the effectiveness of the Salinity Control Program and Strategy.

If salinity is not adequately addressed or control strategies prove to be ineffective, the ultimate impact to the State could be significant and far-reaching.

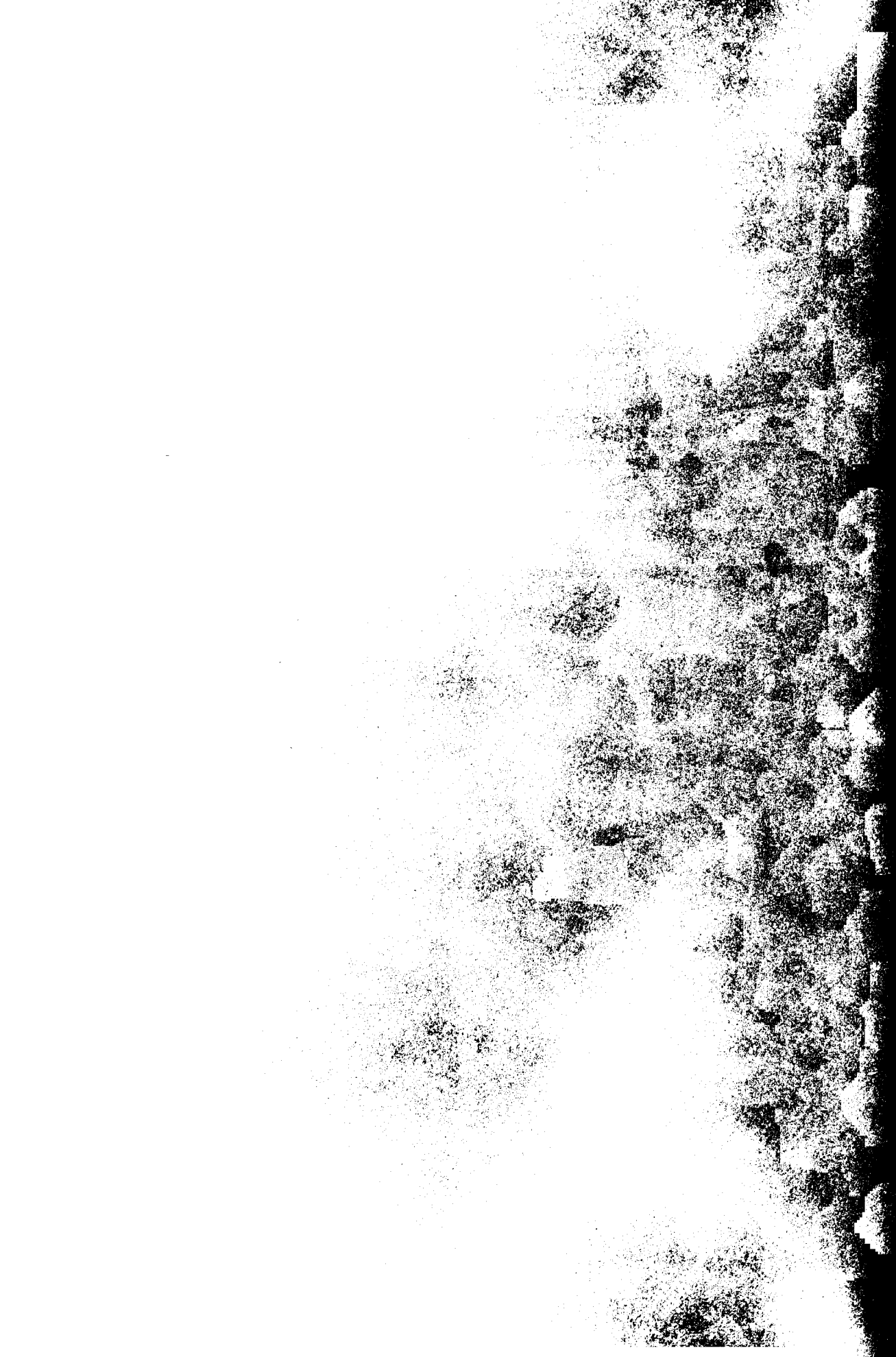


FOREWORD - *continued*

In structuring the Report for the logical flow of information, I have elected to firstly provide an overview to describe the meaning, extent and effects of salinity which is then followed by an outline of the conduct of the audit review and details of the approach taken by government to address the problem. Having set the scene, the Report includes comment on a range of issues including:

- ▶ the impact of decisions of previous governments on the level of salinity;
- ▶ social, environmental and economic factors, and ramifications;
- ▶ cost-sharing arrangements;
- ▶ the central management of the Salinity Control Strategy developed to address the problem; and
- ▶ the processes followed in the development of salinity management plans.

This Special Report has been written in a style which is designed to simplify the matters raised.



OVERALL CONCLUSION

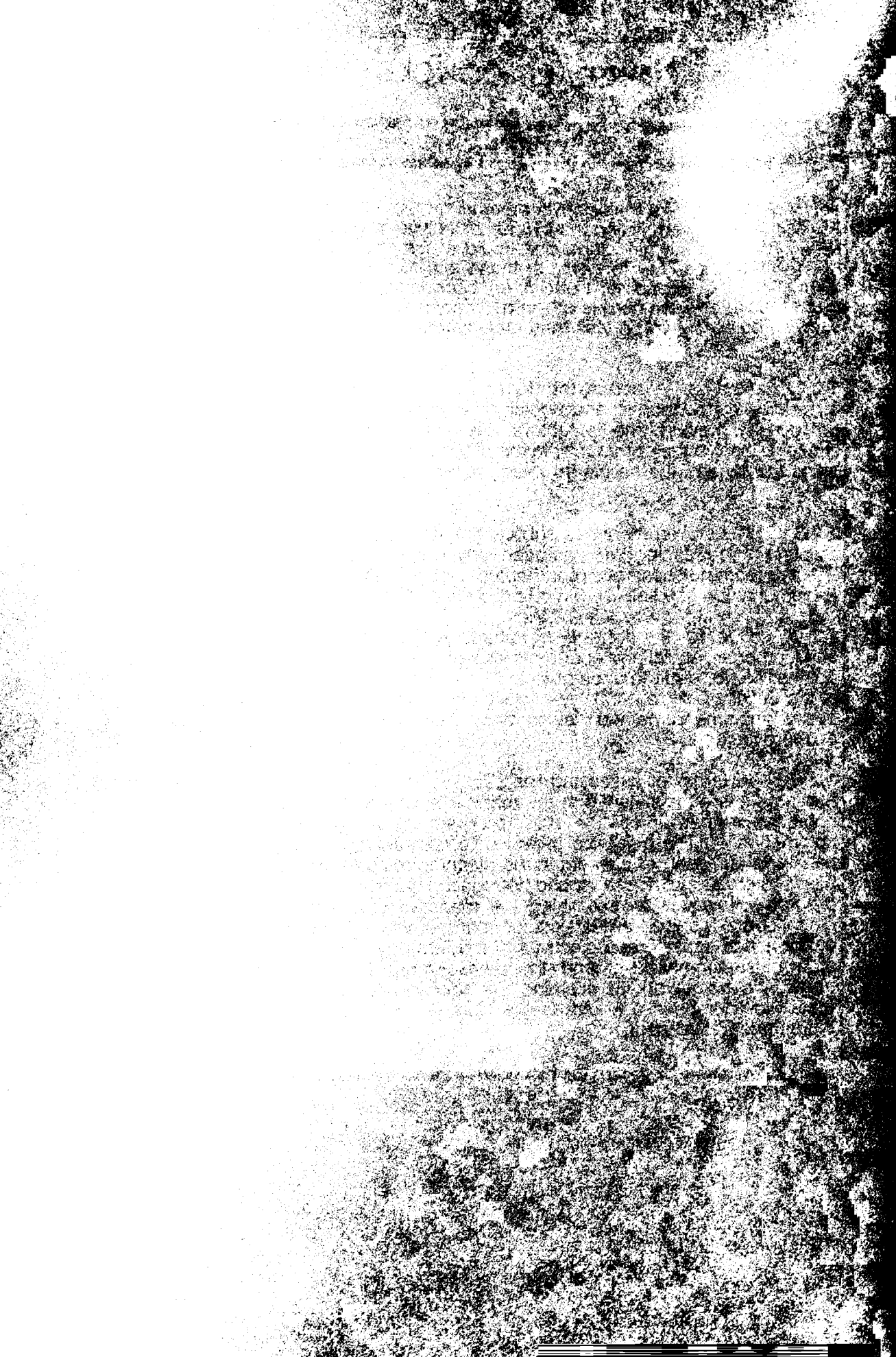
1.2.1 Salinity is a major environmental problem in Victoria which has been influenced by past actions such as extensive tree clearing and irrigation practices. While, in hindsight, one could argue that such actions have been irresponsible, it is fair to say that these activities have been instrumental in stimulating the economy, both in an economic and a social sense. Such practices which were heavily driven by economic considerations could now be seen as being based on less than ideal criteria which should not be repeated in future.

1.2.2 As a consequence, the Government was faced with the complex task of reconciling economic and social considerations of continued agricultural practices with environmental factors. It is for this reason that the Government chose to involve the community in the process of developing the most suitable plans to manage the salinity problems affecting their respective areas of the State.

1.2.3 The Government has publicly acknowledged that salinity is the single greatest threat facing the Victorian environment and, in partnership with affected communities, has contributed significantly to the formulation and implementation of a salinity control program and strategy for the State.

1.2.4 Due to the long-term nature of the program and its complex environmental, social and economic implications to the State of Victoria, it was not feasible for audit to attempt to form an overall opinion on the effectiveness of the Salinity Control Strategy in combating a problem which has developed over a long time-frame and may, in many areas, take equally as long to control or improve.

1.2.5 In terms of assessing the effectiveness of the management of the Strategy, it is audit's view that the manner in which the activities of the large number of participants in the program have been co-ordinated is commendable. The guidance provided to community groups by government has been an essential element in the planning features of the Strategy, which has served to provide a sound foundation for the future direction of the program. However, in examining the management of the Strategy from a global context, opportunities exist for improvement in the central monitoring of performance against the objectives of the Strategy. A greater level of scrutiny at a parliamentary level and the development of a central consolidated monitoring framework to examine the effectiveness of the Strategy from a State-wide perspective would enable Victoria's Salinity Control Strategy to be more readily assessed.

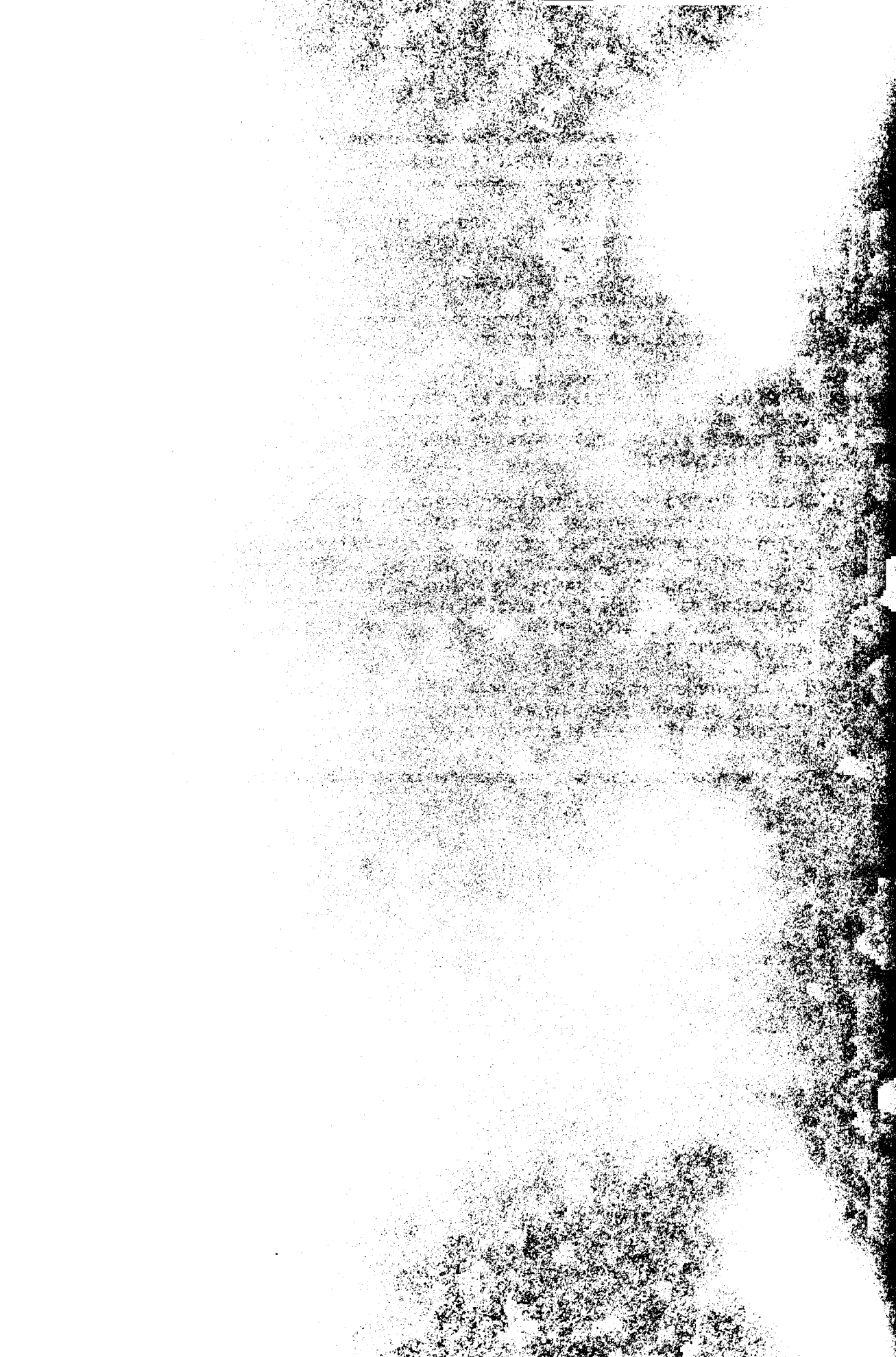


OVERALL CONCLUSION - *continued*

1.2.6 The current Government is faced with a number of difficult decisions in relation to salinity-related issues with substantial social, environmental and economic implications such as the possible retirement of unproductive land in the Kerang Lakes sub-region of the State and the continued use of evaporative disposal methods. Mechanisms to place values on social and environmental factors need to be developed by government to ensure that decisions which are made in the future canvass other than economic considerations.

1.2.7 In the context of each salinity management plan examined, audit found that local communities have shown a strong commitment to forming a partnership with government in determining the most suitable plan of salinity control measures to be implemented in their respective areas. In general, however, it was felt that:

- ▶ Greater attention should have been given to applying the polluter pays principle in formulating cost-sharing arrangements for plans, as upstream communities, whose current activities were adversely impacting on salinity in downstream communities, were not required to contribute to the costs of salinity mitigation works in downstream communities. In addition, processing industries, which derive substantial benefits from salinity control, were not required to specifically contribute to cost-sharing arrangements; and
- ▶ The Government could have taken a more active role in reviewing the progress of plan development - some plans have taken a protracted amount of time to finalise at a cost far in excess of that estimated.



SUMMARY OF MAJOR AUDIT FINDINGS

PROGRAM ACHIEVEMENTS

- ▶ A comprehensive salinity control strategy was released by the Government in May 1988, which co-ordinated and focused an extensive framework of salinity activities undertaken by government and the community as a joint exercise.
- ▶ The level of enthusiasm and effort shown by community and agency staff involved in the development and implementation of various salinity management plans has been substantial.
- ▶ While the State Government has a responsibility to provide resources for salinity control, the introduction of cost-sharing arrangements has ensured that local communities and local government also contribute to the future costs involved in implementing the proposed works identified in the salinity management plans.
- ▶ The improved level of knowledge of salinity that has arisen from the development of the Salinity Control Program and Strategy has enabled irrigation farmers to implement more sustainable irrigation management practices including groundwater pumping, the installation of irrigation drainage re-use schemes and laser-grading irrigated land. In dryland areas, groundwater recharge areas have been identified, areas of discharge have been predicted and targeted work has taken place on the use of improved perennial pasture, tree planting and the water use of plants.
- ▶ Victoria has taken a lead role in the development of the Murray-Darling Basin Ministerial Council, the formulation of the Salinity and Drainage Strategy for the Murray-Darling Basin and encouraging regional communities to implement the Strategy.



**IMPACT OF DECISIONS OF PREVIOUS GOVERNMENTS
ON SALINITY LEVELS**

Page 57

- ▶ Past government decisions concerning the extensive clearing of trees and the introduction of large-scale irrigation schemes, while stimulating the agricultural base and economic growth of Victoria, have in retrospect also been the prime causes of salinity with resultant adverse environmental, economic and social repercussions.

Para 5.2

- ▶ According to the Government, soil and water salinity threatens the future of Victorian agriculture. It estimated the economic cost of the environmental impact of land degradation (including salinity, erosion, soil structure decline and waterlogging) to be reducing the value of farm production in Victoria by more than \$500 million a year. Of this amount, it is estimated that salinity is causing production losses of around \$68 million a year in irrigation areas and \$8 million a year in dryland areas.

Para 5.8

- ▶ Other government estimates of annual losses in agricultural production due to salinity ranged from \$50 million in 1987 to around \$230 million in 1992. Given this wide disparity in estimates, audit did not attempt to establish a figure for salinity-related production losses as this would have added to the confusion surrounding this issue.

Paras 2.15 and 4.6

- ▶ Government records indicate that Victoria's forest cover has been reduced by more than half since European settlement, with possibly less than 15 per cent of the original forest cover remaining in the western half of the State.

Paras 5.15 and 5.16

- ▶ It is somewhat ironic that while tree clearing over many years has been instrumental in accelerating salinity, tree planting has now become an important element of government strategies to alleviate the problem. It is equally ironic that while taxation incentives existed up to 1983 to actually encourage tree clearing, and thus contribute to salinity, in less than 10 years the reverse is the case with taxation incentives offered from 1990 for tree planting.

Para. 5.28



**IMPACT OF DECISIONS OF PREVIOUS GOVERNMENTS
ON SALINITY LEVELS - continued**

Page 57

- ▶ Irrigated agriculture in northern Victoria, in upsetting the water balance, has resulted in dramatic rises in watertable levels. As an illustration, watertables in the Shepparton sub-region have risen from about 30 metres below the surface before European settlement to less than 2 metres below the surface in the majority of the sub-region. Similarly, as a consequence of the Closer Settlement Scheme in the Campaspe West sub-region, watertables have risen from between 4 and 8 metres from the ground's surface in the 1960s to around 2 metres over 60 per cent of the area and about one metre from the surface over 15 per cent of the area.

Paras 5.29 and 5.54

- ▶ The abandonment of the Mineral Reserves Basin Scheme, which involved a proposal to create a series of evaporation basins for the Kerang Lakes sub-region of Victoria, resulted in unnecessary expenditure of some \$7.3 million in the construction of a number of bridges, channels and a pump station for the Scheme.

Paras 5.68 to 5.71

- ▶ Lake Corangamite, which is the largest permanent inland lake in Australia, is a wetland of high environmental significance. The Lake, which is recognised as providing an important habitat for birds, is likely to be biologically dead in less than 15 years if the trend in the reduction of the Lake level and increased salinity continues. While operation of the Woody Yaloak Diversion Scheme (which was constructed to relieve flooding around Lake Corangamite) has enabled large areas of land to become available for grazing, this benefit has been realised at a massive environmental cost. By 1991, the salinity level of the Lake was almost double the maximum level (35 000 milligrams per litre) suitable for bird life.

Paras 5.72 to 5.83

- ▶ Several instances were identified where systems operated by the Rural Water Corporation had caused salinity damage on adjacent land. Compensation amounting to some \$440 000 has been paid to landholders for such damage in the Tandarra Pondage, Woody Yaloak, Lake Batyo Catyo and Pine Lake localities.

Paras 5.84 to 5.85



**SOCIAL, ENVIRONMENTAL AND
ECONOMIC RAMIFICATIONS**

Page 79

- ▶ In assessing the benefits and costs of establishing salinity management plans for particular sub-regions, the benefit-cost evaluations were based on economic factors and did not incorporate values for the social and environmental benefits and costs associated with the various salinity control options.

Para. 6.9

- ▶ The severity of salinity in some regions requires difficult decisions to be made by government to either maintain farming activity in those areas on social grounds or adopt other more sensitive and controversial options such as land restructuring or land retirement, particularly in the Kerang Lakes area.

Para. 6.22

- ▶ In February 1990, when watertables are traditionally at their lowest in the annual cycle, some 45 000 hectares of land in the Kerang Lakes sub-region (41 per cent of the plan area) had watertables within 2 metres of the surface. Salinity of groundwater in the sub-region is typically in the range of 18 000 to 36 000 mg/l (30 000 to 60 000EC) whereas the recommended limit for drinking water is 500 mg/l (830EC) and salinity of water in the Pacific Ocean is 35 000 mg/l (around 58 000EC).

Paras 6.27 to 6.30

- ▶ The audit disclosed that 93 per cent of the Kerang Lakes area, which used 91 per cent of the water, only contributed 24 per cent to the irrigated gross margin of the area. In view of the magnitude and severity of the salinity problem in the Kerang Lakes area and the doubt surrounding the economic viability of continued farming in marginal pasture and field crop areas, the current Government needs to establish, by way of a detailed analysis, that the costs of subsidising non-economic agricultural activities and the resultant devastating effect on the environment is a better alternative than land retirement with its adverse social implications.

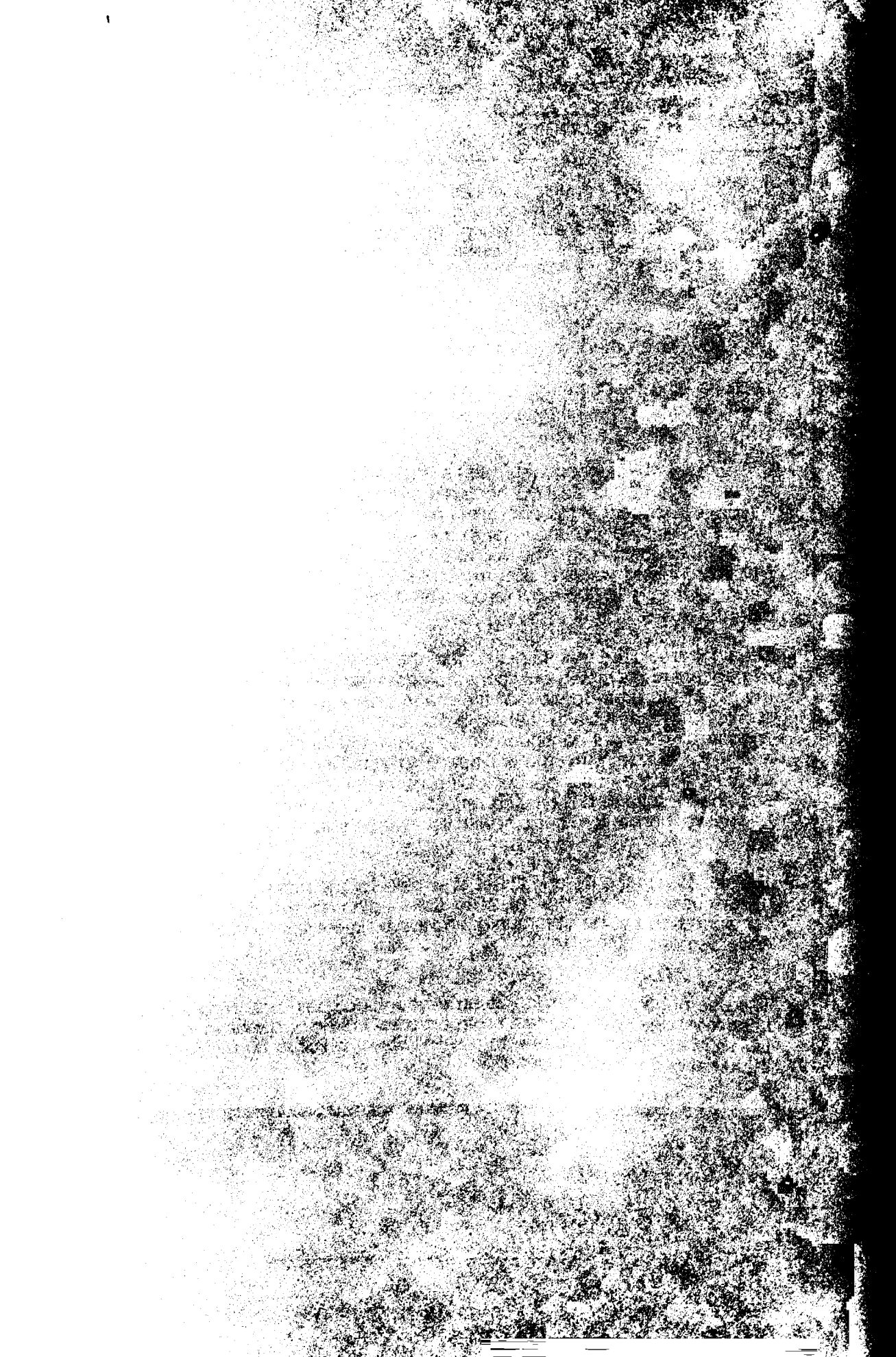
Paras 6.23 to 6.26

- ▶ The situation in the Kerang Lakes area calls for the most difficult options to be discussed in the draft Kerang Lakes plan so that full scrutiny and consideration by the community and government can occur prior to the endorsement of the plan.

Para. 6.63

- ▶ The use of Lake Tutchewop as an evaporation basin has transformed the Lake from one of the highest environmentally rated wetlands in the Kerang Lakes plan area to a lake with a salinity level which is 60 per cent higher than that of the Pacific Ocean.

Paras 6.70 to 6.71



SOCIAL, ENVIRONMENTAL AND ECONOMIC RAMIFICATIONS - *continued*

Page 79

- ▶ The draft Kerang Lakes plan failed to identify any long-term strategy for the disposal of salt accumulating in Lake Tutchewop from the Barr Creek diversion. The use of evaporation basins merely defer the salt disposal problem to future generations.

Para. 6.81

- ▶ The significant environmental value of Lake Tutchewop has been jeopardised in return for a short-term salinity control measure that does not address the source of the salinity problem.

Para. 6.86

- ▶ The application of tile drainage to support horticulture in Tresco and Woorinen within the Kerang Lakes area results in the use of 2 drainage areas which are of environmental significance, namely the Woorinen Drainage Lakes and Golf Course Lake, as evaporation basins for saline drainage.

Para. 6.88

COST-SHARING

Page 111

- ▶ The processors and dependent industries within the Shepparton irrigation sub-region were not required to contribute directly to cost-sharing arrangements, despite accruing more than twice the benefits received by landholders from salinity control in the plan area.

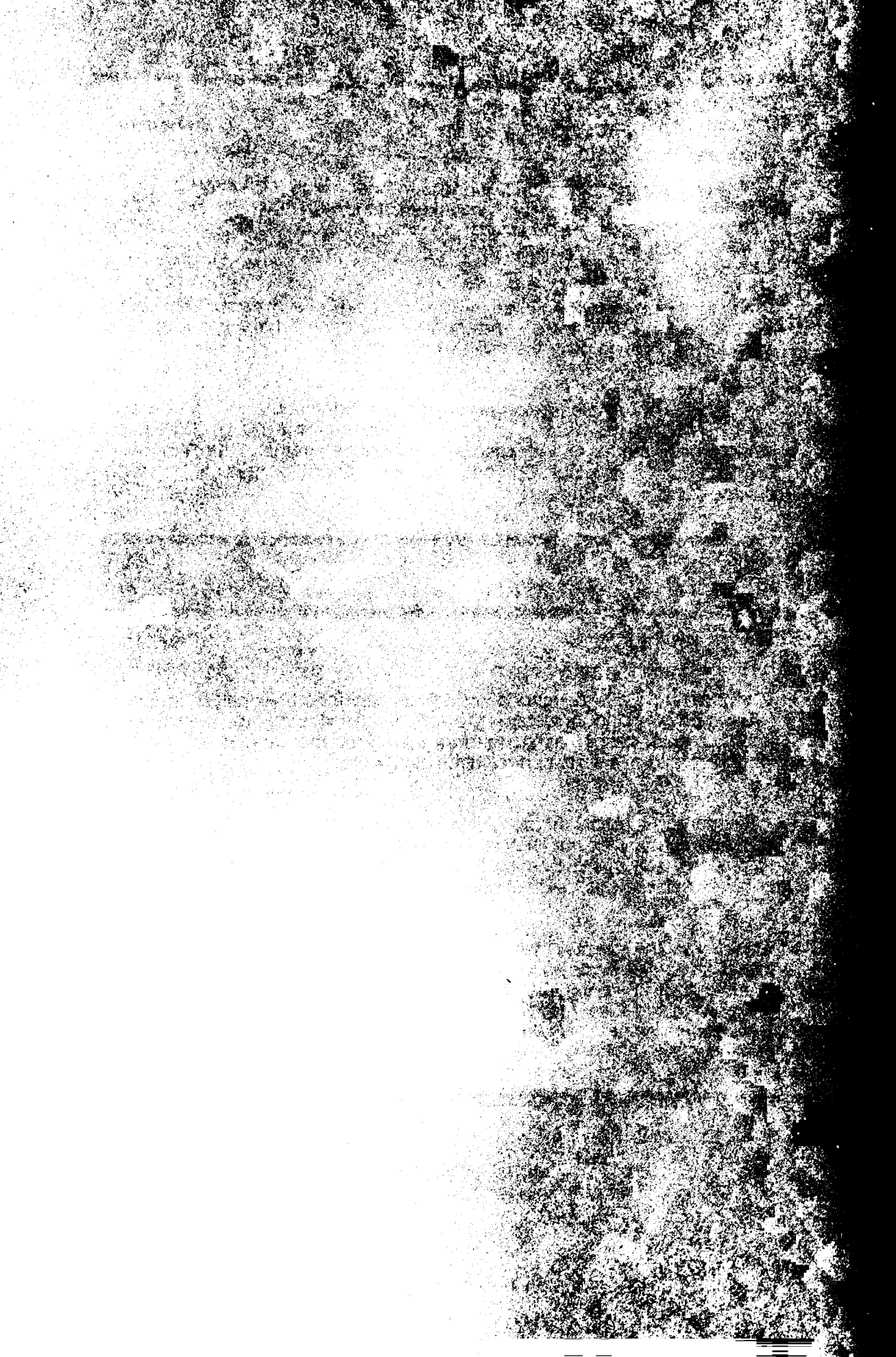
Paras 7.8 to 7.10

- ▶ A mechanism to apply the polluter pays principle to the current inhabitants of those upstream communities, whose activities contribute to additional volumes of salt in the Shepparton, Kerang Lakes and Campaspe West irrigation sub-regions, had not been included in any of the plans.

Para. 7.21

- ▶ Contrary to the direction taken in various studies which strongly favours the allocation of costs to beneficiaries, capital costs of the tree planting program in the Kerang Lakes area and the tree planting and drainage program in the Campaspe West area will be predominantly met by the Government rather than the beneficiaries. Cost-sharing arrangements in relation to tree planting varied between the plan areas.

Para. 7.33



CENTRAL MANAGEMENT OF THE STRATEGY

Page 123

- ▶ A monitoring scheme to evaluate the performance of the Salinity Control Program and Strategy against its goals and objectives has not been established, even though in excess of \$150 million has been spent on the program since 1985.

Para. 8.6

- ▶ A regular review of the adequacy of the Salinity Control Strategy has not been undertaken and only limited oversight has been exercised by the Cabinet Committee in recent times.

Para. 8.11

- ▶ Annual reporting to the Parliament in respect of the Salinity Control Program was regarded by audit as unsatisfactory.

*Paras 8.43 to 8.48***SALINITY MANAGEMENT PLANS**

Page 137

- ▶ Interim reviews of progress in plan development were not undertaken by government.

Para. 9.17

- ▶ After 5 years, the Kerang Lakes and Campaspe West salinity management plans have yet to be finalised.

Paras 9.20, 9.23 and 9.31

- ▶ Economic evaluations cast doubt on the long-term viability of the Goulburn dryland plan, particularly in the absence of quantifiable environmental and social benefits.

Para. 9.66



OVERALL COMMENT FROM MANAGING AGENCY

Audit accurately describes the causes of salinity and the relationship between past government decisions favouring economic and social development and today's salinity problems. The significance of those decisions in terms of salinity has only recently been recognised. The challenge presented to government is the management of a problem that requires trade-offs between the social, environmental and economic well-being of the State.

The report of the Parliamentary Salinity Committee entitled "Salt of the Earth" (October 1984), stressed the need for greater co-ordination between government agencies and between the Government and the community if successful salinity management programs were to be established.

The Salinity Control Strategy "Salt Action : Joint Action" (1988) responded to this need. The Strategy drew together the salinity program developments of the previous 3 years and charted a detailed course of action that would provide a solid foundation for salinity management which in many cases would take up to 30 years before the results became evident.

The cornerstones of the Strategy are community ownership and community-government partnership. Private land managers have to change their land management practices and the changes usually involve a cost to the individual. Often the salinity-related benefits accrue to landholders elsewhere in the catchment and only after a considerable time lag.

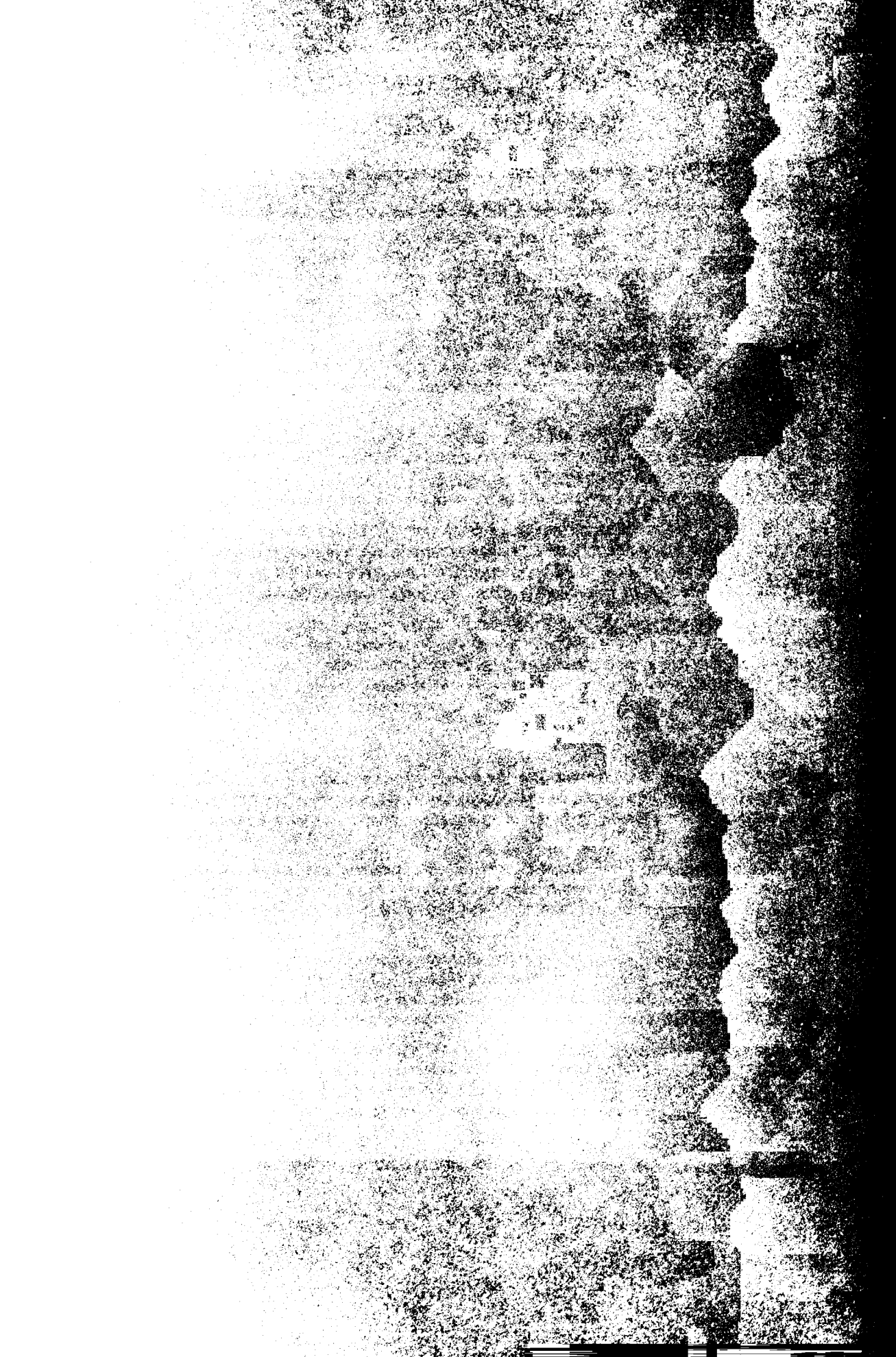
Twenty-one community groups have been established around Victoria to prepare Salinity Management Plans or regional salinity strategies. The Government has supported these groups with executive and technical assistance from the range of technical disciplines required for salinity management. Plan preparation has been directed by Guidelines which require that groups systematically assess the economic, social and environmental implications of their plans.

Community groups have the onerous task of balancing social, economic and environmental requirements of salinity management. The Guidelines are clear about the need for a detailed economic assessment of the plans so that government can assess the merits of investment in a particular area against the merits of investing in other salinity management plans, or indeed other government activities.

But the Government also has a responsibility for environmental and social well-being. The Guidelines recognised that monetary values could not be assigned to these factors and requested that community groups describe these factors so that a judgement could be made by government.

A crucial element of the Salinity Management Planning approach adopted by the Program is the preparation of Government Responses to the community's preferred management plan. The Government Response phase means that all options proposed by community plans will be reviewed, and if necessary further refinements to the plans will be required.

Audit has called for greater quantification of social and environmental factors so that the Government can ascertain the relative merits of investing in plans, of different sub-regions, that aim principally to maintain social and environmental well-being. While the managing agencies accept the usefulness of quantification, an appropriate technology to do so is not available.



OVERALL COMMENT - continued

Clearly, the availability of data on quantifiable social and environmental impacts would assist the consideration of compulsory land retirement. But even then the issue would not be clear cut. If social considerations are paramount then "living with salt" is a realistic option for many communities.

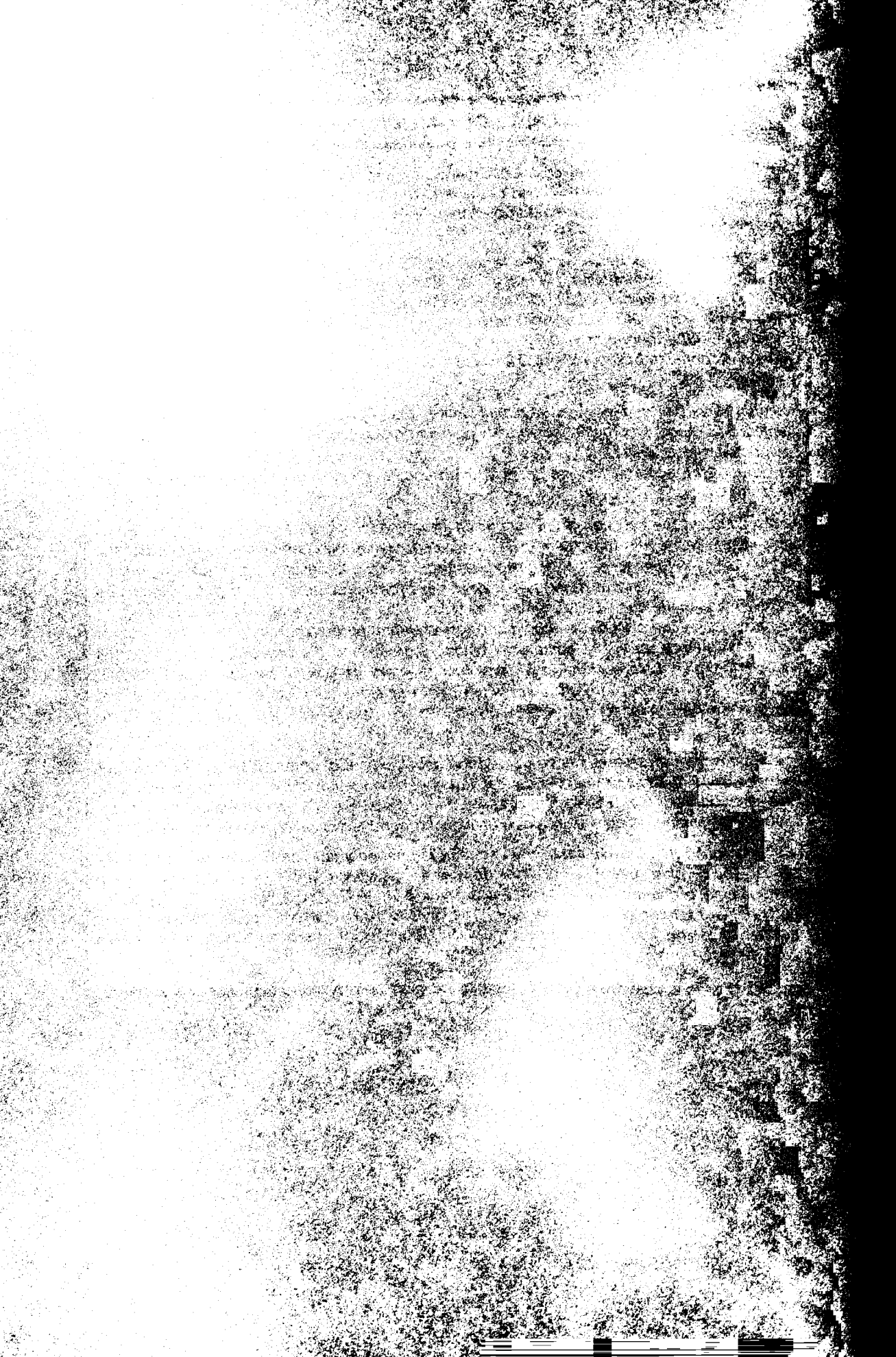
The Mineral Reserves Basin Scheme proposal of the early 1980s reinforced the need for a high degree of community ownership of salinity management. The community-based approach adopted by the Salinity Control Program seeks to ensure that if evaporation basins are required, their siting and environmental impact are subject to rigorous public scrutiny. Research into the long-term viability and management of basins has been accelerated. The Girgarre evaporation basin in Shepparton was built for this purpose and is showing promising results.

Audit identifies the long-term salt accumulation in Lake Tutchewop as a major problem. The problem was recognised by the community planning group and proposals, consistent with the comprehensive Murray-Darling Basin Salinity and Drainage Strategy, are now being considered by the Murray-Darling Basin Commission for the periodic flushing of the Lake into the Murray River.

Audit also raises the question of efficiencies in the community-based planning process. Some plans have taken longer to prepare than anticipated. Managing agencies accept the reasons for the delays as legitimate: the time required to collect the necessary data took longer than planned (as in the case of Kerang Lakes) or the broader community did not endorse the preferred plan of the community working group (as in the case of Campaspe West). Managing agencies have interpreted the community-government partnership theme of the Salinity Control Program literally; the community planning group and the broader community must support the plan before effective salinity management programs can be established. If community involvement were cut short when hard decisions take longer than expected, the community's perception of ownership would diminish along with their will to implement decisions.

The lessons from these areas have guided the development of other planning exercises not reviewed by audit. Dryland plans in central Victoria and irrigation plans in North West Victoria have taken between 2 and 3 years to produce. In the Boort area the formal establishment of a community planning group was deferred until background technical data were collected.

Audit has found that the Goulburn dryland plan is uneconomic. The Government supported the Goulburn plan because of the down-stream salinity impacts and the potential environmental problems. The economic assessment of the Goulburn plan did not include all the benefits from implementing the plan. The dryland plans currently being prepared have included the significant agricultural productivity benefits of improved pastures and these plans are economic.



OVERALL COMMENT - *continued*

The Program's Cost-sharing Guidelines represent a major achievement for the Program. The Government and community partnership extends beyond the planning phase to the implementation of the plans. The community must contribute financially. The Guidelines draw on economic and environmental policy and present a set of decision rules that can be applied by government and the community groups in determining cost-shares. The rules have to be flexible as each plan reflects differing regional circumstances. Audit finds that greater scope exists for applying the polluter pays principle in determining cost-shares. The Salinity Control Program supports the principle but recognises constraints on its practical implementation.

The Program's achievements extend to its management by government. Responsibility for implementing the Salinity Control Strategy clearly lies with operational agencies but new processes were required to ensure that the agency activities were co-ordinated. A Cabinet Committee was established to develop these co-ordination arrangements and to accelerate salinity control programs. A co-ordination unit, the Salinity Bureau, was established to assist with and monitor the effectiveness of the co-ordination process. The Bureau does not manage the Program; it facilitates co-ordination. For example, throughout this Report, audit attributes comments to the Salinity Bureau but the comments originated from the operational agencies and were collated by the Bureau.

The Program's achievements are significant and owe much to the enthusiastic and tireless efforts of community working group members and government officers. However, the Program is far from static. As the audit has found, a systematic State-wide monitoring strategy is now required (and is being developed) to ensure that the existing individual monitoring activities are co-ordinated and that information from monitoring can be acted upon in a timely manner.

The Salinity Control Strategy recognises that there is no one correct solution to salinity. The salinity management process was designed to be iterative, as plans are being implemented the community and government learn and adjust not only the on-ground management techniques but also how the Government responds. The Auditor-General's Report is a timely contribution to this process.



PART 2

Salinity Overview

DESCRIPTION OF SALINITY

What is salinity?

2.1 In simple terms, salinity refers to the presence of excessive quantities of salt in soils and water and relates to the concentration of salt on the land and its accumulation in water systems. While salt deposits exist under natural conditions (primary salting) such as the existence of salt marshes and salt flats, the impact of human activities associated with forest clearing, agricultural practices and irrigation in rural Victoria can exacerbate the situation and lead to the accumulation of salts (known as secondary salting).

2.2 The salting of soils and water is closely linked with rising watertables. The level of a watertable can rise significantly in response to very small increases in the amount of surface water entering the groundwater from rainfall, irrigation or ponded water. As groundwaters rise, naturally occurring salts are dissolved and brought towards the surface where the salt is concentrated by evaporation. The accumulation of salt levels near the surface can damage vegetation and soils thereby decreasing agricultural productivity. High salt levels also increase soil erosion and leads to the degradation and, in some cases, the total loss of wildlife habitat and recreational areas.

2.3 Salinity is not a problem which is unique to Victoria. In addition to salinity emerging as a problem in New South Wales, South Australia and Western Australia, various forms of salinity have been reported in other parts of the world including the United States of America, Canada, Iran, Iraq, Turkey and Latin America.

What are the various types and causes of salinity?

2.4 The types of salinity prevalent in Victoria can be categorised as dryland salinity, irrigation salinity, stream salinity and groundwater salinity.

2.5 Where the watertable or groundwater rises to a critical distance from the surface and the subsoil or groundwater is highly saline, capillary action brings salts to the soil surface. Audit was advised by the Salinity Bureau (an agency under the control of the Department of the Premier and Cabinet which is charged with the responsibility for co-ordinating and monitoring the implementation of the Salinity Control Strategy) that where saline groundwater lies within 1.5 metres of the soil surface in clay soils (most of the land in Victoria seriously affected by salinity is clay based) the critical level has been reached and land will be affected by salinity.

Dryland salinity

2.6 Dryland salting includes all areas of salting where irrigation is not present and is generally caused by the clearing of local native vegetation (such as forest or tree clearing) and certain agricultural practices which lead to higher groundwater levels. These matters are discussed in paragraphs 2.7 to 2.10 of this Report. According to the findings of a report prepared for the Salinity Committee by consultants in 1983, dryland salting may also be caused by saline discharges resulting from vegetation changes at remote locations.

Tree clearing

2.7 Salt accumulates in soil due to the effect of rainfall which contains low levels of salt arising from the evaporation of seawater, the weathering of rock minerals and the natural incidence of salt in soil. In earlier years, when forests dominated the terrain, a great proportion of salt was concentrated close to the surface by trees. Due to the advent of tree clearing, the increased flow of water through the landscape transferred this stored salt into the watertable leading to the salinisation of groundwater flows. The removal of trees has also meant that as more rainfall reaches the soil surface and less water is used by plants, increased accessions to the groundwater and a consequential rising watertable brings dissolved salts in the soil to the surface through evaporation which further increases the salinity of both surface soil and water.

2.8 Forest cover has reduced significantly since European settlement. According to specialist opinion **possibly less than 15 per cent of the original forest cover remains in the western half of Victoria, which has the highest incidence of dryland salting and stream salinity.**

Agricultural practices

2.9 Certain agricultural practices now regarded as undesirable, such as over-grazing and poor crop management, can lead to wind erosion, which then contributes to soil erosion and dryland salting through the exposure of saline subsoil.

2.10 Obviously, shallow-rooted crops or pasture do not use as much water as deep-rooted trees, as water use is affected by the density and depth of plant root systems within the soil surface. Excess water not used by crops or pasture travels below the root zone of agricultural plants, collects soluble salts and adds them to the groundwater system which impacts on the amount of salt located under agricultural areas and, in turn, the level of salinity.

Irrigation salinity

2.11 Inefficient irrigation practices, seepage from irrigation channels, inadequate surface drainage and excessive rainfall have contributed to a rise in watertables in the irrigation areas of northern Victoria and the consequent salinity problems in those regions. If this salt is not subsequently dispersed below the root zone, the soils eventually become salt affected and crop or pasture yields decline. In addition to the effect of a rising saline watertable, the application of excessively saline irrigation water also has an impact on agricultural production.

2.12 Where saline groundwater is close to the surface, lightly irrigated or non-irrigated paddocks are likely to be affected to a greater extent than intensively irrigated areas as excess low saline irrigation water may assist in dispersing salt away from the roots of plants. Against this, if paddocks are intensively irrigated without adequate drainage, the groundwater table will rise causing further salinity.

Stream salinity

2.13 Salting in dryland and irrigation areas, discharges of saline groundwater, cyclic salt (salt carried into the atmosphere from the surface of the sea through evaporation and deposited by way of rainfall) and dissolution of surface salts in run-off water add to the existing salt loads in streams which can increase salt concentrations further downstream. Increased salinity in wetlands is due to high stream salinities, discharge of saline groundwater, planned disposal of saline waste water into lakes and swamps, and river controls which have reduced flood frequencies.

Groundwater salinity

2.14 Groundwater salinity exists in situations where water below the surface is found to be salty. Some of the causes of high salinity levels in groundwater are:

- ▶ accessions from irrigation areas and saline streams;
- ▶ construction of unsealed water channels and reservoirs;
- ▶ tree clearing in dryland areas;
- ▶ weathering of surface material;
- ▶ rainfall passing through saline subsoils; and
- ▶ deposits from ancient inland seas which once covered parts of western Victoria.

What are the salt prone areas in the State?

2.15 The area affected by salinity within Victoria amounts to some 435 000 hectares or 3.3 per cent of the State's agricultural base. An estimate of the annual cost of reduced productive capacity, due to salinity, is in the vicinity of \$230 million. Details of the salt affected sub-regions of the State (individual areas in which salinity problems have a common cause, effect or down-stream consequence and within which planned salinity control practices are likely to be effective) in terms of lost productive capacity are included in Table 2A.

TABLE 2A. EFFECT OF SALINITY ON PRODUCTIVE CAPACITY

<i>Region</i>	<i>Gross value of average annual production</i>	<i>Area affected by salinity</i>	<i>Area affected as a percentage of agricultural land</i>	<i>Current estimated annual loss due to salinity</i>
	<i>(\$m)</i>	<i>(hectares)</i>	<i>(%)</i>	<i>(\$m)</i>
North East	181	200	0.1	0.1
Goulburn-Broken				
Shepparton Irrigation	451	81 000	17.6	79.5
Goulburn Dryland	166	2 300	0.5	2.6
Campaspe				
Campaspe West	5	1 840	30.7	1.6
Dryland	65	5 100	2.7	1.0
Loddon-Avoca				
<i>Irrigation</i>				
Barr Creek	30	33 000	50.0	(a)
Boort	32	83 700	94.0	30
Kerang Lakes	85	13 800	5.7	4.8
Tragowel Plains	58	88 000	70.4	40.9
<i>Dryland</i>				
Avoca-Loddon	240	7 600	1.2	3.3
Mallee				
<i>Irrigation (b)</i>	152	800	0.2	1.3
<i>Dryland</i>				
Mallee Dryland	374	9 000	0.7	2.5
Wimmera				
Avon-Richardson	136	19 900	4.6	5.9
Other	377	35 100	2.8	10.8
Glenelg	1 135	20 000	1.3	14.9
Corangamite	650	12 000	1.4	23.2
South-east				
Lake Wellington	132	12 500	5.1	6.7
Other	310	9 010	1.5	5.2
Total	4 579	434 850		234.3

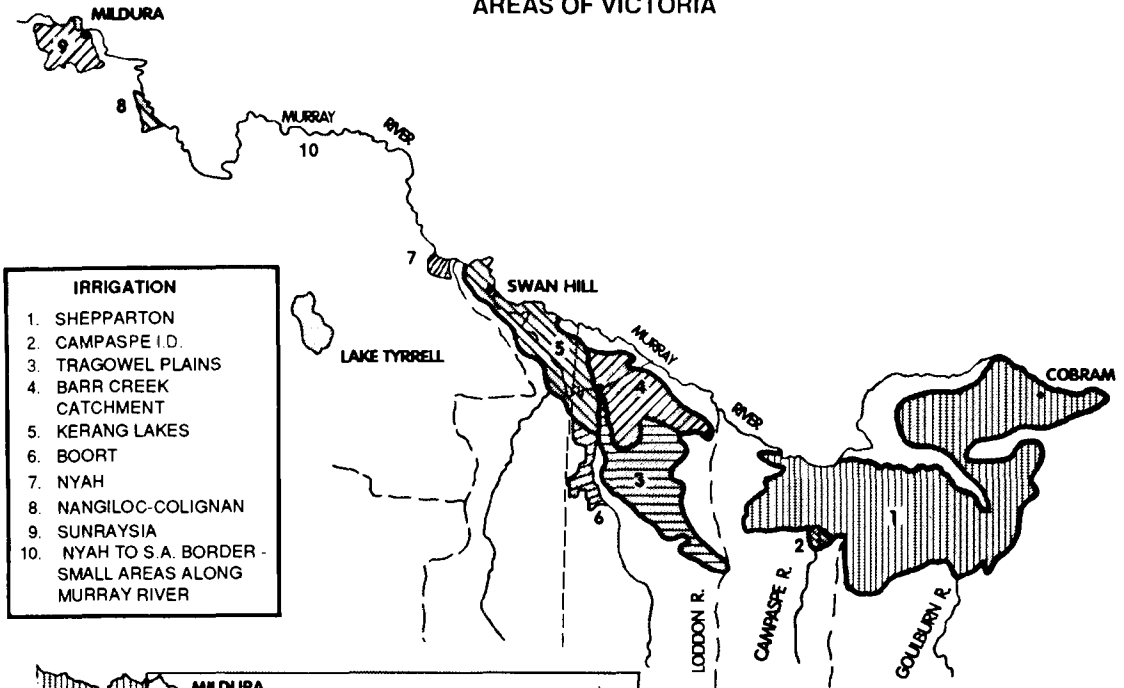
(a) Information not available.

(b) Irrigation figures are the sum of the individual salinity management plans for the Nangiloc-Colignan and Sunraysia/Nyah to border sub-regions.

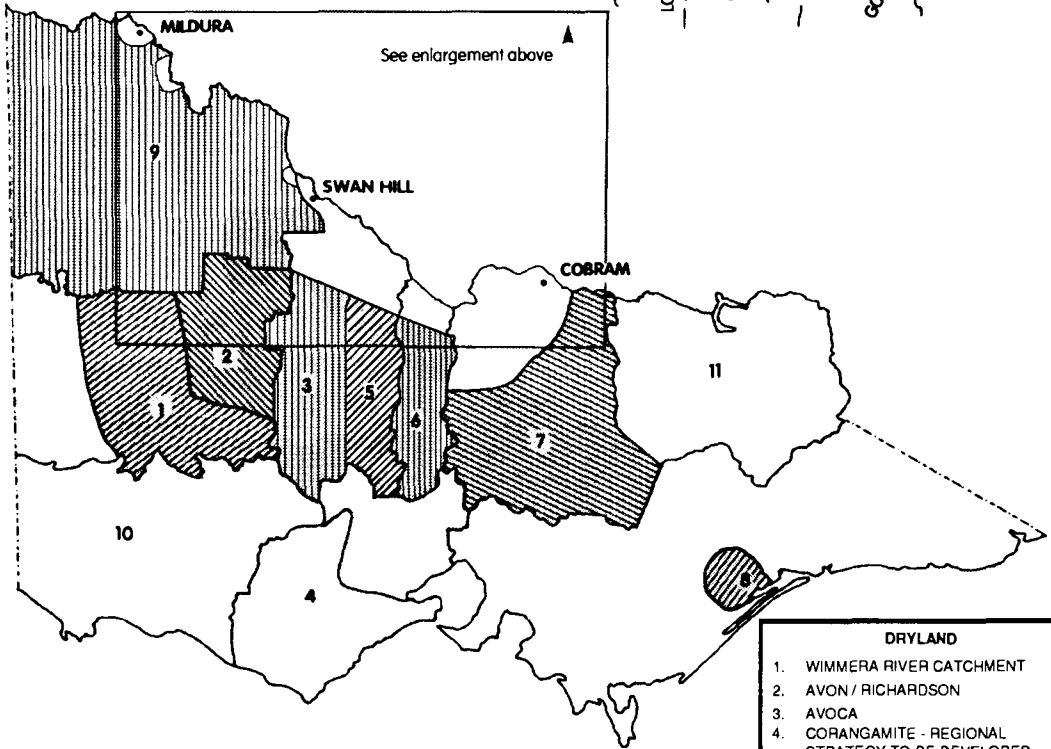
Source: Information obtained from a 1992 discussion document entitled "Regional Salinity Impacts", prepared for the Salinity Planning Working Group (an interdepartmental working group on salinity comprising senior officers from relevant agencies with responsibility for overall planning and co-ordination). Audit was advised by the Salinity Bureau in February 1993 that the document is being revised using an alternative methodology based on net value of annual production.

2.16 Representations of the salt prone areas of the State derived from information obtained from the Government's Salinity Control Strategy and the Salinity Bureau are illustrated in Charts 2B and 2C.

CHART 2B. SALINITY CONTROL IRRIGATION AND DRYLAND AREAS OF VICTORIA

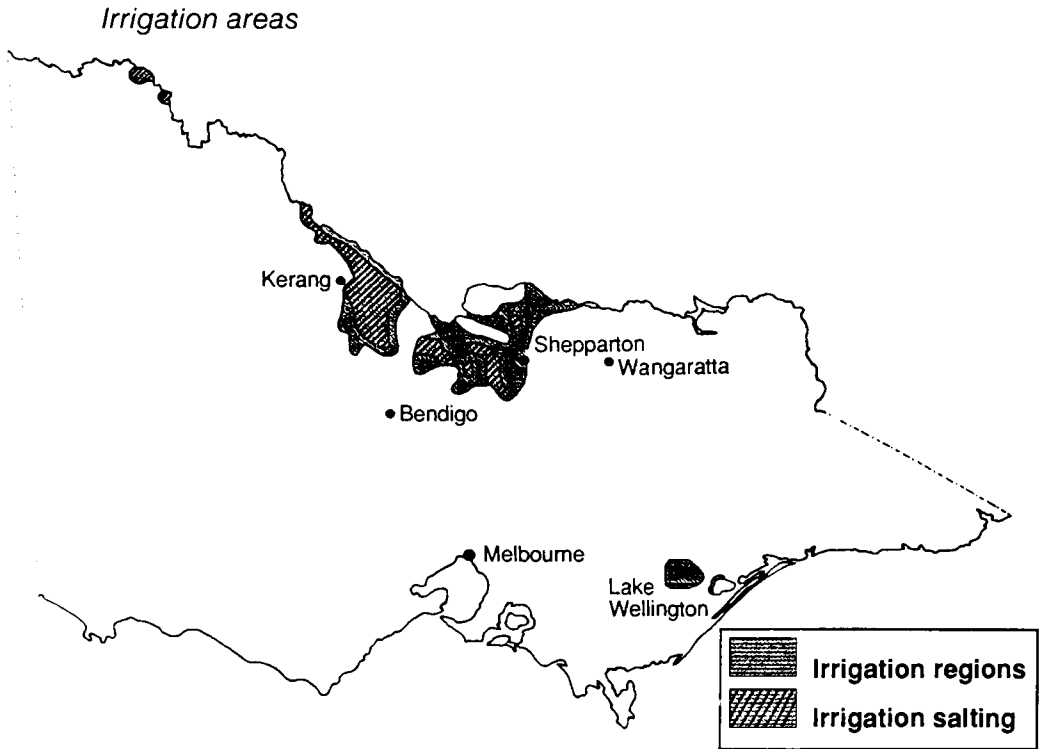


- IRRIGATION**
1. SHEPPARTON
 2. CAMPASPE I.D.
 3. TRAGOWEL PLAINS
 4. BARR CREEK CATCHMENT
 5. KERANG LAKES
 6. BOORT
 7. NYAH
 8. NANGILOC-COLIGNAN
 9. SUNRAYSIA
 10. NYAH TO S.A. BORDER - SMALL AREAS ALONG MURRAY RIVER

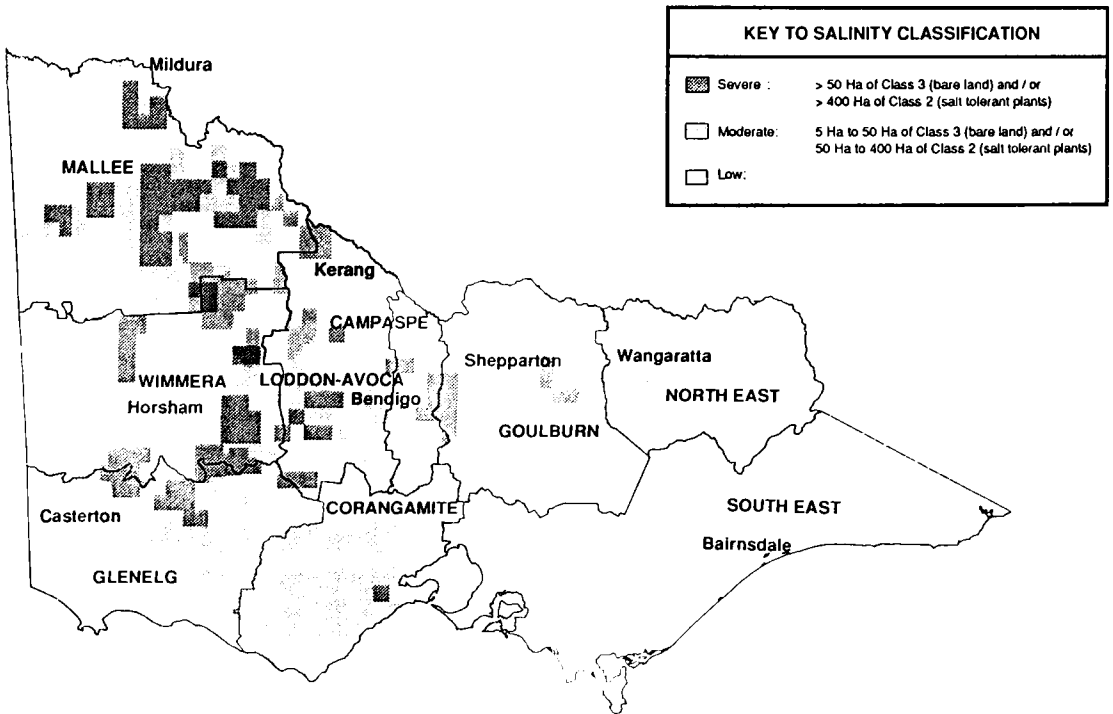


- DRYLAND**
1. WIMMERA RIVER CATCHMENT
 2. AVON / RICHARDSON
 3. AVOCA
 4. CORANGAMITE - REGIONAL STRATEGY TO BE DEVELOPED
 5. LODDON
 6. CAMPASPE
 7. GOULBURN
 8. LAKE WELLINGTON HINTERLAND
 9. MALLEE
 10. GLENELG - REGIONAL STRATEGY TO BE DEVELOPED
 11. NORTH-EAST - REGIONAL STRATEGY TO BE DEVELOPED

CHART 2C. SALT AFFECTED LAND IN VICTORIA



Dryland areas



What are the effects of salinity?

2.17 The salinity of water and soil can give rise to 3 serious consequences, namely, an economic impact on agricultural production and urban uses, an environmental effect in terms of wetlands and forestry, and a social effect at the farm and community level. **If salinity is not adequately addressed or control strategies prove to be ineffective, the ultimate impact to the State could be significant and far-reaching.** The various effects of salinity in general terms are briefly outlined below. Many of these examples have been drawn from reports prepared for the former Salinity Committee of the Victorian Parliament. In addition, the specific impacts in the context of environmental, economic and social repercussions of past government decisions, which have only been widely recognised in recent times, are detailed in Part 5 of this Report while other ramifications are outlined in Part 6.

2.18 In summary, salinity can have far reaching economic, environmental and social consequences. According to the State Salinity Strategy, it is the single greatest threat facing the environment of Victoria.

Economic effect

Agriculture

2.19 Agriculture within the State comprises numerous farming activities including horticulture, pasture production, cropping, livestock production and dairying. Increasing salinity levels have led to a decline in areas set aside for horticultural production and to reduced yields in horticultural activities. Salinity of irrigation water impacts on pasture production and crop yields as well as increasing the costs of production.



Salt affected pastures in the Harston area, Shepparton Irrigation sub-region

2.20 Dryland salting also reduces the productivity of cropping and grazing land.



A dryland site near Ouyen in the Mallee region.

Urban implications

2.21 Saline water supplies can affect urban communities by increasing maintenance costs and reducing the service life of water pipes and certain household appliances. Salinity may also impair the quality of drinking water, adversely affect the operations of mining, industrial and commercial enterprises, and accelerate road deterioration.

Environmental effect

Wetlands

2.22 The increasing salinity of wetlands has meant that certain habitats in Victoria have become unsuitable for some waterbirds. Decisions to use more wetlands for evaporative disposal or receive saline drainage from irrigation run-offs, further reduce existing refuge and breeding sites for various bird species and other wildlife.

Forestry

2.23 High salinity levels in the atmosphere, soil and groundwater have an adverse impact on the growth of trees. In many areas rising watertables and increasing salinity have led to the death of trees.

Social effect

2.24 The economic impact of salinity also has a social effect at both the farm and community levels. Long-term reductions in farm incomes and land values have affected farming communities. In the event of a reduction in the productivity of land brought on by salinity, younger and more adaptable farmers may decide to leave their farms.

How is salinity measured?

2.25 The salt content of solutions is determined by measuring the amount of dissolved salts in a given volume of water. The most accurate method of salt measurement, although the process is relatively slow, is to take a sample of the solution, dry it and weigh the remaining salts.

2.26 However, a quicker process is to measure the ability of the solution to conduct electricity, a characteristic which has been shown to be related to the amount of salt present in the solution (the measurement is expressed in EC units).

2.27 In technical terms, salinity measured in EC units means the electrical conductivity expressed in microsiemens per centimetre. The more salt in water, the more electricity will be conducted. To calculate the approximate concentration of salts in milligrams per litre of water (or kilograms per megalitre of water), the EC units are multiplied by 0.6.

2.28 Details of the various classes of water determined according to their salinity levels and the uses which can be made of water in each category are outlined in Table 2D.

TABLE 2D. LEVEL OF SALINITY IN WATER AND ITS USES

Class of water	Level of salinity (EC units)	Uses
Fresh	0 - 800 EC	<ul style="list-style-type: none"> ◦ Good drinking water for humans. ◦ Generally good for irrigation, although above 300 EC some care must be taken, particularly with overhead sprinklers which may cause leaf scorch on some salt sensitive plants. ◦ Suitable for all livestock.
Marginal	800 - 2 500 EC	<ul style="list-style-type: none"> ◦ Can be consumed by humans, though most would prefer water in the lower half of this range. ◦ When used for irrigation, requires special management including suitable soils, good drainage and consideration of salt tolerance of plants. ◦ Suitable for all livestock.
Brackish	2 500-10 000 EC	<ul style="list-style-type: none"> ◦ Not recommended for human consumption, although water up to 3 000 EC could be consumed in emergencies. ◦ Not normally suitable for irrigation, though water up to 6 000 EC can be used on very salt tolerant crops with special management techniques. Over 6 000 EC, occasional emergency irrigation may be possible with care, or if sufficiently low salinity water is available, it could be mixed with the high salinity water to obtain an acceptable supply. ◦ When used for drinking water by poultry and pigs, the salinity should be limited to about 6 000 EC. Most other livestock can use water up to 10 000 EC.
Saline	Over 10 000 EC	<ul style="list-style-type: none"> ◦ Not suitable for human consumption or irrigation. ◦ Not suitable for poultry or pigs, but beef cattle can use water to 17 000 EC and adult sheep on dry feed can tolerate 23 000 EC. However, it is possible that water below these EC levels could contain unacceptable concentrations of particular ions. Detailed chemical analysis should therefore be considered before using high salinity water for stock. ◦ Water up to 50 000 EC (the salinity of the sea) can be used: <ul style="list-style-type: none"> · to flush toilets provided corrosion in the cistern can be controlled; and · for making concrete.

Source: "Causes, Extent and Effects of Salinity in Victoria" A report to the Salinity Committee of Parliament November 1983, and "Salinity Control in Northern Victoria" a report to the Salinity Committee of Parliament, September 1984.

PART 3

Conduct of the Audit Review

OBJECTIVES AND SCOPE

3.1 The audit review focused primarily on the management practices employed centrally by government to address salinity and its related economic, environmental and social impacts. This central focus was complemented by an examination of salinity management plans for 4 sub-regions of the State.

3.2 Given the magnitude of technical analysis and specialist advice obtained by government over the past decade in relation to the issue of salinity, the audit largely concentrated on evaluating the manner in which the State's Salinity Control Program through the Salinity Control Strategy has been managed in terms of economy, efficiency and effectiveness. However, where considered relevant, certain technical matters of significance have been addressed in detail. The review of issues of a technical nature was assisted by the use of staff on the audit team who possessed qualifications in natural sciences. In addition, specialist advice was obtained in the evaluation of technical aspects through the engagement of expert practitioners with skills in engineering, soil sciences and environmental issues from Van De Graaff and Associates Pty Ltd and Fisher Stewart Pty Ltd.

3.3 The Report has been structured in non-technical terms, where possible, for ease of reading. To further assist readers, a glossary of terms explaining certain terminology is contained in Appendix A to the Report.

Objectives

3.4 The overall objectives of the audit were to:

- ▶ review the salinity management practices employed by government in implementing the Salinity Control Program to assess whether:
 - the State-wide Salinity Control Program has been centrally managed in an efficient and effective manner;
 - any actions by government have contributed to salinity and resulted in unnecessary costs to the Government;
 - any issues relating to the development and implementation of sub-regional salinity management plans examined by audit have State-wide implications; and
- ▶ examine the procedures involved in developing salinity management plans to assess whether:
 - the program components of the Salinity Control Strategy have been undertaken in an economic, efficient and effective manner;
 - the plans are consistent with other government environmental policies; and
 - any issues relating to individual plans have State-wide implications.

Scope

3.5 The audit focused on:

- ▶ an examination of the monitoring and evaluative framework established by government to assess the performance of the Program against its goals and objectives;
- ▶ an evaluation of processes developed by management at a central level to assess the degree to which the various commitments outlined in the Salinity Control Strategy had been effectively met by government;
- ▶ an assessment of the adequacy of annual reporting and financial accountability;
- ▶ a review of documentation held by lead agencies concerning salinity related projects; and
- ▶ an examination of the following 4 salinity management plans (plans provide a detailed coverage of the extent of salinity on a sub-regional basis and the recommended control measures to be implemented to address the problem):
 - Shepparton Irrigation;
 - Goulburn Dryland;
 - Kerang Lakes; and
 - Campaspe West.

PROCESSES FOLLOWED

3.6 In conducting the audit, relevant records were examined and discussions held with key officers of the following government agencies involved in the Program:

- ▶ Department of the Premier and Cabinet (including the Salinity Bureau - formerly within the Department of Agriculture);
- ▶ Department of Agriculture;
- ▶ Rural Water Corporation; and
- ▶ Department of Conservation and Natural Resources (which includes the former Department of Conservation and Environment and the Department of Water Resources).

3.7 Discussions and meetings with relevant parties, including local community groups, formed an integral part of the audit. To provide a broader perspective, meetings were also held with representatives from the Victorian Farmers' Federation and the Australian Conservation Foundation. A list of individuals and groups consulted by audit during the review is contained in Appendix B of this Report.

3.8 A questionnaire was issued to the Salinity Bureau to obtain relevant information and an advertisement was placed in certain newspapers inviting comments from the public concerning the implementation of the Salinity Control Strategy. In addition, with the assistance of departmental and community representatives, audit conducted on-site inspections within the regions subject to review.

3.9 The review of financial information relating to the salinity management plans focused primarily on the 1991-92 financial year.

3.10 In preparing the Report, it was not considered an efficient process to re-work figures contained in the draft plans examined by audit. These figures have been subject to detailed scrutiny and questioning by government agencies, consultants and the community and, in the circumstances, were accepted by audit as reliable information on which to conduct the audit review.

3.11 The managing agency responses throughout the Report were co-ordinated by the Salinity Control Program's interdepartmental Planning Working Group and have been endorsed by the:

- ▶ Acting Secretary of the Department of Conservation and Natural Resources;
- ▶ Secretary of the Department of Agriculture; and
- ▶ Managing Director of the Rural Water Corporation.

3.12 Unless specifically stated, government agencies and departments will be referred to by their current titles. As the audit review commenced in December 1991 and relates mainly to administrative processes over the last decade, any references to the current government will be clearly identified.

3.13 In referencing to aspects of the 1988 Salinity Control Strategy, the present tense has been used throughout the Report. Audit was advised by the Salinity Bureau that despite the change in government, the Strategy is still of an on-going nature and has remained unchanged.

DESCRIPTION OF SALINITY MANAGEMENT PLANS EXAMINED BY AUDIT

3.14 To facilitate a program-wide review by audit, 4 sub-regional salinity management plans, namely Shepparton Irrigation, Goulburn Dryland, Kerang Lakes and Campaspe West were selected for detailed examination.

Rationale for selection

3.15 In selecting the 4 plans, audit covered a cross-section of different lead agencies, dryland and irrigation plans, finalised plans that were in the implementation stage and plans that were in the process of preparation. In addition, the estimated production losses due to salinity in the Shepparton Irrigation sub-region, which comprise around one-third of the State's losses, prompted selection of the Shepparton Irrigation plan.

3.16 The draft Kerang Lakes plan was selected for review as it was a particularly complex plan with perhaps the most sensitive environmental issues of any plan. The environmental significance of the area is illustrated by the extent of its wetlands and lakes (according to information distributed by the Kerang Lakes Area Working Group, some 50 wetlands and 35 lakes cover about 10 per cent of the area). In addition, there has been a history of controversy in the area surrounding salinity mitigation works arising from the aborted Mineral Reserves Basin Scheme. Also, the planning process which had significant time overruns was nearing completion, the draft plan having been officially released for community consultation in March 1992.

3.17 The Campaspe West plan was chosen on the basis that although the completion date set by the government strategy was 1988, the draft plan was rejected by the community and is now in the process of further refinement.

Agricultural characteristics of selected plan areas

Shepparton Irrigation plan area

3.18 Irrigated agriculture is the predominant form of farming within the Shepparton Irrigation plan area. The largest proportion of this irrigated land is used for pasture production (dairying and beef cattle) while the remainder is used for horticultural activities (particularly fruit growing), grain crops, seed crops, lucerne, forage crops and vegetables.

Goulburn Dryland plan area

3.19 The Goulburn Dryland plan area comprises non-irrigated land which is used primarily for cereal cropping and grazing sheep and cattle.

Kerang Lakes plan area

3.20 The Kerang Lakes plan area is mainly irrigated land which supports both dairy and grazing industries. There are also highly productive pockets of irrigated horticulture, centred mainly around Tresco and Woorinen in the north, and some dryland grazing and cropping enterprises.

Campaspe West plan area

3.21 Farming within the Campaspe West plan area is centred around dairying which is its predominant source of production. Other agricultural activities in the region include grazing (beef, sheep and horses), cropping (sunflowers, wheat, soy beans, oats and tomatoes) and the growing of lucerne.

PART 4

Government Approach to Salinity

FORMULATION OF POLICY ON SALINITY

4.1 Until the 1960s very little government activity occurred in relation to salinity issues. Awareness of the problem gained momentum through the 1970s and early 1980s with expenditure by government between 1972 and 1984, in areas such as capital works and research associated with salinity, amounting to at least \$60 million according to information obtained from the Rural Water Corporation. In response to the growing problems of land and river salinity in Victoria, the Government in 1982 initiated an inquiry by an all-party Joint Select Committee of the Victorian Parliament (the Salinity Committee) into salinity with particular reference to:

- ▶ the opportunities for co-operative efforts in salinity control involving other State Governments and the Federal Government;
- ▶ meeting the costs of salinity control; and
- ▶ administrative and other arrangements for salinity control.

4.2 The aim of the inquiry was to provide a comprehensive basis for the development of an effective program for the control of salinity in Victoria. During the course of the inquiry, which included over 100 meetings and input from a wide cross-section of community, governmental and specialist groups, the Salinity Committee presented 4 reports to the Parliament, namely:

- ▶ *Progress Report on the Barr Creek Catchment, Mineral Reserve Basins and Lake Tyrrell Schemes* (December 1982);
- ▶ *The Activities of the Salinity Committee* (October 1983);
- ▶ *Salt of the Earth: Final Report on the Causes, Effects and Control of Land and River Salinity in Victoria* (October 1984); and
- ▶ *Water Allocations in Northern Victoria* (October 1984).

4.3 In addition, 7 other technical reports and discussion papers were published by the Salinity Committee.

4.4 Based on this information the Government, in early 1985, gave a commitment to an accelerated program of salinity management, developed a salinity control program and established a **Cabinet Task Force on salinity**. The role of the Cabinet Task Force, which became the Natural Resources and Environment Committee of Cabinet (subsequently changed by the former government to the Conservation and Environment Committee of Cabinet), was to co-ordinate salinity control activities at a high level and prepare, on an annual basis, an overall salinity control budget.

Relationship with the Conservation Strategy for Victoria

4.5 The Conservation Strategy for Victoria, which was released in June 1987, indicated that in the 150 years since European settlement, the Victorian landscape has undergone dramatic and in some cases disastrous changes. To illustrate this point, **the Conservation Strategy stated that thousands of hectares of once fertile soil have become salted or eroded wastelands and that the State has lost half its original forest cover.**

4.6 The Conservation Strategy highlighted the importance of the Salinity Control Program and identified salinity control as one of the 7 priority areas for action over the ensuing 4 years. In terms of environmental benefits, the Conservation Strategy was aimed at reducing the spread of salinity and with regard to economic benefits indicated that the annual loss of agricultural production from salinity was estimated at \$50 million. According to the Conservation Strategy, conservation measures to control salinity could lead to substantial local increases in agricultural productivity and sustainability. Furthermore, the Conservation Strategy also indicated that every farmer retained on the land as a result of salinity control measures represented employment and wealth to country areas which, in turn, contributed positively to the economies of rural towns and communities.

Salinity Control Strategy

4.7 Following the results of former parliamentary inquiries, the direction taken in the Conservation Strategy for Victoria and recognition that a co-ordinated joint approach was needed between government and many sectors of the community to control salinity, the then Natural Resources and Environment Committee of Cabinet prepared a **detailed Salinity Control Strategy (known as "Salt Action: Joint Action") to guide the Salinity Control Program for the management of land and water salinity**. This Strategy was endorsed by the Government in May 1988. The Government indicated in the Strategy that **salinity is the single greatest threat facing the environment of Victoria**. The Government claimed that salinity was widespread throughout northern and western parts of the State and its extent and severity continued to increase.

4.8 In setting goals and priorities for its policy, the Government recognised the need for the Salinity Control Strategy to reflect the goals and priorities of other government policies, including the Conservation Strategy, the Economic Strategy, the Social Justice Strategy and the Wetlands Conservation Policy.

4.9 The principal long-term goal of the Salinity Control Strategy is:

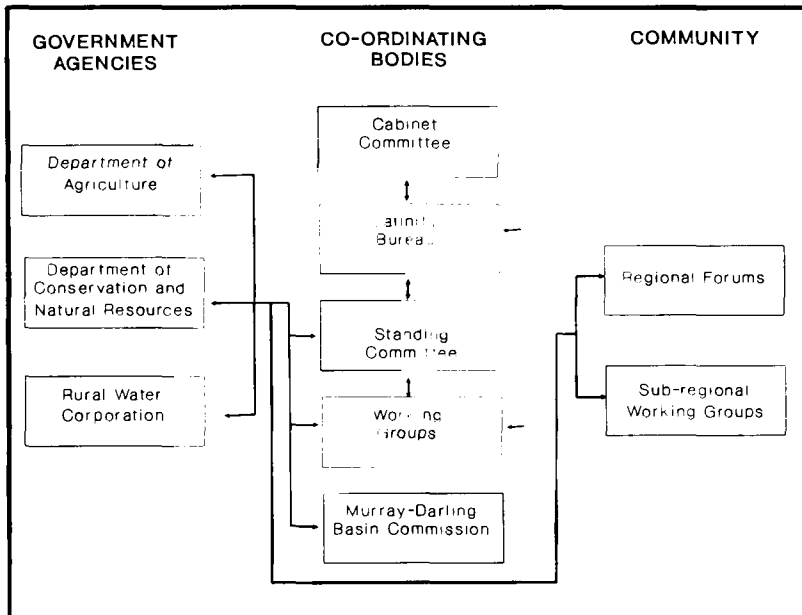
"... to manage the salinity of land and water resources throughout Victoria in order to maintain and, where feasible, to improve the social well-being of communities, and the environmental quality and productive capacity of the regions. Where possible, the spread of salinity will be controlled. Where an increase is unavoidable, this strategy will help communities to adapt to more saline conditions".

4.10 In order to achieve this goal the Strategy outlines 5 program objectives as well as setting numerous targets to be achieved in the short and long-term. The Strategy is co-ordinated through the development of 8 programs which provide the basis for the preparation of salinity control plans at a State, regional and local level. Seven State-wide working groups, comprising government and non-government members (as required), were established by the Natural Resources and Environment Standing Committee to overview and co-ordinate activities relating to the 8 programs. The aim of the groups was seen as keeping the Committee advised on the implementation of the Salinity Control Program and to provide assurances that public moneys were appropriately spent.

4.11 In terms of implementing the Strategy, the **Salinity Bureau** plays a vital role in the on-going co-ordination of the Strategy. Community participation in the development and implementation of salinity plans is achieved through the establishment of regional forums and community working groups.

4.12 Chart 4A shows the position of the various groups in the framework established for the implementation of the Strategy.

CHART 4A. FRAMEWORK OF GROUPS INVOLVED IN UNDERTAKING THE STRATEGY



4.13 For the purpose of planning, Victoria is divided into 9 salinity control regions, 10 salinity sub-regions in the northern irrigation districts and 8 sub-regions in dryland areas.

4.14 Salinity in Victoria is addressed through the development of **salinity management plans** for each sub-region of the State which forms a crucial element of the Salinity Control Strategy for Victoria. A joint planning process is undertaken between the community and the Government whereby a community working group is formed to develop each plan. **Community involvement in the planning process was seen as a cornerstone of the Salinity Control Strategy.** (Further audit comment in relation to salinity management plans is contained in Part 9 of this Report). After the relevant plan is endorsed by the Government, the control options and related infrastructure works are put into place through the implementation phase of the Strategy. The planning and implementation phases may extend over a time frame of between 10 and 50 years and as such the Strategy is a clear example of a long-term government program.

4.15 A further element of community involvement in the Program arises from participation in Watertable Watch and Saltwatch activities. Watertable Watch is a community program involving children and adults monitoring watertable levels throughout the State at specific monitoring sites. Similarly, Saltwatch is a program conducted State-wide in which adults and children collect and analyse water samples from creeks, rivers, streams and bores. Information collected from these programs is maintained by the Rural Water Corporation on a central database. This information is used to produce maps disclosing areas which have high watertable and salinity levels.

4.16 Government agencies with a key role in program delivery under the Salinity Control Strategy are:

- ▶ Department of the Premier and Cabinet (including the Salinity Bureau - formerly within the Department of Agriculture);
- ▶ Department of Conservation and Natural Resources;
- ▶ Department of Agriculture; and
- ▶ Rural Water Corporation.

Victorian Decade of Landcare Plan - effects on the Salinity Control Strategy

4.17 The Victorian Decade of Landcare Plan, released by the Government in February 1992, is designed to provide the framework for:

- ▶ rehabilitation of resources adversely affected by past management; and
- ▶ continued development and implementation of sustainable land management systems and practices that prevent future resource degradation.

4.18 The goal of the Victorian Plan is to "*achieve sustainable land use by the end of this decade*". The Plan has been initiated to build upon the major advances of both the Conservation Strategy of Victoria and the State's Salinity Control Strategy. The 3 government departments responsible for administering the State's Salinity Control Strategy are also the "*principal operational agencies*" for administering the Plan in rural areas.

4.19 As the Salinity Control Strategy forms a major segment of the Plan, it will be influenced by the future direction of that Plan.

Policy formulation by the recently appointed Coalition Government

4.20 Policies relating to salinity, which have been released by the recently appointed Coalition Government, are contained in the Liberal-National Coalition policies on Conservation and Land Management, Water and Agriculture.

4.21 The current Government also sees the problem of salinity and associated land degradation as one of Victoria's most serious and challenging environmental problems resulting in substantial agricultural losses affecting the State's economic, social and environmental well-being. Its policies provide inter alia:

- ▶ Soil conservation and salinity programs with Federal, State and local funding will be given a high priority;

- ▶ Encouragement and assistance will be given to private tree planting for conservation, erosion and salinity control;
- ▶ Restoration of affected land, both private and public, will be one of the highest priorities for the Department of Conservation and Natural Resources, with overall co-ordination for salinity control resting with the Department of the Premier and Cabinet;
- ▶ Salinity will be controlled by a co-ordinated approach involving Government and the community identifying a range of solutions, with particular emphasis on land management programs;
- ▶ Strong support will be offered to landcare groups and practical conservation programs;
- ▶ Sustainable agriculture will be supported;
- ▶ Departmental research and extension work is acknowledged and will be facilitated. The Coalition will raise the priority of research by funding adequate research staff, both in Melbourne and in appropriate regional areas;
- ▶ A coalition government recognises salinity as a major source of soil and water degradation in Victoria. Programs to rectify recharge areas, intensive tree planting schemes and whole farm planning will be encouraged; and
- ▶ The environmental challenges facing the State require permanent parliamentary overview. The Coalition Government will ensure that a powerful Joint House Parliamentary Committee acts as a watchdog on major conservation issues.

4.22 In summary, it can be seen that an elaborate structural framework has been established to administer the Salinity Control Strategy and a concerted effort has been undertaken by government in conjunction with the community to address the salinity problems facing the State.

FUNDING, EXPENDITURE AND STATUS OF PLANS

Funding of the Salinity Control Strategy

4.23 The financial resources required to implement the Salinity Control Strategy are derived from a number of sources. These are highlighted below:

Federal and State Governments

4.24 Annual funding from the Federal Government and the Victorian State Government is incorporated into the State's Co-ordinated Salinity Budget.

4.25 Federal funding within the Budget is generally provided under the following Commonwealth programs:

- ▶ Federal Water Resources Assistance Program;
- ▶ National Soil Conservation Program;
- ▶ National Afforestation Program;

- ▶ National Water Research Program for works and research associated with salinity; and
- ▶ Murray-Darling Basin Commission initiatives.

4.26 The State proportion is the larger component of government funding and the principal source of funding for implementation of the Salinity Control Strategy.

Local government

4.27 Local government, while generally perceived as an essential element in the exchange of information and as a participant in sub-regional and regional planning, also plays an important role in providing resources to salinity groups, sharing the cost of implementing salinity control options and approving rate incentives for salinity initiatives.

Local community

4.28 Financial contributions from local community members are an essential element of the Salinity Control Strategy. The Strategy states that:

"Contributions by community at regional and local levels should reflect both the extent to which these communities derive benefits from salinity control, and the relative inputs of local farming, water management and disposal systems to the worsening of the salinity problem".

4.29 Contributions generally form part of the Strategy's cost-sharing principles which allocate a certain percentage of the overall costs to the local community and a certain percentage to the Government. The social dimension of the Salinity Control Strategy is an important element which aims to achieve agreement and support of the community to undertake specific salinity control works. Given that many of the works comprise "on-farm" works such as whole farm planning, drainage re-use schemes, private groundwater pumping and tree planting, the Strategy endeavours to enlist the support and active participation of landholders in order to achieve its objectives. Audit was advised by the Salinity Bureau that:

"Community contributions are significant. In the Broken Goulburn catchment, for example, the community contributed an estimated \$33 million in 1990-91 towards the implementation of the irrigation and dryland plans. The Government contributed approximately \$10 million."

4.30 In those sub-regions where salinity management plans are yet to be finalised, funds are expended on various programs within the region. For example, research is conducted in relation to various plan options, monitoring of current salinity levels to establish benchmarks is carried out and a variety of community awareness activities are conducted with the aim of raising public awareness of the salinity problem.

Expenditure

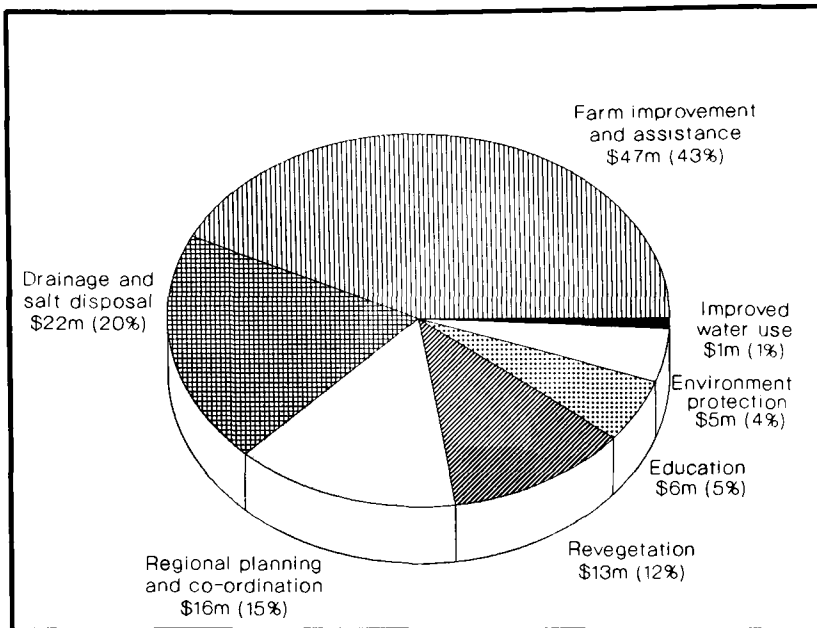
4.31 As previously mentioned in paragraph 4.4, the Salinity Control Program was accelerated in 1984-85. Table 4B shows total State and Federal Government expenditure since 1984-85:

TABLE 4B. GOVERNMENT EXPENDITURE UNDER SALINITY CONTROL PROGRAM
(\$million)

<i>Year</i>	<i>Expenditure</i>
1984-85	10.5
1985-86	12.0
1986-87	14.0
1987-88	17.5
1988-89	25.8
1989-90	23.6
1990-91	26.4
1991-92	27.1
	156.9
1992-93 (budgeted)	30.3
Total	187.2

4.32 Of the total expenditure of \$156.9 million incurred to June 1992, an amount of \$46.9 million relating to funding provided to the Murray-Darling Basin Commission, program support, research, education and monitoring has not been specifically allocated to programs. Chart 4C shows expenditure of the remaining \$110 million on a program basis.

CHART 4C. EXPENDITURE BY PROGRAMS, 1984-85 TO 1991-92



Source: The Co-ordinated Salinity Budget and the Salinity Bureau.

4.33 The research and investigation program forms a component of each of the other programs.

Status of salinity management plans and regional strategies

4.34 The status of the 18 salinity management plans developed for sub-regions throughout Victoria and the 3 regional salinity strategies at January 1993 was as follows:

- ▶ 7 salinity management plans were in the planning phase, 2 plans had been submitted to the current government for endorsement while 9 were finalised and had proceeded to implementation; and
- ▶ all 3 regional salinity strategies were in the process of development.

PART 5

Impact of Decisions of Previous Governments on Salinity Levels

OVERVIEW

5.1 This section of the Report discusses the impact of decisions of previous governments on salinity levels and the related economic, social and environmental consequences. The Section also addresses, in some detail, the impact of certain specific government decisions which have subsequently contributed to the salinity problem. The development of the Closer Settlement Scheme to stimulate irrigated agriculture in the Campaspe West sub-region of the State, the proposal to establish the Mineral Reserves Basin as an evaporation basin in the Kerang Lakes area and the construction of the Woody Yaloak Diversion Scheme to relieve flooding around Lake Corangamite are specifically discussed.

Impact of past government decisions

5.2 Past decisions by governments relating to the extensive clearing of trees from both highlands and plains, and the introduction of large-scale irrigation schemes have been crucial in stimulating the agricultural base of Victoria and thus essential for the economic growth of the State. However, in retrospect, these decisions have also been the prime causes of salinity and have contributed to major environmental problems, with substantial economic and social repercussions. The principal lesson that emerges from an analysis of the implications of past decisions is that future decisions of such importance involving large-scale government policies need to take into account not only economic but also social and environmental considerations. Cost-benefit analyses of the social and environmental impacts of government proposals should be undertaken and their results evaluated before final policy decisions are reached. The Government needs to be mindful of the lessons of history to ensure that the mistakes of the past are not repeated.

5.3 Decisions involving tree clearing, the widespread replacement of native vegetation with shallow rooted crops and grasses, the advent of irrigation and the construction of unsealed water channels and reservoirs, although made in good faith and based on prevailing knowledge, have contributed to an increase in the level of groundwater, a rise in watertable levels and an increase in the levels of salinity of soil and water.

5.4 In examining the emergence of the salinity issue confronting Victoria and assessing the degree to which the role of government has accentuated the problem, it would be unfair to assign all responsibility to government decisions.

5.5 Research indicates that pioneers encountered salinity in Victoria almost as soon as they arrived and land settlement began. Some areas of the colony were found dotted with salt-water lagoons and a number of rivers were already brackish. Charles Tyers, as early as 1839, when undertaking a survey of land from Melbourne to Portland, in referring to the salinity of salt lagoons and rivers along the route stated that, in relation to one large lagoon, "the water is perfectly salty and leaves a white secretion on the rocks". Historical material also indicates that the saltiness of our rivers, including the Murray River, was documented by the initial white explorers, and local salt was a common item of freight on the Murray River's paddle steamers many years prior to salinity becoming a major problem. In addition, extreme climatic factors also contributed to the problem as pronounced watertable rises were reported in the Kerang and Shepparton irrigation areas after intervals of heavy rainfall in 1956, 1963 and 1973-75.

5.6 Research undertaken by audit confirmed that the presence of naturally occurring high salt levels in many of the soils of northern and north western Victoria were known in the late nineteenth century. According to a leading authority in the rural sector:

"... much of Victorian agricultural development can be attributed to irrigation. Much of that irrigation has been carried out on land which has a geographical history of being a former sea-bed. The application of considerable quantum of water in this situation has led to increasingly high watertables which, in the light of the geological history, are often saline."

5.7 However, very little attention has been given to the relationship between water management projects and the environment. While governments promoted the more intensive use of land and water resources by developing closer settlement schemes and soldier settlement schemes after both World Wars, **it has only been in recent years that changes in social attitudes have placed increased emphasis on environmental and conservation values and government policies have focused on social justice principles and environmental issues.**

Economic and social repercussions

5.8 The Government acknowledged that soil and water salinity, in part, threatens the future of Victorian agriculture and estimated that the economic cost of the environmental impact of land degradation (including salinity, erosion, soil structure decline and waterlogging) is currently reducing the value of farm production in Victoria by more than \$500 million a year. The Government estimated in 1991 that **salinity in irrigation areas is causing production losses of around \$68 million a year and dryland salinity is resulting in losses in farm production of an estimated \$8 million a year.**

5.9 Land degradation and loss of income may have social implications for farmers. Non-viable salinity-affected farms would be difficult to sell and young people may not see any future on the family farm and therefore may elect to train for jobs in the city rather than undertaking agricultural courses.

5.10 As a consequence of salinity, the current level of income in some areas from agriculture will not be sustainable in the longer-term, unless effective salinity control measures are implemented.

Environmental impacts

5.11 Agricultural development has had a significant impact on the environment, contributing to land degradation, the loss of habitats and species of birds and other wildlife, and increased chemical wastes and pollution.

5.12 According to the findings contained in a report released in November 1991 by the Agriculture Working Group, a group established by the Federal Government to examine the issue of Ecologically Sustainable Development, environmental damage on developed agricultural land is more likely to occur when actual returns from an investment in agriculture are substantially lower than expected returns. This may arise where there is a lack of understanding of the consequences of particular agricultural practices or where structural adjustment is hampered by economic or social factors. Farmers are often faced with the dilemma of attempting to reconcile short-term economic goals with longer-term environmental goals. An economically viable farmer earning a profitable income from the land is in a better position to make environmentally sound decisions than a farmer in financial difficulties.

5.13 For specific comments relating to the environmental impact of government decisions on Lake Corangamite refer to paragraphs 5.72 to 5.83. In relation to the environmental impact on various lakes in the Kerang Lakes sub-region, comments are included in Part 6 of this Report.

TREE CLEARING AND IRRIGATION

Tree clearing

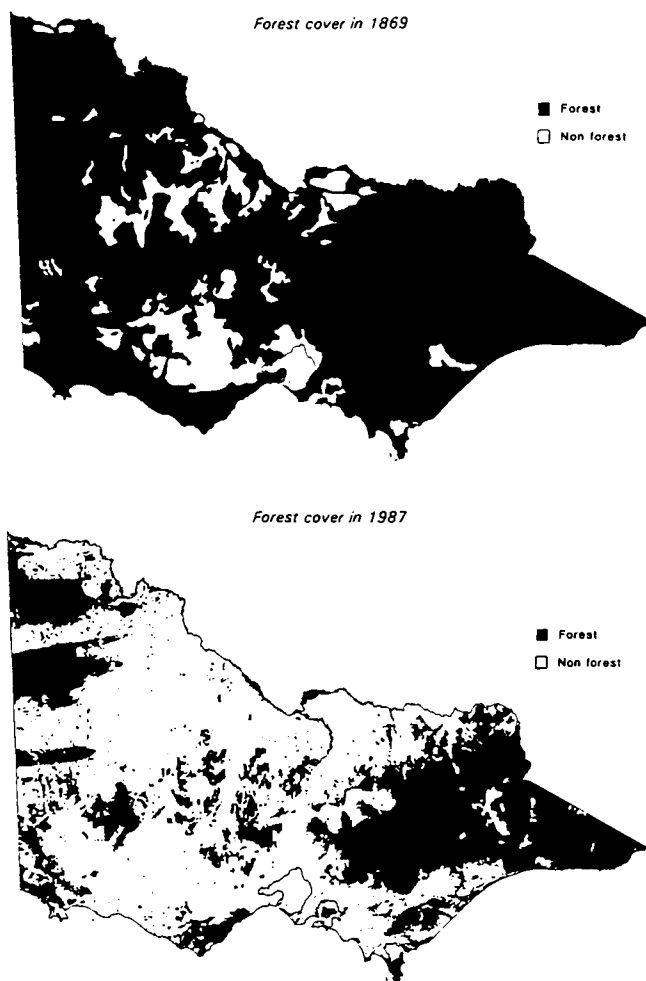
Historical perspective

5.14 Examination by audit of various reference material indicates that the advent of European settlement and the clearing of trees, which were originally seen as a barrier to agricultural development, has upset the water balance.

5.15 The history of the progressive removal of Victoria's forests mirrors the economic history of the State. Pastoral squatting in the 1840s, gold rushes in the 1850s, a succession of Land Acts in the 1860s and the continued expansion of the transport network combined to produce, by the turn of the century, a pattern of large-scale deforestation. **According to the Government, Victoria's forest cover has been reduced by more than half since European settlement.**

5.16 Chart 5A shows the extent of forest cover in 1869 compared to the forest cover in 1987. **In the western half of Victoria, possibly less than 15 per cent of the original cover remains.**

CHART 5A. FOREST COVER IN 1869 AND 1987



Source: "Forest Cover Changes in Victoria 1869-1987", Woodgate, P and Black, P, 1988.

5.17 During the 1840s, tree clearing occurred as a result of squatters occupying most of the fertile plains and foothills around Melbourne. To the north along the Goulburn Valley and in the Murray Valley from Echuca to Wangaratta, explorers' reports of fertile, grassy woodlands quickly encouraged new pastoralists and squatters. By the mid-1840s the broadening push for new grazing lands reached the Wimmera in the north-west.

5.19 The enactment of various pieces of legislation during the 1860s provided the impetus for agricultural development and the economic development of Victoria which permitted large expanses of land to be occupied primarily by squatters and pastoralists. By 1878, with 40 per cent of land used for agriculture, the colony of Victoria produced a surplus of food for the first time.

5.20 Clearing continued in the north-west and the east during the late 1860s and 1870s and large quantities of cereal crops were produced in the Wimmera and in the Swan Hill district. The Mallee was opened up in the 1880s with the advent of the stump-jump plough and mechanical harvesters, the extension of the rail system and the breeding of hardier strains of wheat.

5.21 To assist in redressing the situation of indiscriminate tree cutting, a Royal Commission on forestry was instituted in 1897. It concluded that effective management and conservation of forests was not possible without appropriate legislation, policy and bureaucratic support.

5.22 It was not until 1907, with the passing of the Forests Act, that the first significant steps were made towards the conservation of the State's forests by the introduction of a State Forests Department under its own Minister. The new department set about the licensing of forest production and securing forest reserves from widespread illegal clearing. Substantial clearing of freehold land continued and in the north-west of the State, soldier settlement following the First World War saw the northern Mallee occupied.

5.23 It is interesting to note that the current Government's water policy indicates that it accepts that inappropriate tree clearing is one of the factors responsible for the salinity problem. An outline of the relationship between tree clearing and salinity was provided in part 2 of this Report.

Taxation incentives

5.24 Taxation incentives for tree clearing operated between the period 1973 to August 1983.

5.25 The practice of tree clearing for agriculture was assisted with the provision to primary producers of a special taxation deduction in relation to expenditure incurred prior to August 1983 connected with:

- ▶ the destruction and removal of timber, scrub or undergrowth indigenous to the land; and
- ▶ the preparation of land for agriculture.

5.26 Expenditure would have qualified for the deduction even though it was not incurred on measures which actually increased the productive capacity of the land.

5.27 **The advent of large-scale tree clearing, while stimulating the State's agricultural base and economic development, has been one of the major causes of the current salinity problem which now faces the State.**

5.28 It is somewhat ironic that while **tree clearing** over many years has been instrumental in accelerating the salinity problem, **tree planting** has now become an important element of government strategies to alleviate the problem. **It is equally ironic that while taxation incentives existed up to 1983 to actually encourage tree clearing, and thus, contribute to salinity, in less than 10 years the reverse is the case with taxation incentives offered from 1990 to encourage tree planting.**

Irrigation

Large-scale irrigation practices in Victoria

5.29 Irrigated agriculture in northern Victoria has resulted in dramatic rises in watertable levels. As an illustration, **watertables in the Shepparton Irrigation sub-region have risen from about 30 metres below the surface before European settlement to currently less than 2 metres below the surface in the majority of the sub-region.**

5.30 According to the Public Bodies Review Committee, in its Twelfth Report of November 1984 to the Parliament on "*Future Structures for Water Management*", some landholders were evidently engaged in small-scale private irrigation as early as 1860. Early settlement in northern Victoria took the form of very large station properties of around 30 000 to 50 000 hectares. In 1875 many of these station properties were opened for closer rural settlement. During the 1880s the passing of legislation enabled the formation of around 90 small irrigation trusts, the majority of which failed financially by the early part of this century. In 1905 the Victorian Government formed the State Rivers and Water Supply Commission to take over the former small irrigation trusts, which had been established to divert water from creeks, and organise the irrigation and water supply for the State. One of the responsibilities of the Commission was to advise on how Victoria's water resources could be utilised in the best interests of the people of the State. **Closer settlement** in irrigation areas, which involved intensive activity on small, closely settled holdings, became the objective governing the management of the irrigation system for Victoria. Large pastoral holdings in irrigation areas were acquired by the Government, subdivided into smaller blocks and then resold. **Between 1909 and 1928 the former State Rivers and Water Supply Commission acquired and then subdivided around 85 000 hectares, which had supported only 232 families, into 3 900 irrigation blocks, each supporting at least one farm.**

5.31 In the early part of this century intensive development was greatly accelerated after the First World War by the **soldier settlement** movement. From 1906 to 1935 the area irrigated increased from 43 000 to 198 000 hectares. Massive development continued after the Second World War with the State's water storage capacity increasing from 3.2 million megalitres in 1950 to 15.5 million megalitres by the mid-1980s, by which time around 500 000 hectares or some 17 000 farms across Victoria were irrigated for intensive agricultural production from publicly-owned water storage and distribution systems.

5.32 The Public Bodies Review Committee's report also reported that Australia has a high level of irrigation development with about 0.105 hectares of irrigated land per head of population (0.084 hectares per head for the United States). The largest irrigation developments are located in northern Victoria and southern New South Wales where irrigated pastures dominate. Irrigated grazing pastures involved predominantly in dairying, while covering large areas, produce relatively low value outputs compared to the smaller areas which are devoted to more intensive horticultural and agricultural crops (e.g. fruits and vegetables) which are generally of higher economic productive value. The pattern of the use of irrigation water in Victoria during this century has changed from an emphasis on crops, lucerne and fruit in the earlier years to that of irrigated pasture largely due to the inability of the red-brown earth soils in most of the irrigation areas to withstand continued conventional cropping under irrigation.

Resource pricing

5.33 Irrigation water is the main agricultural resource and accordingly government pricing policies connected with this resource have a direct influence over the extent of farming practices. In the past, governments have effectively subsidised irrigation water by setting charges at levels below the cost of supplying the resource and building other social objectives into pricing policies. This policy has not provided an incentive for the efficient use of irrigation water, thereby contributing to intensive irrigation practices and the incidence of salinity and waterlogging.

5.34 This situation is recognised in the Rural Water Corporation's Business Plan for 1990-91 to 1994-95 which states:

"By and large the existing tariff structures do not reflect costs imposed on the system by customers. Nor do they reward efficient use of water."

5.35 However, current proposals to adopt user-pays principles for irrigation water are designed to change past practices. The Rural Water Corporation's Plan indicates that the Corporation will introduce revised tariff structures which "achieve fairer cost-sharing" and "assist in water use efficiency". (These issues are also discussed in paragraphs 7.27 to 7.32 of this Report.)

Taxation incentives

5.36 Primary producers may claim a deduction for capital expenditure on water storage and farm reticulation systems for use in carrying on a business of primary production on the land. Items covered include dams, bores, irrigation channels or similar improvements, pipes and pumps.

Stimulating the agricultural base of Victoria

5.37 Agriculture, which constitutes a significant component of Australia's economy, produced commodity exports of around \$14 billion in 1991-92, of which more than 20 per cent was produced in Victoria.

5.38 Irrigation has played a significant role in Victoria's total agricultural output and has made a substantial contribution to the total national production. In 1987-88, 17.5 per cent (\$805 million) of Victoria's agricultural production (\$4.6 billion) was derived from irrigated land. In 1987-88 Victorian land under irrigation produced about 12.3 per cent of the national total of milk and milk products, 8.8 per cent of the national vegetable production and 25.5 per cent of the national fruit production.

5.39 In terms of land use in Victoria, **the dominance of agriculture is illustrated by the 33 000 farms which occupy more than 13 million of Victoria's 22.8 million hectares.** Land used for farming represents 57 per cent of the available land in this State. The gross value of production from these farms in 1989-90 was \$5.2 billion and 99 000 people were employed in agriculture and the agricultural services sector.

5.40 In terms of assessing the effect of irrigation on the regional growth of major rural centres, large-scale irrigation projects and closer settlement policies have enabled many people to live in areas where dryland farming alone would have been unlikely to support them. In this context, the Public Bodies Review Committee in its *Future Structures for Water Management* report, commented:

"There can be no doubt that the irrigation schemes of northern Victoria are directly responsible for the presence of substantial numbers of people in the area from Yarrawonga in the east to Merbein in the west. The effects of irrigation are perhaps most striking in the Sunraysia area, where the transition from arid Mallee scrub to rich vineyards or citrus plantings is sudden and spectacular.

"Attempts to put numbers on the extent of the population increase due to irrigation are made difficult and imprecise by the large number of variables involved. It is virtually impossible to estimate what the population of a city such as Shepparton would be now if there were no irrigation around it."

5.41 In attempting to estimate the direct contribution of irrigation to the population of northern Victoria, the Committee compared the population density (measured by the number of residents per square kilometre) of irrigation areas in early 1981 with that of similar areas that had little or no irrigation within them. This exercise disclosed that, in broad terms, the population densities of the irrigated shires was 6 times that of unirrigated shires.

5.42 According to the current government's 1992 Water Policy, irrigation offers many advantages to Victoria's economy. It produces 24 per cent of the farm gate value of the State's agricultural output, which in dry years can rise to 30 per cent. The added value to the community is over 3 times the farm gate value, employing many people in the process. A large proportion of Victoria's regional population draw their employment from production through irrigation. Irrigation water use accounts for some 77 per cent of total Victorian water consumption. Such use amounts to about 3.8 million megalitres annually, servicing around 570 000 hectares of land each year. Victorian irrigation production (as measured by production value) is dominated by beef, veal and milk production (48 per cent) with pasture occupying 80 per cent of irrigation land and using 85 per cent of irrigation water. Vegetables, orchards and grapes account for the majority of the remaining irrigation production.

5.43 In addition to stimulating the agricultural base of Victoria, the advent of irrigation has had secondary impacts in terms of generating hydro-electricity at power stations located at various major water storages, contributing to the mitigation of flood damage, and promoting tourism and recreational activities in the State.

5.44 **Intensive irrigation practices over many years have been a prime determinant in developing agriculture in rural Victoria and providing a means for economic development. However, in achieving these results, such irrigation practices have proven to be a predominant factor in causing salinity in the very areas which have benefited from these practices.**

IMPLICATIONS OF OTHER SPECIFIC GOVERNMENT DECISIONS

5.45 This Report has previously focused on the 2 principal causes of salinity arising from government action, namely tree clearing and irrigation practices, both of which date back to the previous century.

5.46 During the review, audit also identified 3 examples where government, in the last 30 years, has intervened to create schemes which have contributed to a deterioration in the environment. These schemes relate to:

- ▶ the Closer Settlement Scheme in the Campaspe West sub-region;
- ▶ the development of the Mineral Reserves Basin Scheme in the Kerang Lakes sub-region which aimed to reduce the salt load reaching the Murray River; and
- ▶ the Woody Yaloak Diversion Scheme in the Corangamite region aimed at relieving flooding around Lake Corangamite.

Closer Settlement Scheme - Campaspe West sub-region

5.47 The relationship between irrigation designed to promote agricultural development and increasing salinity is illustrated by the Closer Settlement Scheme in the Campaspe West region of the State.

5.48 In the 1890s the first irrigation infrastructure was put in place in parts of the Campaspe West plan area. This infrastructure consisted of a weir on the Campaspe River south of Rochester together with 75 kilometres of supply channels. Natural summer flows in the Campaspe were unreliable and allowed only sporadic, small-scale irrigation until the Eppalock Reservoir was completed in 1963.

5.49 The Closer Settlement Scheme, established in the 1960s, involved new areas for intensive irrigated agriculture, which concentrated on irrigated pasture for dairying, and represented an attempt to strengthen Victoria's agricultural base by increasing agricultural production and national development. Under the Scheme, the Government at the time compulsorily acquired private estates which were then subdivided and made available on easy terms and conditions for closer settlement. The Campaspe West scheme was financed by the Rural Finance Corporation, which purchased the required land, financed the redevelopment and associated construction, and sold the land to scheme participants through low interest loans.

5.50 The Rural Water Corporation was responsible for the design and construction of farm layouts, irrigation supply systems and drainage facilities. Audit was advised by a leading figure involved in the establishment of the Closer Settlement Scheme that the Campaspe West scheme operated at a profit to the State even after income from the scheme was used to finance a substantial proportion of the road construction costs associated with the development.

5.51 A consultant's report (known as the "Objectors' Report"), prepared in late 1989 for landholders opposed to the draft Campaspe West salinity management plan, stated:

"The Campaspe Irrigation District West ... is dominated by excellent soils that are probably too permeable for ideal irrigation. These facts are well documented in the DARA soil survey of 1962. In addition local experience prior to irrigation development had shown a substantial salinity problem with several highly saline bores reported."

5.52 This claim is supported in the draft plan which indicates that a soil survey taken in the area in 1964 identified that "the highly permeable soils in the sub-region would produce a shallow watertable problem".

5.53 Despite these views, which cast doubt on the long-term viability of intensive irrigation in the Campaspe West region due to the possible advent of salinity related problems, 2 950 hectares of land in the area (51.7 per cent of the plan area and 87 per cent of irrigated land) were developed as a Closer Settlement Area (CSA) in the Campaspe West region for intensive irrigated dairying. A report prepared by the Department of Agriculture in 1992 relating to the CSA stated:

"The CSA was settled from south to north, following the flow of the supply channel. The southern end is higher and better protected from salinity. The northern end was lower and this is where the salinity problems first appeared, even as the last of the blocks were being settled."

5.54 The last of the 54 irrigated farms created under the Closer Settlement Scheme were occupied in 1976. The emergence of a salinity problem in the Campaspe West plan area is outlined in the draft plan which indicates that in the 1960s, **at the start of the Scheme, watertables in the plan area were 4 to 8 metres below the ground's surface. Data gathered between 1978 to 1983 indicated that watertables had risen and stabilised at around 2 metres below the ground's surface for over 60 per cent of the plan area and around one metre for over 15 per cent of the area.** However, the draft plan also indicates that these readings may be underestimated as they were taken during a period of average or below average rainfall and states:

"... recent figures indicate that the area that has watertables within one metre of the surface continues to increase."

5.55 According to the draft plan, in August 1989 the effects of salinity were visible in 13 per cent of the plan area (741 hectares) and another 23 per cent of the area (1 311 hectares) was producing at below full potential due to the effects of high watertables.

5.56 The 1989 *"Objectors Report"* summarises the problem as follows:

"In hindsight, intensive irrigation development on highly permeable soils adjacent to a major source of seepage and a known high groundwater mound explains the rapid salinity development of the area and the nature of that development."

5.57 According to the draft plan for Campaspe West, this area is one of the most productive dairying regions of the State. However, production from the plan area in 1988 was estimated at only 85 per cent of what it could have been without the effects of high watertables and salinity, representing an annual cost in lost production of \$600 000. Estimates in the plan suggest that **if nothing is done to arrest the problem, annual production losses will be in the vicinity of \$1.4 million and production will drop from the 1989 level to 65 per cent of the area's potential by 2009.** Taking into account multiplier effects, the plan indicates that **this loss will cost the regional community \$6.4 million a year and 86 jobs.**

5.58 The experiences of intensive irrigation in the Campaspe West region serve as a stark warning of the problems that can arise if government planning for water management is less than complete, and does not take into account environmental and social factors in addition to economic considerations.

Mineral Reserves Basin Scheme

5.59 Prior to the establishment of the Government's accelerated Salinity Control Program in 1985 and the Salinity Control Strategy in 1988, a scheme was developed for the Kerang Lakes sub-region which involved **a proposal to create a series of evaporation basins known as the Mineral Reserves Basin Scheme.**

Scheme overview

5.60 The Kerang Lakes area and Barr Creek are 2 sub-regions within the Loddon-Avoca salinity control region. The Barr Creek enters the Loddon River some 10 kilometres upstream of the junction of the Loddon River with the Little Murray River and is the largest individual source of salt entering the Murray River from Victoria. Estimates prepared by government suggest that on average **the Barr Creek is responsible for 190 000 (or 27 per cent) of the 700 000 tonnes of salt of Victorian origin in the Murray at the Victoria/South Australia border annually.**

5.61 The salt problem associated with Barr Creek was identified in the 1960s and between then and the early 1970s various works were undertaken to improve the position. One of these schemes, which was completed in 1968, involved the diversion of 15 per cent of the flow and salt load of the Barr Creek into Lake Tutchewop, and the nearby Lakes William, Little and Kelly situated north-west of Kerang in the Kerang Lakes plan area. These lakes became evaporation basins for Barr Creek water, whereby saline water is pumped into the basins and the water evaporates over time leaving a salty residue.

5.62 The Mineral Reserves Basin Scheme arose from a proposal to extend the Barr Creek disposal scheme further west, by a series of channels, to Lake Tyrrell (a large natural inland salt lake 70 kilometres further west). Lake Tyrrell was to become the terminal evaporation basin in the scheme which was to further decrease the salt load reaching the River Murray from Barr Creek. This Scheme would have involved the water passing through a series of naturally occurring depressions (known as the Mineral Reserves Basins) just outside Tresco. In late 1978, the State Rivers and Water Supply Commission formed the view that Stage 1 of the Lake Tyrrell scheme, the Lake Tutchewop to Mineral Reserves diversion, could be built and operated on a stand alone basis. It was estimated that this Scheme would enable the diversion of an additional 16 000 tonnes a year of Barr Creek salt away from the Murray River.

5.63 The then Parliamentary Public Works Committee approved the construction of the Scheme in October 1980 and work commenced in April 1981. At that time, the projected cost of the Scheme was \$3.7 million.

Litigation proceedings

5.64 In late 1985, local landholders launched a Supreme Court bid to halt the Scheme primarily on the basis that it would damage their farms. They also claimed the Scheme would be uneconomic due to increases since the initial analysis in 1981, in land acquisition costs and costs associated with additional pumping and monitoring of rising groundwater. Included in the evidence tendered by the plaintiffs was an up-to-date cost-benefit analysis showing that the Scheme would not attain a targeted return of 4 per cent set by the Government for the Scheme.

5.65 The court action was not upheld. The judgement in March 1986 indicated heavy reliance had been placed on the expert evidence supplied by what is now the Rural Water Corporation, that the risk of damage to farms was low. The judgement also indicated that it was not up to the court to decide on the economics of the Scheme.

Discontinuance of project

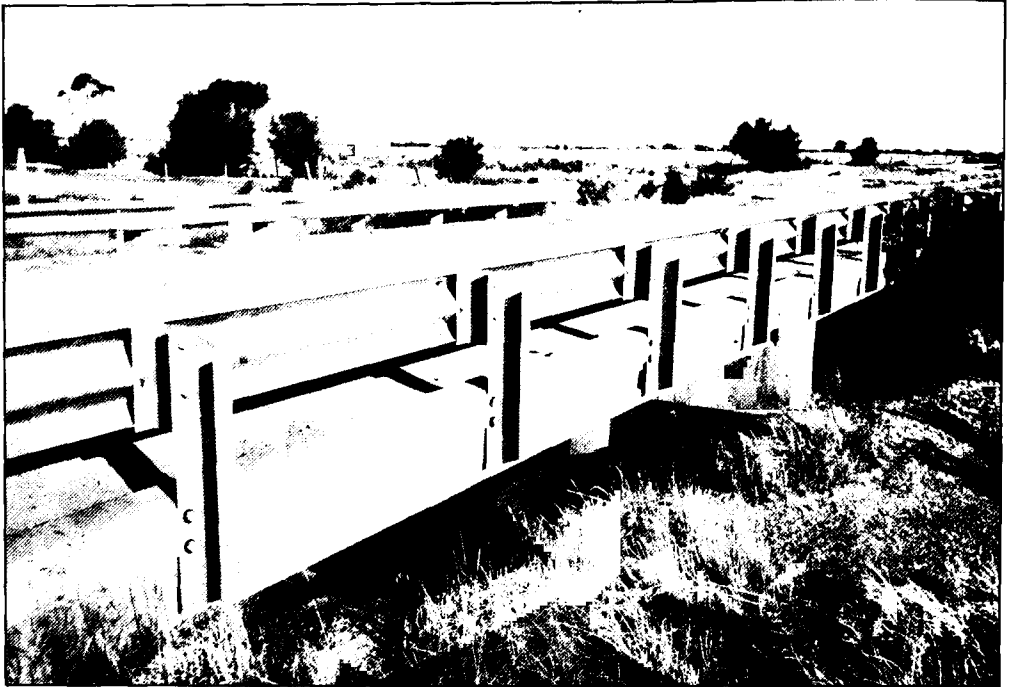
5.66 In December 1986, the then Minister for Water Resources announced that the Scheme was to be indefinitely deferred. Among the reasons given was that a current cost-benefit analysis indicated that the Scheme would have a negative return. Estimated operating costs alone had risen to over \$200 000, which offset the value of the projected salt reductions at Morgan in South Australia (also estimated at \$200 000), without considering other costs such as depreciation.

5.67 **The total expenditure incurred on the Scheme at the time of its deferral was \$7.3 million, which included \$3.2 million for land acquisitions.**

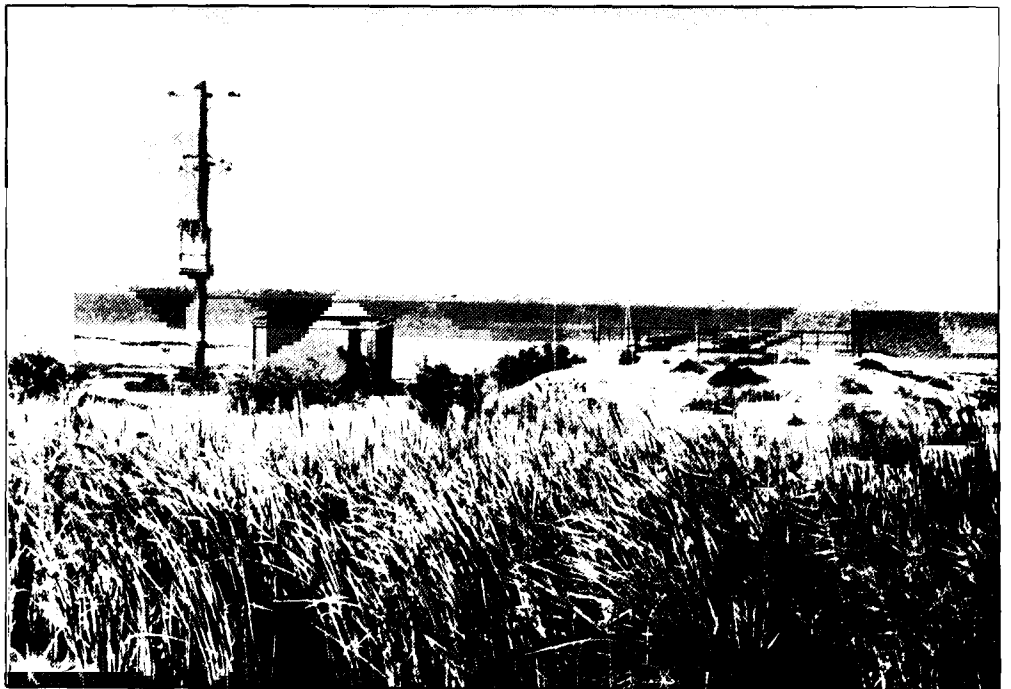
Inadequate project analysis

5.68 The audit revealed that **prior to the commencement of construction, landholders were not adequately consulted in relation to their reactions to the Scheme, and advice was not sought from other government agencies in regard to the economic implications of the Scheme.** With the benefit of hindsight, expenditure amounting to some \$7.3 million may have been avoided if a thorough consultation process had been undertaken with the community and other government agencies prior to construction. **The bridges, channels and the pump station constructed for the Scheme were in fact never used.**

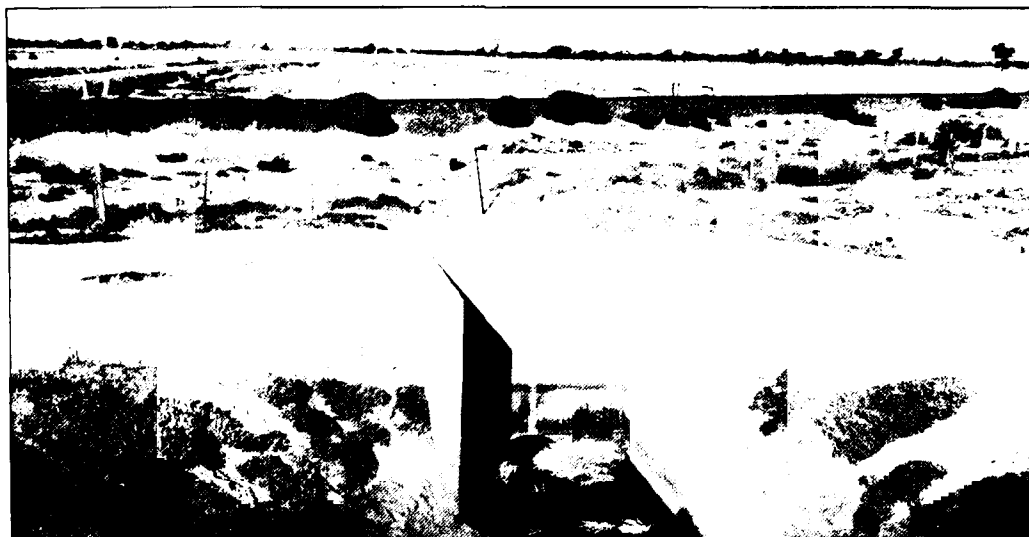
5.69 The Salinity Bureau advised audit that, due to the problems which arose from the Scheme, the importance of community consultation subsequently became an issue for special emphasis in the development of the Salinity Control Strategy.



Unused bridge over the intended Lake Tutchevop - Mineral Reserves Basin Channel.



Pump station and associated structures on the banks of Lake Tutchevop



Culvert constructed to take flows from the proposed Lake Tutchevop - Mineral Reserves Basin Channel under the railway line.

5.70 The Rural Water Corporation currently leases out 5 parcels of the land, previously reserved for the Scheme, for \$55 000 a year which equates to a rate of return of 5 per cent based on a June 1992 valuation. The Corporation regards this return as commercially acceptable for rural property. However, based on the original purchase cost, the rate of return is only 2 per cent. Of the remaining 2 parcels of land, one parcel is the subject of tenders for lease and the other is to be sold. The total value of the land currently held as a result of the Scheme (excluding the parcel to be sold), as estimated by the valuers of the Corporation in June 1992, is \$1.4 million.

5.71 The experiences of the Scheme reinforce the importance of a thorough community and departmental consultation process and economic evaluation in the development of evaporation basins. Procedures established for any future developments with evaporation basins should incorporate an assessment of the full impact of any damage likely to occur from leakage and a comparison of projected costs against savings from salinity reductions. Further comments on the use of evaporation basins are contained in paragraphs 6.64 to 6.109 of this Report.

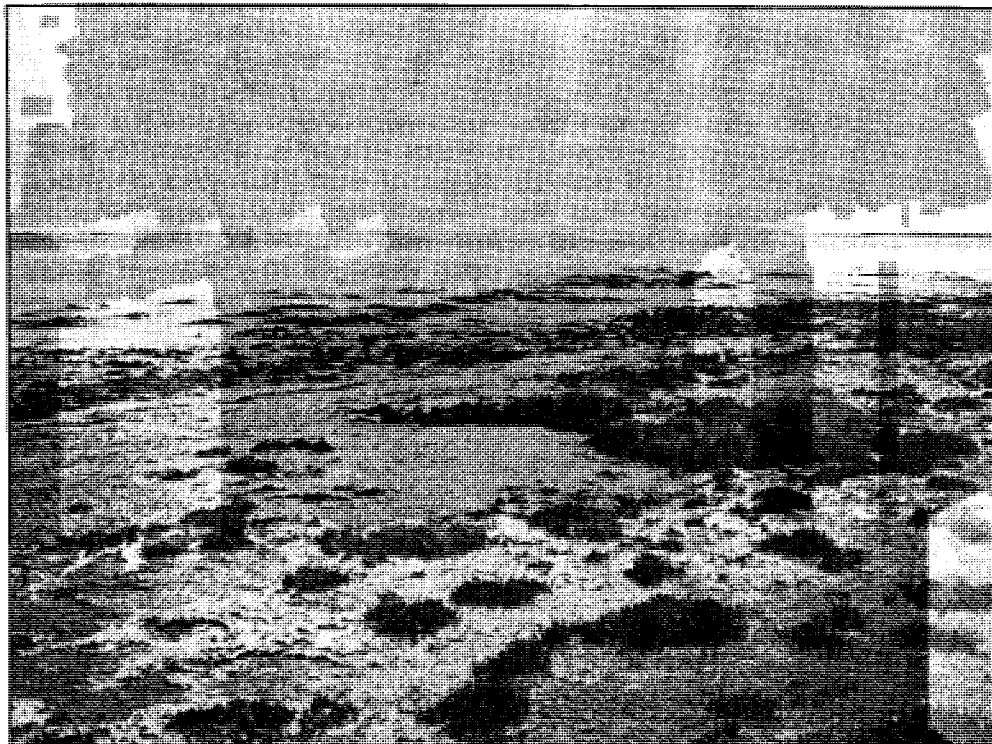
Lake Corangamite

5.72 The Lake Corangamite situation demonstrates very clearly the difficult issues faced by government in reconciling the conflicting needs of agriculture against the needs of the environment.

5.73 Lake Corangamite, which extends over an area of about 230 square kilometres, is the largest permanent inland lake in Australia. It is an integral part of the Western District lakes system and is recognised under the International Ramsar Convention as "*Wetlands of International Importance*". It also provides an important habitat for birds listed under the international Japan and China-Australia Migratory Birds Agreements. The Lake has been assessed by the Victorian Wetlands Scientific Committee as a "*High Value*" wetland for its ecological, scientific, educational, cultural and scenic features. Lake Corangamite and neighbouring lakes have a history of cyclic fluctuations in level which correlates to wet and dry years.

5.74 Following heavy rain in 1951, the Lake rose to an elevation of about 114.7 metres above sea level which has since been generally referred to as its normal level. The Lake continued to rise due to very heavy rainfall in 1952 and large inflows from the Woody Yaloak River, Pirron Yalock Creek and other tributaries. Further rises in the so called "*Creeping Lakes*" through to 1956 created virtually a single lake which inundated several thousand hectares of farm land up to an elevation of 117.9 metres above sea level.

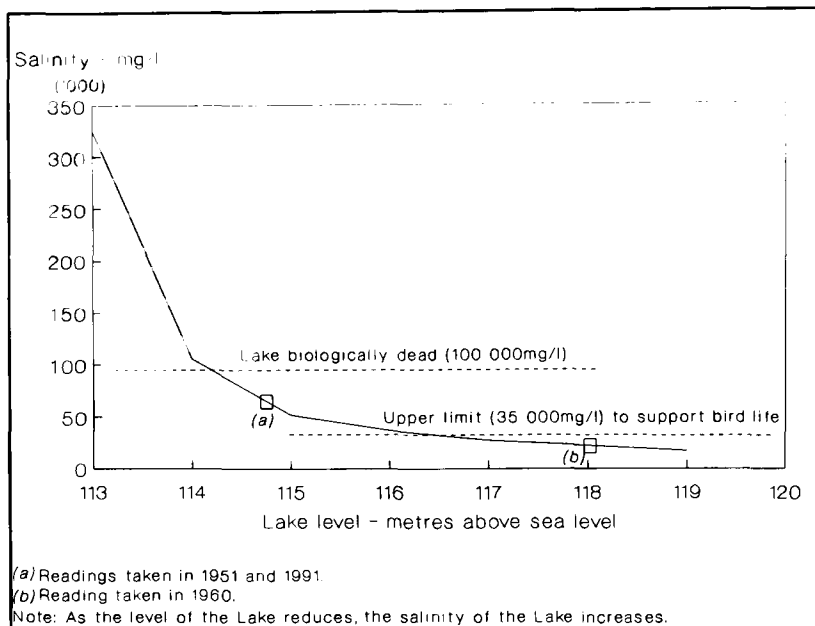
5.75 In 1959, after 2 parliamentary inquiries (1954 and 1959), the Rural Water Corporation **constructed the Woody Yaloak Diversion Scheme at a cost of \$1.6 million to relieve flooding around Lake Corangamite.** The Scheme, which was endorsed by the Government, was designed to prevent about 50 per cent of the Woody Yaloak River flow from reaching Lake Corangamite by diverting it through a channel to Warrambine Creek and then to the Barwon River. **Over a period of 32 years the Scheme has succeeded in achieving its objectives of reducing water levels in the Lake which has made large areas of land, previously under risk of inundation, now available for grazing.**



Northern shore of Lake Corangamite, February 1992, showing the considerable expanse of bare and recently exposed lake bed now available for grazing.

5.76 However, persistent concerns expressed by interest groups have highlighted apparent inadequacies in the objectives and operation of the Scheme. According to the Rural Water Corporation, if there is a volume decrease, the constant salt mass is concentrated in a lesser volume and the salinity of the Lake subsequently increases. **It has now become evident to the authorities that the benefits of the Woody Yaloak Diversion Scheme have been realised at a massive environmental cost to Lake Corangamite. Chart 5B shows that while the Lake's water level has fallen, Lake Corangamite has become increasingly saline.**

CHART 5B. RELATIONSHIP BETWEEN THE LEVEL OF LAKE CORANGAMITE AND ITS SALINITY LEVEL
 (Based on 27 million tonnes salt load)



5.77 The Lake has taken approximately 30 years to halve its volume and more than treble its salinity (1960, volume 1 227 600 megalitres, level 118 metres, salinity 22 000 milligrams per litre; 1991, volume 400 836 megalitres, level 114.7 metres above sea level, salinity 67 000 milligrams per litre). While audit acknowledges that in the 1950s environmental factors would not have attracted the prominence that they do today, **the diversion scheme in serving to reduce the Lake level has unfortunately now adversely affected the salinity level of the Lake.**

5.78 According to a recent report to the Department of Conservation and Natural Resources from the University of Adelaide, 35 000 milligrams per litre is the maximum level of salinity which should be allowed to occur if the Lake is to be managed for the maximum support of bird life. A level of salinity above this threshold would lead to changes in the food chain which would reduce the number of birds which can be supported. Investigations carried out by the Rural Water Corporation and the Department of Conservation and Natural Resources revealed the lake would be biologically dead at a salinity level of 100 000 mg/l.

5.79 In 1991 the level of the Lake was 114.7 metres above sea level and its associated salinity level of 67 000 milligrams per litre was almost double the threshold set by the Department of Conservation and Natural Resources. If the climate of the last 30 years continues, it will take only a further 15 years for the Lake to again double its salinity to approximately 120 000 milligrams per litre and then only 7.5 years to again double to approximately 240 000 milligrams per litre. Therefore, under current operating conditions, the level of the Lake will continue to fall and the Lake is likely to be highly saline and biologically dead in less than 15 years.

5.80 In line with the Government's objective of reversing the trend of environmental degradation, the Rural Water Corporation considers only 2 possible options available :

- ▶ Close the Scheme completely; or
- ▶ Operate the Scheme with a trigger level of 116 metres above sea level (That is the minimum acceptable level of the Lake. If the water level falls below this level, the salinity will be at an unacceptable level in terms of providing the maximum support of bird life and would cause the lake to be biologically dead at a level of 114.1 metres).

5.81 According to an internal departmental discussion document, although definitive costings have not been determined, both options may result in large compensation payments to landowners. If the Scheme is closed completely, the total cost incurred could be at least \$7.5 million in relation to costs involved in compulsory land acquisitions and the construction of easements. In addition, the significance of the benefits in terms of farming which have occurred over the past 30 years as a proportion to the cost of constructing the Scheme (\$1.6 million) would be diminished. On the other hand, the option of operating the Scheme with a trigger level of 116 metres, if adopted, could result in costs of at least \$3 million for land acquisitions and easements.

5.82 The government agencies involved in the project have conducted several studies and a decision on whether the Woody Yaloak Diversion Scheme will remain in operation is expected to be made by government in the near future.

5.83 The prospect of wetlands of such international importance as Lake Corangamite becoming biologically dead within a few years highlights the necessity of ensuring that all environmental as well as economic factors are considered when planning for major projects.

■ *RESPONSE from managing agency*

The Auditor General's Report uses an example which illustrates the complexities of managing the State's water systems. The Woody Yaloak Diversion Scheme was established in 1959, long before salinity was recognised as a major problem, following extensive Parliamentary Public Works Committee reviews. The Scheme was designed to prevent flooding of farmland around Lake Corangamite. It has been successful in meeting this objective but has been accompanied by an increase in salinity in the period since this Scheme became operational.

In 1991, it was recognised that the current operating rules of the Scheme, while minimising flooding, caused unacceptable increases in salinity and therefore environmental damage. Operating rules are currently being reviewed to reduce salinity levels in the Lake.

COMPENSATION CLAIMS

5.84 One of the causes of salinity is increased accessions leading to a rise in the watertable. Several instances were noted by audit where lakes, pondages and irrigation systems operated by the Rural Water Corporation were found to have caused salinity damage on adjacent land.

5.85 To date, the Corporation has found it necessary to pay out approximately \$440 000 as compensation to landholders for salinity damage in the Tandarra Pondage (Loddon-Avoca Region), Woody Yaloak (Corangamite Region), Lake Batyo Catyo (Wimmera Region) and Pine Lake (Wimmera Region) localities.

PART 6

Social, Environmental and Economic Ramifications

6.1 The audit examination of the Salinity Control Program highlighted the dilemma faced by government in administering a program which comprises a complex mix of interrelated social, environmental and economic factors. Difficult decisions are required by government in assigning priorities and achieving the most suitable balance between competing social, environmental and economic issues evolving from the problem of salinity. While, in the past, emphasis has been given to improving the agricultural base of Victoria, it is now equally important that environmental factors are also thoroughly evaluated and social consequences extensively explored before making critical decisions concerning the continuance of farming practices and the implementation of salinity control measures.

6.2 In the light of these considerations, audit considers that the following 3 specific issues, all complex in nature, need to be resolved:

- ▶ allocation of values to social and environmental factors;
- ▶ land restructuring and land retirement; and
- ▶ the continued use of evaporation basins.

6.3 This section of the Report discusses the above issues, as they relate to the 4 salinity management plans examined by audit.

ASSIGNING VALUES TO SOCIAL AND ENVIRONMENTAL FACTORS

6.4 In addition to the adverse impact of salinity on the productive capacity of salt prone regions of the State, salinisation of soil and water has social and environmental ramifications. During field inspections, audit observed physical damage to the environment in the form of severe soil erosion in the Warrenbayne Boho district of the Goulburn Dryland sub-region and widespread tree deaths and salinised lakes in the Kerang Lakes area. The salinity management plans examined by audit listed various examples of the impact of salinity on the environment, some of which are outlined in Table 6A.

TABLE 6A. ENVIRONMENTAL EFFECTS OF SALINITY

<i>Sub-Region</i>	<i>Environmental features affected by salinity</i>
Shepparton Irrigation	Green Lakes, Lake Cooper, Corop Lakes, Lake Stewart and Honeysuckle Creek
Goulburn Dryland	Sugarloaf Creek, Sunday Creek, Stony Creek, Honeysuckle Creek, Major Creek, Cornella Creek, Wanalta Creek and Downs Lane Swamp
Campaspe West	Campaspe River
Kerang Lakes	Duck Lake, Pelican Lake, Long Lake, Lake Tutchewop, Lake William, Lake Elizabeth, Lake Murphy, The Marshes, Golf Course Lake, Barr Creek, Loddon River, Little River Murray and Avoca River

6.5 The severity of the impact of salinity on the environment can be appreciated by the following comment contained in the draft Kerang Lakes salinity management plan:

"Direct saline intrusions, disposal of saline drainage water and isolation from natural flushing flows have combined to cause salinity increases in excess of 100 fold in many wetlands. The characteristics of these wetlands have been completely altered, causing the extinction of many freshwater dependent plant and animal species."

6.6 The Government recognised the importance of social and environmental factors in framing its Salinity Control Strategy which aimed to maintain and, where feasible, improve the social well-being of communities and the environmental quality of the regions. The Strategy maintained that, in addition to assessing whether investments in salinity control schemes were economically sound, costs and benefits associated with environmental and social factors (**which according to the Strategy could not be expressed in monetary terms**) would need to be assessed in the preparation of salinity management plans, using guidelines to be provided by the Government. These guidelines, subsequently prepared by the Salinity Bureau, indicated that environmental effects considered to be significant **should be costed in dollar terms and included in economic analyses where possible**. However, these guidelines were, in audit opinion, not considered to be particularly helpful and of limited benefit as they did not outline a suitable approach to costing the significant effects of salinity.

6.7 The environmental program within the Strategy is designed to achieve "benefits" to the environment by protecting land and water ecosystems from the effects of salinity and where feasible, undertaking rehabilitation, and also controlling the environmental "costs" in terms of the adverse environmental consequences of salinity control measures. Guidelines developed to assist in the preparation of community-based salinity management plans require that the social effects of each plan be disclosed. **The Strategy has set a 10 year (1998) target for the development of an adequate understanding of the social and environmental effects of salinity control measures.**

6.8 Audit found that certain research into social and environmental effects of salinity had already occurred. For example, in the Deakin and Waranga Shires within the Goulburn and Broken River catchments and at Tragowel Plains, research had been undertaken to examine the social impact of salinity. Examples of social issues researched detailed the impact of salinity-related farm productivity losses on family well-being, community health, provision of community services and local industries. In terms of environmental factors, current examples of environmental research include studies currently underway by the Centre for Stream Ecology (Monash University), the Environmental Protection Authority and the Kialla Fisheries Centre to improve techniques for assessing the effects of salinity in stream and wetland ecosystems.

6.9 However, evaluations of the benefits and costs of establishing salinity management plans for particular sub-regions have been purely based on economic factors and have not to date attempted to incorporate values for the social and environmental benefits and costs associated with the various salinity control options.

6.10 As an illustration, the draft Kerang Lakes salinity management plan, which covers one of Victoria's most important sub-regions from an environmental viewpoint, simply summarised the major wetlands targeted for action without any consideration of placing values on social and environmental factors. Table 6B presents this summary.

TABLE 6B. SUMMARY OF WETLANDS TARGETED FOR ACTION UNDER THE KERANG LAKES PLAN

<i>Wetlands</i>	<i>Proposed action</i>
Avoca Marshes	Reduce excessive ponding of flood water and revegetate.
Hird and Johnson Swamps	Improve water management and drying cycles.
Cullens Lake	Water management for natural "through flushing".
Murphys Swamp	Provide flushing works and drying cycle.
Cemetery Swamp	Modify levees to permit "flood flushing".
Third, Middle and Reedy Lakes	Improve water management.
Lake Elizabeth	Provide flushing works.
Lake Wandella (Brandy Lake)	Provide flushing works.
Woorinen Drainage Lakes	Increase pumping to North Drainage Lake to control salinity in other lakes.
Golf Course Lake	Provide flushing flows as required.

6.11 The draft plan indicated that the works associated with protecting and improving these wetlands was justified as the wetlands are of "*national and international significance due to their extremely high environmental values*".

6.12 However, discussion with the community working group responsible for preparing the draft plan indicated that each of these proposed actions was based on a subjective judgement that the respective lakes were "worth" the amount required to save them. The economic evaluation contained in the draft plan (as shown in Table 6C) also indicated that the present value of benefits from the environmental program was "unquantifiable".

TABLE 6C. SUMMARY OF ECONOMIC EVALUATION OF KERANG LAKES PLAN
(\$million)

<i>Salinity Control Program</i>	<i>Present value of benefits</i>	<i>Present value of costs</i>	<i>Net present value</i>
On farm	13.8	9.3	4.5
Environmental	(a)	(b) 3.9	(3.9)
Water quality	23.7	10.0	13.7
Surface drainage	13.7	(b) 10.7	3.0
Flood plain management	3.6	2.8	0.8
Channel seepage reduction	2.5	1.5	1.0
Salt disposal	(a)	0.6	(0.6)
Implementation, education and extension	(a)	1.1	(1.1)
Total plan	57.3	39.9	17.4

(a) Benefits of these programs not quantifiable in dollar terms.

(b) Includes monitoring costs.

Source: Executive summary of draft Kerang Lakes salinity management plan.

6.13 Audit does not question the validity of the decisions made in respect of these wetlands. However, it was disturbing to find that the Government had failed to develop clear guidelines for community working groups with regard to the valuation of environmental and social considerations.

6.14 In the absence of such guidelines, community working groups were forced to rely on their subjective judgement which can lead to inconsistencies across the State. In addition, it could result in protection of certain environmental features in one area, while features of equal or greater significance are sacrificed in a trade-off for salinity mitigation in another region.

6.15 Audit acknowledges the extreme complexities associated with the valuation of natural assets as research shows that this is a problem currently encountered throughout the world. However, the ability of the Salinity Control Program to achieve a true balance between agricultural, social and environmental issues has been severely limited when community working groups have been unable to place a dollar value on such issues in the cost-benefit analyses of plans.

6.16 In terms of the Salinity Control Program in Victoria, the non-quantification of social and environmental benefits and costs means that the economic evaluations undertaken for each plan could be overstating or understating the salinity problem in each sub-region and the effects of the salinity control procedures that are to be established.

6.17 Measures designed to place values on damage to human welfare and the natural environment caused by the advent of salinity need to be developed to supplement the economic considerations that have been evaluated and quantified as part of the development of salinity management plans. This procedure, together with continual monitoring of benefits and costs, would provide additional information to the Government and enhance future decision-making processes in relation to the Program's implementation. As such there would be merit in the Government undertaking a research program aimed at developing an acceptable approach to carrying out benefit-cost analyses involving environmental and social issues. Such a methodology would also have significant benefits to government programs outside of salinity control.

6.18 Examples of the salinity-related social and environmental factors which in audit opinion could be incorporated into the benefit-cost evaluations of salinity management plans are shown in Table 6D.

TABLE 6D. SOCIAL AND ENVIRONMENTAL FACTORS RESULTING FROM SALINITY

Social factors

Benefits -

- Greater employment
- Improving health and reducing stress of the farming community
- Maintaining the social equilibrium within the community and the family unit.

Costs -

- Disharmony or disunity within certain elements of the farming community over some of the control options such as the use of evaporation basins, rural restructuring or land retirement and relocation of farming communities
- Apprehension towards government agencies

Environmental factors

Benefits -

- Maintaining wildlife habitats and ecosystems
- Improving community enjoyment of environmental areas such as wetlands which includes lakes, rivers, streams and swamps
- Halting the degradation of land and water systems and maintaining these areas for future generations

Costs -

- Land sacrificed for the development of a particular control measure such as land purchased for the development of evaporation basins
- Cost of control measures in terms of their effect in degrading environmental assets of the State, e.g. the use of an environmentally sensitive lake for an evaporation basin.

6.19 Audit was advised by the Salinity Bureau that a research project into the Gippsland Lakes has been commenced by the Department of Agriculture as a basis for placing values on environmental factors and funds have been provided in the 1992-93 budget of the Office of the Environment for the conduct of environmental assessments.

■ **RESPONSE from managing agency**

A major initiative of the Salinity Program has been to provide resources to each of the community groups for the systematic assessment of environmental features threatened by salinity. Much of this work has focussed on wetlands and has been co-ordinated by the Wetlands Unit of DCNR.

In relation to Kerang Lakes the environmental, conservation and heritage features were documented in 18 separate reports to the Community Working Group. The selection of wetlands for protection was based on the findings of a report "Conservation Value of Wetlands in the Kerang Lakes Area".

The purpose of "Guidelines for the Preparation of Salinity Management Plans" is to provide a consistent framework for comparison between options within plans and between salinity management plans and other sectors of the Victorian economy. It is important that the approach taken by the Salinity Control Program is consistent with conventions used in other proposals for public sector investment in Victoria and throughout Australia.

There is no widely accepted methodology that adequately assigns dollar values to environmental and social costs. Other programs also face this problem and as a result an accounting convention called cost-benefit analysis is used to compare the societal attractiveness of proposals for public sector investments. The Salinity Planning Guidelines are based on OECD and world best practice, consistent with cost-benefit analysis. Wherever possible, benefits and costs are expressed in monetary values, and non-monetary aspects are systematically addressed so decision-makers can make an informed judgement.

The Salinity Control Program is supporting 2 initiatives to improve the systematic assessment of environmental degradation:

- *The Program is reviewing "shadow-pricing" methods of placing monetary values on environmental and social factors to enhance monetary assessment of proposals. At this time it appears that the cost associated with collecting the information is prohibitive and the value of the information gained provides only a marginal benefit to the decision-making process; and*
- *The Department of Conservation and Natural Resources is putting in place a process, for the Salinity Control and Landcare Programs, to bring together the existing data to assess the impact of environmental degradation and places priorities on wetlands, rivers and streams and native terrestrial vegetation.*

LAND RESTRUCTURING AND LAND RETIREMENT AT KERANG LAKES

6.20 In the context of agricultural development, **land restructuring or structural adjustment** refers to the methods employed to alleviate the social and financial problems which have arisen due to changing technical, financial and environmental considerations. Land restructuring aims to improve the efficiency of rural industry by maintaining viable farm units. It encourages the amalgamation of farms to increase the number of viable farms and, in the case of salinity, concentrates resources on lower salinity soils.

6.21 In contrast, **land retirement** concerns the withdrawal of irrigation from parcels of land considered to be unsuitable in the long-term for irrigation because of factors such as high accession rates or high soil salinity. It involves extremely difficult and sensitive decisions on the movement of communities from their farming areas.

6.22 In discussing the concepts of land restructuring and land retirement, various factors other than the effects of salinity such as adverse climatic or seasonal considerations, the state of the economy and the strength of export markets, also impinge on the viability of continued farming practices in certain areas. However, **the severity of salinity in some regions of the State will require difficult decisions by government to either maintain farming activity in those regions on social grounds or adopt other more sensitive and controversial options such as land restructuring or land retirement.**

6.23 The audit found that in view of the magnitude and severity of the salinity problem in the Kerang Lakes area and the doubt as to the economic viability of continued farming in marginal pasture and field crop areas **(which comprise 93 per cent of the irrigated area, utilise 91 per cent of the region's water, but produce only 24 per cent of the irrigated gross margin of the plan area), the Government needs to decide whether:**

- ▶ government support should only be provided to irrigated farming activity which concentrates on structural adjustment in terms of the more productive soils and discontinue the provision of water to unproductive soils; or
- ▶ there is a need to plan for large-scale land retirement in the area.

6.24 The proposed salinity control measures contained in the draft plan address structural adjustment by recommending that farmers be assisted in amalgamating farms, including their water rights. Such a process concentrates irrigation on Class A soils (which are the most productive soils) and forces the establishment of larger farms that will be viable in the long-term. The proposal, in preference to forced land retirement, is aimed at promoting the long-term viability of farmers.

6.25 During the review, audit evaluated the severity of salinisation in the Kerang Lakes area and analysed the various complex issues which need to be considered fully in determining whether irrigated farming should be retained throughout the entire area.

6.26 On economic grounds alone, it is exceedingly difficult to justify continual farming of the less productive marginal areas of this region of the State. It is equally clear that there are compelling social arguments for the retention of farming throughout the entire Kerang Lakes area. If such farming is to continue, the current Government needs to establish, by way of a detailed analysis, that the costs of subsidising non-economic agricultural activities and the resultant devastating effect on the environment is a better alternative than land retirement with its adverse social implications.

Severity of salinisation in the Kerang Lakes area

6.27 The Minister for Agriculture stated, as recently as March 1992, that the Kerang Lakes area faced a host of environmental problems including tree and native vegetation loss, rising watertables, wetland degradation, and high soil and water salinity. Soil salinity in the irrigation areas was estimated by the Government to be currently reducing potential yields in the affected areas by about 50 per cent.

6.28 Expert opinion provided by consultants involved in the preparation of various salinity management plans indicates that 2 metres is considered to be the threshold level at which high watertables represent an immediate salinity problem. Comments included in the draft plan for the Kerang Lakes area revealed that:

"The majority of the irrigated land within the project area is now underlaid by a high, saline watertable that fluctuates continually between 0 to 2 metres below ground surface".

6.29 The draft plan also indicated that in February 1990, when watertables were at their lowest in the annual cycle, some 45 000 hectares of land (41 per cent of the project area) had watertables within 2 metres of the surface.

6.30 Information contained elsewhere in the draft plan highlights the extreme salinity of groundwater in the Kerang Lakes area which is typically in the range of 18 000 to 36 000 mg/l (30 000 to 60 000 EC) whereas the recommended limit for drinking water is 500 mg/l (830 EC) and salinity of water in the Pacific Ocean is 35 000 mg/l (around 50 000 EC).

- *RESPONSE from managing agency*

Kerang Lakes is possibly the most complex of the State's salinity management plans. The Lakes and other environmental features are at risk from increasing salinity levels while land salinisation is reducing agricultural productivity. Both these issues interact with flood management issues. The community group faced all these issues.

Community sensitivity about the distribution of costs and benefits of salinity control measures in the Kerang Lakes area was higher than anywhere in the State following the proposed Mineral Reserves Basin Scheme. There was strong community interest in developing a management plan and the only approach to ensuring that the community group had credibility with the community was through the community selecting its own members. Understanding between the community and Government agencies has developed greatly within the region throughout the planning process.

Farming practices in the Kerang Lakes area

6.31 According to the draft plan, the Kerang Lakes area covers 110 500 hectares of which 33 885 hectares (31 per cent) is devoted to irrigated farming. When analysing the productive capacities of the 2 main irrigated areas within the Kerang Lakes sub-region (the Murray Riverine Plain - western extremity and the Tresco and Woorinen areas), a sharp contrast emerges from a comparison of areas occupied, extent of water used and contributions to gross margin (income derived by farmers from agricultural production less costs involved in producing that income) of the sub-region. Information disclosed in Table 6E illustrates this contrast.

TABLE 6E. ANALYSIS OF IRRIGATED AREAS WITHIN THE KERANG LAKES SUB-REGION

Area	Number of farms	Type of farming	Area of the sub-region occupied	Extent of water used	Contribution to the irrigated gross margin
			(%)	(%)	(%)
Murray Riverine Plain (Western extremity)	548	Cropping and pasture (including dairying)	93	91	24
Tresco and Woorinen	273	Horticulture	7	9	76

Source: Draft Kerang Lakes salinity management plan.

6.32 As shown in Table 6E approximately 76 per cent of the gross margin for the irrigated component of the Kerang Lakes area was produced by irrigated horticultural produce from the Tresco and Woorinen areas. Audit was advised by the Salinity Bureau that while horticulture has substantial returns, it is unlikely that a significant area of the agricultural land devoted to irrigated cropping and pasture could be converted to horticulture due to the unsuitability of the soil and the lack of sub-surface drainage services in that area.

6.33 The impact of irrigation practices on salinity was evidenced by the comment contained in the draft plan which indicated that:

"The primary cause of rises in the watertable under irrigated areas is the cumulative impact of winter rainfall following after summer and autumn irrigation applications. The Tresco and Woorinen horticultural areas are largely tile drained so high watertables and waterlogging are not generally a problem there".

6.34 As 93 per cent of the irrigated area produces only 24 per cent of the area's gross margin and is a significant factor contributing to salinity in the sub-region, this situation provides a perfect example of the difficult decisions which have to be made when reconciling social factors against environmental and economic considerations. In commenting on this dilemma facing the Government, audit compared the respective arguments in support of:

- ▶ retention of irrigated farming throughout the entire plan area by way of restructuring existing farming practices (the approach advocated in the draft plan); and
- ▶ large-scale land retirement from the area.

Arguments to support retention of irrigated farming throughout the entire Kerang Lakes plan area

Social considerations in support of this option

6.35 It is evident that decisions made in respect of salinity control in the Kerang Lakes plan area will have significant social implications for the local community.

6.36 The principal long-term goal of the Government's Salinity Control Strategy comprised 3 elements, one of which in addressing social issues stated:

"The long-term goal of the strategy is to manage the salinity of land and water resources throughout Victoria in order to maintain and, where feasible, to improve the social well-being of communities".

6.37 In this context, the importance of the social benefits to be gained through implementation of the draft plan, which involves proposed improvements in agricultural productivity and land management and retention of irrigated farming practices in the area, is indicated by the following quotes from the draft plan:

"Existing jobs will be retained and new ones created."

"Increased incomes for the area's inhabitants will retain viable populations and support essential community services, particularly in smaller towns and rural districts."

"The improvements in ... environmental value ... will improve the quality of life available to local residents and visitors."

"The net effect of implementing the plan will be increased social well-being for the population."

Views of the Salinity Bureau

6.38 Audit asked the Salinity Bureau why a quantitative evaluation had not been made of the benefits of large-scale land retirement in less productive non-horticultural areas. In supporting the retention of farming in the entire Kerang Lakes plan area, audit was advised that:

"The removal of water from C and D soils is a strategy which retires low productivity areas from irrigated agriculture and focuses this water on A and B soils, producing substantial improvements in productivity."

"The working group considered the issue of large-scale land retirement and concluded that the social impacts would be substantial. Also given that there was substantial benefit to be gained by concentrating water on A and B soils there was little merit in wholesale removal of water. The availability of Transferable Water Entitlements (TWE) will allow a gradual shift of water to more economic uses via market forces."

"Also, wholesale removal of water could lead to substantial increases in salinisation as pressures in deep aquifer systems would maintain high water tables. Without the leaching effect of applied irrigation there is potential for increased land salinisation and consequent increases in saline run-off reaching the river systems."

"The decision regarding the future of irrigation within the Kerang Lakes area will require a more sophisticated analysis than whether the Gross Margins of some farm areas are greater or less than neighbouring farms. The significant issue is whether farming enterprises can afford to pay the full cost of the supply of irrigation water. If structural adjustment is to be considered then an evaluation of the cost (including social) of structural adjustment will need to be compared with a "do nothing" scenario.

"An added complication of restructuring in irrigation areas is the legal requirement for delivery of irrigation water to properties that have a water entitlement."

Community working group

6.39 In discussing the question of large-scale land retirement with the Chairman and representatives of the community working group for the Kerang Lakes area, audit was advised that:

- ▶ broad acre irrigation in non-horticultural areas enables better quality water to be supplied to the horticultural areas;
- ▶ trials in the Tragowel Plains sub-region of the State are showing that the removal of water will lead to increased salinisation; and
- ▶ if the supply of water was to be removed from the land, the accumulation of salt on the surface would move out of the area through run-off leading to increased salinity of surface waters.

Arguments to support large-scale land retirement in the Kerang Lakes area

6.40 Arguments to support large-scale land retirement can be illustrated by examining the views expressed by certain parties regarding the adequacy of the draft plan and by discussing the cost-sharing requirements of the Government.

Doubts expressed by integration consultant

6.41 An integration consultant was engaged by the Rural Water Corporation to assist in the development of the draft Kerang Lakes salinity management plan. The role of the integration consultant was to assess the technical data and research results produced by the various government agencies and to bring them together in a draft plan. The tender for the consultancy was advertised in February 1988 and let in May 1988 to a firm specialising in agricultural and economics consulting. **The selection was made largely by the community working group.**

6.42 Funds for the consultancy were fully expended before the required tasks were completed. On 4 March 1991, **the consultants offered a parting assessment of the draft plan as it stood at that time. This assessment cast substantial doubts on the adequacy of the draft plan.** Some of the more relevant comments made by the consultant were as follows:

- ▶ *"Further, the work undertaken identifies the fact that pasture and field crop activities utilise 95% of all irrigation water in the Kerang Lakes area but only produce 25% of the total gross margin. Given that salinity is a water problem, it is astonishing that such significant volumes of irrigation water are producing little more than the cost of supply. Perhaps more alarming, the questions that this inefficient use of resources raise (for example structural adjustment) have yet to be asked, let alone addressed in the plan."*
- ▶ *"The plan will achieve significant improvements in the value of environmental habitats and the quality of irrigation water supply. However, the longer term prognosis for the Kerang Lakes area has not changed. That is, the entire lower floodplain will be salinised and unproductive within 30 years. This situation is attributable to the inability of the plan to deal with the fundamental cause of the Kerang Lake area's problems, namely high and saline ground water tables."*

6.43 The 30 year prognosis referred to by the consultant is detailed in the no-intervention scenario contained in the draft plan.

6.44 The following paragraph from the draft plan conveys the nature of the proposed structural adjustment framework for irrigated cropping and pasture in the Kerang Lakes plan area developed since the March 1991 consultancy:

"Amalgamation of farms based on a matching of water rights with areas of Class A soils into larger units will provide the basis for long term financial viability. The package proposed aims to support the sale of salt affected properties with relatively small areas of Class A soils and a water right that is currently largely allocated to C and D soils ... It doesn't attempt to bring about forced land retirement but rather to assist people to farm viably, profitably and voluntarily."

6.45 It can be seen that in terms of land retirement the proposed approach advocates voluntary land retirement for certain farms rather than forced large-scale relocation. The comments concerning the issues on structural adjustment and the state of the entire lower floodplain in 30 years were corroborated by independent specialist advice obtained by audit.

Views of the former Department of Water Resources

6.46 The irrigation water supply for the Kerang Lakes plan area is part of the Torrumbarry irrigation system. After diversion from the Murray River at the Torrumbarry Weir, the water travels west, through over 160 kilometres of supply system before it reaches irrigators at the extreme end of the system at Woorinen.

6.47 The focus of the draft Kerang Lakes salinity management plan is on controlling salinity throughout the supply system. However, the Department raised serious doubts, in the following terms, about the validity of this approach in its September 1991 assessment of the draft plan:

"... while horticulture uses only a fraction of the region's water, it dominates the region's economic returns. In other words, nine per cent of total water use accounts for three quarters of the irrigated gross margin. Dairy and other uses account for 93 per cent of the irrigated area and 91 per cent of water use, but only provide a quarter of the region's gross returns. This is a good indicator of which areas ought to be a priority to protect.

"Given ... economic factors, combined with the physical characteristics of the Kerang Lakes region, suggests that in the medium to long-term irrigated pasture in the region will not be viable.

"It does not seem practical to operate 160 kilometres of irrigation distribution system to serve these two areas (i.e. Tresco and Woorinen). Especially when you consider that a major problem of operating the system is to tightly manage salinity levels of the irrigation water.

"An alternative solution requiring investigation to the water quality program proposed in the plan would be to serve those districts (ie. Tresco and Woorinen) with fresh Murray River water. Woorinen is located close to the Murray, so it should be simple to serve them with fresh Murray River water. Tresco is located adjacent to the Pentel Island pumps (which are used to freshen water for Woorinen)."

Cost-sharing guidelines

6.48 In January 1989 the Government issued *"Cost-Sharing Guidelines for Salinity Management Plans in Irrigation Areas"*. These guidelines state:

"Government will not assist land and water management projects which are not cost-effective and are dependent on continued subsidy. A more appropriate approach under these circumstances is the development of policies which facilitate rural restructuring."

6.49 This concept has been incorporated into one of the 4 key cost-sharing principles of the draft Kerang Lakes salinity management plan which states:

"... wherever possible, creating a situation requiring long-term government subsidies to support non-viable enterprises should be avoided."

6.50 While the above provisions of the cost-sharing guidelines could be viewed as supporting structural adjustment strategies, they could also be interpreted as advocating large-scale land retirement where farming is not viable.

Significant matters not canvassed in draft plan

6.51 The audit revealed that although various control options had been extensively considered by the community working group, **the draft plan released for public comment did not discuss:**

- ▶ **the option of large-scale retirement of irrigated land, including the concept of providing the highly productive districts of Tresco and Woorinen with fresh water from the Murray River and discontinuing the supply of irrigation water to the remainder of the catchment; and**
- ▶ **the long-term prognosis of the Rural Water Corporation's integration consultant that, despite implementation of the measures outlined in the draft plan, the western extremity of the Murray Riverine Plain will still be salinised and unproductive within 30 years.**

6.52 As a consequence of the failure to identify all issues in the draft plan, audit is of the view that the basis for critical decision-making is incomplete and this may preclude an adequate evaluation of the plan.

6.53 **It is essential that the draft plan discusses all significant salinity control options, even those that may be regarded as socially unpalatable such as the large-scale retirement of irrigated land.**

Viability of continued irrigation of unproductive cropping and pasture areas

6.54 As stated earlier, the Salinity Control Strategy provides that before the Government invests in salinity control schemes **an assessment needs to be made of whether the investment is economically sound.** Each investment proposal is to be subject to an economic evaluation in order to ensure that the State's limited financial and other assets are used efficiently. The Strategy also maintains that **costs and benefits associated with environmental and social factors, which cannot be expressed in monetary terms, will also need to be assessed** in the preparation of salinity management plans. The government "*Guidelines for the Preparation of Salinity Management Plans*" indicate that **environmental effects considered to be significant should be costed in dollar terms and included in economic analyses where possible.**

6.55 Despite the concerns expressed by the integration consultant and the former Department of Water Resources, the economic evaluation of the plan (refer to Table 6C earlier in this Part of the Report) shows a positive return for the entire region (net present value of \$17.4 million over 30 years). However, further analysis by audit revealed that **it was the highly profitable horticultural enterprises of Tresco and Woorinen which have a substantial impact on the economic evaluation and which have compensated for the less productive areas of pasture and cropping that comprise the bulk of the area.**

6.56 In examining the option of large-scale land retirement in the unproductive cropping and pasture areas, audit acknowledges that economic and social benefits are to be gained in these areas by concentrating water on the more productive A and B soils. In addition, the changed water management practices proposed under the draft plan (such as periodic flushing of lakes to reduce salt levels) will lead to certain improvements in environmental values. **However, a cost-benefit analysis to justify the retention of farming in the unproductive cropping and pasture areas, including a detailed analysis to support the contention that the social impacts of land retirement (or the social benefits of continued farming) would be substantial, had not been undertaken as part of the plan preparation.** In other words the social costs involved in large-scale land retirement (or the social benefits of continued farming) had not been evaluated against the economic costs of continued government subsidisation to support unproductive irrigation practices and the adverse environmental implications of these practices.

6.57 In the absence of such an analysis, there can be no assurance that the social benefits actually outweigh the economic and environmental costs (such as soil degradation due to salinity damage) associated with the provision of significant volumes of irrigation water to all areas used for cropping and pastures. In audit opinion, **the assertion by the Salinity Bureau that substantial benefit is to be gained by concentrating water on A and B soils in low productivity areas in preference to large-scale land retirement of these areas needs to be supported by a cost-benefit analysis,** irrespective of the influencing factors of the more productive horticultural areas of Tresco and Woorinen.

6.58 Expert technical opinion from specialists used in the audit review cast doubt on the view expressed by the Salinity Bureau that the wholesale removal of water would, in fact, lead to increased salinisation.

6.59 Continuation of the planning process has been based on the perceived social need to provide government support for the continuation of farming in marginal pasture areas of the sub-region. In the light of the reservations expressed by the integration consultant (paragraph 6.42) and the former Department of Water Resources (paragraph 6.47) such an approach may not, in the long-term, prove to be cost-effective. It is also contrary to the cost-sharing arrangements outlined by the Cabinet Committee and in the draft plan that subsidies to support uneconomic enterprises should be avoided.

6.60 The productivity of a plan area is dependent on a number of factors including climatic conditions, the state of the economy and environmental considerations such as the degree of salinity in the area. However, as scientific evidence suggests that in the long-term there is a strong possibility of land degradation due to salinity which will severely affect the productivity of the Kerang Lakes sub-region, a decision has to be made in the process of formulating the salinity management plan for the sub-region on whether:

- ▶ there is a need to plan for:
 - large-scale changes in agricultural patterns by removing water from unproductive soils and concentrating irrigated farming activity, salinity control measures and government funds on the most productive areas; and

- long-term structural readjustment (e.g. to a sustainable dryland farming industry or by concentrating irrigated agriculture on areas of high quality soils);
- or
- ▶ large-scale land retirement should be adopted which would result in relocating farming communities to more economically viable parts of the State.

The government dilemma

6.61 Deciding on the future of irrigated farming in the Kerang Lakes sub-region poses a significant dilemma for the current Government. The complexities involved in addressing this issue, which are influenced by important social and environmental factors as well as economic considerations, are evidenced by the diverse range of views expressed on the matter.

6.62 It is clear from the audit analysis that the community working group, with the support of the Salinity Bureau, has regarded the social aspect to be so substantive that it outweighs all other considerations. As a consequence, the group has advocated measures that involve land restructuring in preference to large-scale land retirement in unproductive areas.

6.63 It is acknowledged that there are a myriad of difficult options to be considered by the current Government before adopting the most desirable control measures to tackle the complex salinity crisis in the Kerang Lakes area. For this reason, audit considers the significance of the situation calls for the most difficult options to be discussed in the draft plan so that full scrutiny and consideration by the community and government can occur prior to the endorsement of the plan. It is only through this approach that the current Government can be assured that the most appropriate and responsible long-term decisions are made from a State perspective.

■ *RESPONSE from managing agency*

In developing a government response to the Kerang Lakes plan the issue of restructuring will be considered (the necessary technical information has been generated by the community's plan).

The Salinity Control Program has also supported the development of an Irrigation Management Strategy by the Murray-Darling Basin Ministerial Council. Work on the Salinity Control Strategy has commenced and the Kerang Lakes area will be one area closely examined.

It should be noted that other policies are addressing the issue of restructuring and that a government response will review the Kerang Lakes plan in the context of these policies. For example, Transferable Water Entitlements (TWE) have been available to irrigators in the area for the past 2 years. TWE assist with restructuring by enabling irrigators to either sell or buy water and in making the choice irrigators consider the likely return on continued use of water or the additional benefits to be gained from purchasing extra water.

■ **RESPONSE from Kerang Lakes Working Group**

The audit review expresses concern that the Kerang Lakes plan did not discuss all options and alternatives, thereby limiting the degree of scrutiny and consideration by the community prior to endorsement of the plan.

The sheer volume of options makes it impossible to discuss all fully in the plan. Option papers, background papers and numerous technical reports are available which detail the many options considered during the planning stage. KLAWG (Kerang Lakes Area Working Group) believes its option evaluation to be accurate, given all of the circumstances at the time.

In particular, audit expected discussion on land retirement because it is of the view that the plan promotes continuation of non-economic agricultural activities.

Throughout the planning period, input from the community indicated that attempts to introduce major radical change (e.g. large-scale forced land retirement) would be strongly opposed. KLAWG therefore proposed a strategy which would be accepted and which would initiate a process of evolutionary change, ultimately achieving the type of significant on-farm change that the plan saw as essential.

KLAWG strongly supports the need to bring about changes in land-use and discontinue irrigation of areas which are not viable due to salinity. For this reason, the plan gives a high priority to soil surveys to identify the areas suitable for irrigation. The concentration of resources on the suitable A and B soils coupled with structural adjustment will achieve the changes in land-use suggested in the audit review.

Irrigation of pasture and crops on A and B soils is economic, (although not achieving the same returns as horticulture). The plan does not propose that subsidies should be provided to non-viable enterprises. Also, the monitoring and re-evaluation of achievements through the implementation phase will enable criteria for assistance to be modified to ensure that such assistance continues to be directed to enterprises which will be viable in the long-term.

One of the objectives of the plan is to "maintain the social fabric ..." and this impinges heavily on the issue of land retirement. To supply the more-productive horticultural areas with water direct from the Murray River and cease irrigation on the less-productive areas would lead to the destruction of the existing irrigation infrastructure and ultimately to the wider community infrastructure. With 20 000 people living in the Kerang Lakes area, KLAWG considered that wholesale land retirement would have massive social implications and destroy the area as a regional centre. With other viable alternatives available, such as discussed above, KLAWG dismissed the option of land retirement.

The audit review was disturbed that costs and benefits associated with social and environmental factors were not quantified in economic terms.

KLAWG agree that expressing the social and environmental consequences in economic terms would make evaluation of options more objective. Such an assessment is well beyond the scope of this group and plan, and indeed, has yet to be fully mastered anywhere.

KLAWG was keen to establish dollar values for social and environmental benefits, however, it is almost impossible to do so in any useful analysis. It is clear however that an area like the Kerang Lakes area which is environmentally of national and international significance and is the residency of 20 000 people and has an influx of thousands of tourists each year, that the social and environmental benefits are significant. The plan has an overall positive economic return without quantification of the social and environmental factors.

CONTINUED USE OF EVAPORATION BASINS

6.64 An evaporation basin is a shallow lake or pond into which saline surface water or groundwater is deposited to allow it to evaporate, leaving behind a concentrated saline residue. Although evaporation basins act to localise the salt which has entered the surface waters as a consequence of salinity, the basins do not act to reduce the generation of salt in any way. While newer evaporation basins are often man-made, in many cases in the past natural shallow lakes have been used for this purpose.

6.65 The June 1987 Conservation Strategy for Victoria stated that evaporation basins should only be considered as a method for disposing of saline wastes if they represented the most cost-effective solution and after social and environmental implications have been properly evaluated. Evaporation basins were not to be located in existing wetlands or lakes unless a compelling public interest could be demonstrated. The Government indicated that investigation of long-term sustainable solutions for the disposal of saline wastes in northern Victoria would continue.

6.66 Because of their environmental impact, the use of evaporation basins was specifically examined by audit during the review of 2 plans, the draft Kerang Lakes salinity management plan and the Shepparton irrigation salinity management plan. This examination addressed:

- ▶ the impact of the Barr Creek Diversion Scheme on Lake Tutchewop and nearby lakes in the Kerang Lakes area;
- ▶ Tresco and Woorinen evaporation basins in the Kerang Lakes area;
- ▶ the use of small-scale evaporation basins in the Shepparton irrigation plan area; and
- ▶ the Girgarre pilot evaporation basin project.

Overall conclusion

6.67 The Government, when considering future proposals for the establishment of evaporation basins, needs to evaluate the costs of development against the economic, environmental and social benefits of such schemes. Projects should only proceed if it can be clearly demonstrated that productivity gains and environmental and social benefits exceed the economic costs involved in the development.

- *RESPONSE from managing agency*

The community-based planning approach now ensures that evaporation basins are subject to widespread public consultation and rigorous economic and environmental assessment. In relation to the establishment of a research program to assess the long-term environmental implications of the use of evaporation basins as a short-term salinity control measure and the ultimate disposal options for salt accumulating in such basins, there is a need for a comprehensive review before priorities in research are nominated. The research review planned for March 1993 will assist in addressing this issue.

Lakes Tutchewop, Kelly, William and Little in the Kerang Lakes area

Background

6.68 In the Kerang Lakes area, Lake Tutchewop and the nearby Lakes Kelly, William and Little (which are known as the Tutchewop basins) are used as evaporation basins for water diverted from Barr Creek under a Scheme known as the Barr Creek Diversion.

6.69 The draft Kerang Lakes salinity management plan states that 41 000 tonnes of salt a year is accumulated in the Tutchewop basins, of which 19 000 tonnes of salt is annually intercepted from Barr Creek and pumped to Lake Tutchewop for disposal under a scheme known as the Barr Creek Diversion.

6.70 While Lakes Kelly, William and Little were saline prior to European settlement, **Lake Tutchewop was described by researchers in 1975 as one of the highest environmentally rated wetlands in the Kerang Lakes area.** At that time, the salinity of Lake Tutchewop was only 13 300 mg/l. The draft Kerang Lakes salinity management plan indicates that *"Today with its salinity at 50 000+ mg/l that value has significantly reduced."*

6.71 In little more than 15 years, the salinity level of Lake Tutchewop has almost quadrupled. Its salinity level is currently 60 per cent higher than that of the Pacific Ocean.

Barr Creek Diversion Scheme

6.72 In 1988 the Federal Government and the Governments of Victoria, New South Wales and South Australia became signatories to the Murray-Darling Basin Commission (MDBC) Salinity and Drainage Agreement. The terms of the Agreement provided that the salt discharge of each State into the Murray River at 1 January 1988 became the benchmark against which future actions which increased or decreased that State's salt discharge could be evaluated. In Victoria, the Government determined that the salt disposal arrangements in place within each of Victoria's 9 salinity control regions at 1 January 1988 would be the base for all intrastate planning activities.

6.73 Under the existing *"Guidelines for the Development of Salinity Management Plans"*, regions or sub-regions are not compelled to reduce existing discharges of salt below this 1988 level in developing salinity management plans. However, if they wish to dispose of additional salt downstream, they are required to make an offset, by either generating EC credits elsewhere in the plan area (i.e. minimising the generation of salt) or by purchasing credits (disposal entitlements) from other regions, other States or the MDBC.

6.74 The Barr Creek Diversion Scheme was constructed in 1968 in order to reduce the amount of salt entering the Murray River through the advent of evaporative disposal. Evaporative disposal refers to the drainage of saline waste water into an evaporation basin (in the form of a lake, swamp, natural depression or man-made basin). Saline waste water can be concentrated by solar evaporation or leakage. At this time, less emphasis was placed on the downstream implications of salinity mitigation projects and the boundaries of the current salinity control regions had not been established. Audit noted that the salinity management plan for the Barr Creek sub-region, (which is adjacent to the Kerang Lakes area), placed little emphasis on minimising the discharge of salt into the Kerang Lakes area. The aim of the Barr Creek plan, which in 1987 was the first salinity management plan endorsed, was:

"... to provide a minimum reduction of 6.2 EC (3.7 mg/l) in the Murray River salinity at Morgan, South Australia. This will be accomplished by reducing the quantity of relatively fresh water entering the Barr Creek flow, and thereby maximising the effectiveness of the Lake Tutchewop disposal scheme to remove the saline flow before it reaches the Murray River". (Source: the Rural Water Corporation's Review of the Barr Creek Salinity Project, May 1989.)



The Barr Creek.

6.75 In other words, emphasis of the plan was to minimise the volume of water flow and consequently to maximise the salt in every litre of water pumped into Tutchewop, rather than attempting to reduce the generation of salt within the sub-region.

6.76 Of the average net annual accumulation of 64 600 tonnes of salt which arose from salt entering and leaving the Kerang Lakes area from surface waters, the draft plan for the area estimated that 41 000 tonnes (64 per cent) is generated by the Barr Creek Diversion Scheme and accumulates in the Tutchewop basins.

6.77 Under the Kerang Lakes draft plan Lake Tutchewop will continue to be used as an evaporation basin but changes will need to be introduced to the way it is managed through the backflushing of Lake Tutchewop to Lake William and then possibly on to Lakes Little and Kelly. The *"Proposal for the Development of the Kerang Lakes Area management plan"*, issued by the Rural Water Corporation in May 1987, provided for Lake Tutchewop to continue as an evaporation basin for the disposal of saline waters from Barr Creek, unless alternate evaporative capacity could be provided. These changes were designed to stabilise the Lake's salinity at 40 000 mg/l. Notwithstanding this reduction, the environmental significance of Lake Tutchewop will still largely be lost to the State and, in particular, the Kerang Lakes community.

6.78 While, the restrictions placed on the disposal of salt into the Murray River under the MDBC Salinity and Drainage Agreement may help preserve the Murray River, it is clear from the above discussion that the Barr Creek Diversion Scheme has unfortunately been environmentally detrimental to Lake Tutchewop.

Ultimate disposal of accumulated salt

6.79 As previously mentioned, evaporation basins do not act to reduce salt generation, rather, they capture and localise the salt at one location. The operating life of these facilities is finite. In time, the salt concentration in the water becomes so high that evaporation rates decline significantly, thereby reducing the volume of saline water which the basin can process.

6.80 The draft Kerang Lakes salinity management plan draws attention to the fact that over the next 10 years actions under the plan will increase the amount of salt stored in the Tutchewop basins from the current 41 000 tonnes a year to 60 300 tonnes a year. The plan estimates that if no action is taken, on current trends, by the year 2050 the salinity level of Lake Tutchewop would increase to 195 000mg/l which would reduce its evaporative capacity by 15 per cent. This would result in an increase of 2 EC (1.2 mg/l) at Morgan in South Australia (the point at which Murray River salinities are normally monitored) as the saline water that Lake Tutchewop could no longer process would find its way to the Murray River. While not significant in the context of the salinity of the Murray, this increase represents approximately 10 per cent of Victoria's salt disposal entitlement.

6.81 Audit notes that the draft Kerang Lakes salinity management plan fails to identify any long-term strategy for the disposal of salt accumulating in Lake Tutchewop resulting from the Barr Creek diversion. While evaporation basins may solve the salt disposal problem in the short-term, it would appear that they merely defer the problem to future generations.

■ **RESPONSE from the Kerang Lakes Area Working Group**

It has always been a matter of major concern to KLAGW (Kerang Lakes Area Working Group) that the plan does not address salt accumulation in the Kerang Lakes area. For this reason, research and investigation into sustainable salt export is a high priority in the plan, in the 1992-93 budget and in on-going negotiations between MDBC and the Victorian Government. This matter will take time to resolve and is a matter that is considered beyond the scope of this plan. It is a matter of State, national and maybe international concern and should be addressed in those forums.

KLAGW has identified that the use of Lake Tutchewop for the disposal of saline water from outside areas has placed this area at an enormous disadvantage with regard to its own salt disposal - particularly when the subject of retirement of saline land is considered. KLAGW has identified that the area is a victim of circumstances because of this.

Environmental impact of the use of evaporation basins

6.82 The draft Kerang Lakes salinity management plan acknowledged the importance of the Barr Creek diversion in generating EC credits for Victoria and its impact on mid-river salinity levels. However, the plan also identified that the current arrangements have 3 major problems;

- ▶ **failure to halt the environmental degradation of Lake Tutchewop;**
- ▶ **declining evaporative capacity of all 4 lakes as salt levels reach saturation point; and**
- ▶ **the potential for increased leakage from the lakes into the local groundwater system due to the increase in density of the water as it becomes more saline and for the associated implications for the sub-region's salinity problem.**

6.83 In an effort to overcome these problems, the draft plan identified a number of alternate solutions involving the introduction of a periodic flow of water through Lake Tutchewop. The plan acknowledged, however, that these options generally:

"... have a high number of significant drawbacks including high costs and social problems associated with "transferring" salinity problems from one area to another."

6.84 The adverse consequences of the use of evaporation basins were further illustrated by comments made by the then Department of Industry, Technology and Resources in its 1986 "Review of the Hydrogeological Evaluation and Numerical Modelling of the Mineral Reserves Basin" which stated that:

"It is likely that all evaporation basins constructed in a Riverine Plain setting will be problematic and costly due to the combined effect of flat topography and seepage."

6.85 Audit was advised by the Salinity Bureau that the Salinity Control Strategy does not advocate the use of evaporation basins as a long-term solution. In this context, the draft plan indicated that extensive research was required to identify and assess all possible options and proposes a 10 year program to achieve this aim. Research work is to include the development of operating guidelines to optimise the strategy of backflushing to Lake William in an effort to stabilise the salinity of Lake Tutchewop.

6.86 Audit contends that the significant environmental value of Lake Tutchewop has been jeopardised in return for a short-term salinity control measure that does not address the source of the salinity problem. Also, the use of evaporation basins may potentially have deleterious side-effects in terms of salinisation due to the distinct possibility of increased accessions to the watertable.

6.87 In the event that Lake Tutchewop is to continue to be used to evaporate saline water from upstream communities, audit is of the view that the research program proposed in the draft Kerang Lakes plan should be dramatically accelerated in order to expedite recommendations aimed at:

- ▶ preventing any further environmental damage to Lake Tutchewop;
- ▶ minimising the costs of salt disposal to be borne by future generations; and
- ▶ avoiding any potential adverse consequences facing the sub-region from greater salinity in the area due to increased leakage from the Lake.

Tresco and Woorinen evaporation basins in the Kerang Lakes area

6.88 Audit was advised by the Chairman of the community working group for the Kerang Lakes area that **the application of tile drainage to support horticulture in Tresco and Woorinen necessitates the use of 5 lakes in the sub-region as evaporation basins for saline drainage. Two of these drainage areas, namely the Woorinen Drainage Lakes (the South Drainage Lake and the South Lake) and the Golf Course Lake were regarded by the Chairman as being of environmental significance.**

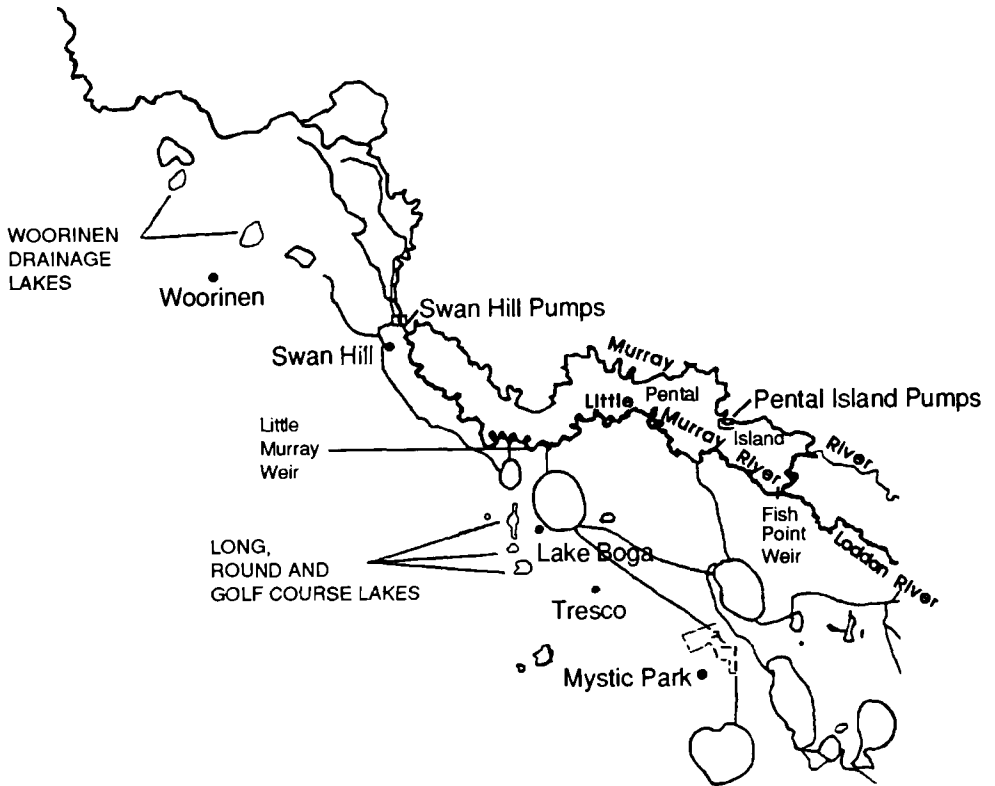
6.89 The draft plan states that:

"The salinity level of the Woorinen Drainage Lakes is increasing due to saline drainage inflows. South Drainage Lake (North West Lake) has a high conservation value due to the presence of a wide variety of waterbirds and the Hardyhead fish. The conservation value of Woorinen South Lake could be enhanced and salinity could be reduced and controlled by changing the operating rules for the Lakes.

"Golf Course Lake is a very high value wetland due to the large numbers and diversity of waterbirds using the Lake as a feeding ground and to the presence of the rare Hardyhead fish upon which they feed. It is also surrounded by a relatively undisturbed area of Mallee scrubland ... Salinity levels in all of these lakes are rising due to saline water disposal and lack of flushing".

6.90 Diagram 6F shows the location of the Woorinen Drainage Lakes and the Golf Course Lake in relation to Woorinen and Tresco.

DIAGRAM 6F. LOCATION OF DRAINAGE AREAS FOR WOORINEN AND TRESCO



Woorinen Drainage Lakes and Golf Course Lake.

6.91 Given these circumstances, consideration should be given to widening the research program for Lake Tutchewop to encompass the lakes used as evaporation basins in the Tresco and Woorinen areas.

Shepparton irrigation plan area - small-scale evaporation disposal system

6.92 The use of both sub-surface and surface drainage form integral components of the Shepparton irrigation plan. Sub-surface drainage can involve the use of groundwater pumping or tile drainage methods in order to minimise rises in groundwater levels. Groundwater pumping can only be used where there is a reasonably high yielding aquifer from which to pump, i.e. where the soil structure and type allows significant quantities of groundwater to be extracted by a groundwater pump. However, in areas where groundwater pumping is not considered a viable control method, tile drains can be used to intercept accessions to the watertable. In these areas, as access to surface drainage is not possible, saline water collected by tile drains can be disposed of locally to small-scale evaporation basins.

6.93 The Government in its support for the plan identified that the approach outlined within the plan, which primarily involved sub-surface and surface drainage, could substantially protect 100 000 hectares from salinisation. **Included in the salinity management plan was an additional area of approximately 40 000 hectares (around 500 farms representing 8 per cent of the total plan area) which, although suitable for farming, will not be protected by either sub-surface or surface drainage.** This area of land is considered unsuitable for groundwater pumping due to the low yielding aquifers (i.e. because of the soil structure, there is only a limited quantity of water that can be extracted from beneath the surface of these lands which would make groundwater pumping ineffective). The plan comments on this situation as:

"At this stage there are few options for these farmers beyond further research into evaporative disposal and tile drainage. However, opportunities are likely to be available in part, at least, for most properties."

6.94 The Government, when acknowledging its support for the plan in June 1990, commented:

"A vigorous program of research will be undertaken. One key focus will be a means of sustaining productive agriculture in situations where economic or disposal constraints limit the use of sub-surface drainage. Government, through pilot trials, will assist the community investigate small-scale groundwater pumping and evaporative disposal options, for use by individuals. The use of tile drainage as an element of 'within farm' restructuring will also be trialled."

Current status of trials

6.95 At the time of completing the audit, the Executive Officer of SPAC advised audit that the tile drains had been installed and the project results were undergoing assessment to determine the effect on productivity.

Findings of integration consultant used in the development of the Shepparton irrigation plan

6.96 The integration consultant, in the July 1988 report entitled "*Policies for Areas without High Yielding Low Salinity Aquifers*", assessed the merit of agricultural management techniques in assisting farm productivity in areas which do not have high yielding aquifers. The consultant concluded that:

"... the recommended policy towards those areas which cannot be protected with pumping and salt disposal via channels and drains will include agricultural methods, protection by pumps, tile drains and buy-back.

"Agricultural methods of enabling farmers to live with salt will have a significant role to play in particular locations and on particular parts of individual farms. Careful re-structuring of pasture types, water use and farm operations will be important as will outcomes of research on salt tolerant varieties.

"Agricultural methods, on their own, in unprotected areas, will not prevent totally inequitable, forced restructuring. Therefore additional policies or methods must be found for such unprotected areas.

"The most likely long-term result in the unprotected areas if the only policy to be adopted was a "living with salt" type of agricultural methods based policy, would be a massive and quite painful, socially disruptive, high cost, forced restructuring. That is the unlucky farmers would be forced out."

6.97 In view of the vulnerability of unprotected land to the effects of salinity, the trial work associated with the tile drainage and small-scale evaporative disposal options and the monitoring of the impact on productivity needs to be given priority, with the aim of maintaining the long-term viability of landholders within these areas. The use of small-scale evaporative basins will need to be evaluated in the context of any adverse long-term environmental implications and the ultimate disposal options available for salt accumulating in such basins.

- *RESPONSE from managing agency*

This recommendation by audit for priority for research to be given to a particular area reinforces the need for detailed review of the Program's research effort and an assessment of the competing research needs. A review will begin in March 1993.

- *RESPONSE by the Budget Sub-Committee of SPAC*

In the very early days SPPAC made the policy decision to protect the entire region and rejected the proposal put to it by the Rural Water Corporation to enhance the Phase B. SPAC is aware that there are some parts of the catchment which will have a high watertable which cannot be economically protected using technology currently available.

SPAC has funded, and is continuing to fund agronomic research including the "living with salt" option. A tile drainage trial is being conducted in the Katandra area with a view to testing the economics of tile drainage in an intense irrigation area.

Girgarre pilot project

6.98 According to the Salinity Bureau the success of the Girgarre pilot project, an evaporative basin located west of Shepparton in the Shepparton irrigation sub-region, is one of the major achievements of Victoria's Salinity Control Program. The Rural Water Corporation also maintain that construction of the Girgarre evaporation basin has demonstrated that a project of this type can benefit the control of salinity without any negative environmental effects.

6.99 This project was initiated after serious salinisation problems were identified by the Corporation and the Department of Agriculture in the early 1980s on a group of properties near Girgarre. Investigation in 1982 identified that **60 per cent of the area surveyed around the Girgarre district was suffering some loss of production due to salinisation.**

6.100 The project consisted of 3 groundwater pumps and a 30 hectare evaporation basin. Two of the pumps commenced operation in May 1985 and February 1986, respectively, and both discharge to the Deakin Main Drain, a drain which forms part of the Rural Water Corporation's drainage system used for irrigation purposes. The third pump discharges to the evaporation basin and commenced pumping in September 1987 when the evaporation basin was completed.

Early reservations on project's viability

6.101 During the planning period in 1983-84, concerns were raised by the community over the possible negative effects of the evaporation basin. According to landholders, leakage from the basin was seen as a major concern due to the deleterious effects this would have on farm productivity and land values in the area. Other concerns expressed by nearby farmers, who already had groundwater pumps operating, related to the fear that the extra pumps could reduce the amount of groundwater available for them to pump and use for irrigation. Irrigators whose water was diverted from the Deakin Main Drain considered that the quality of water in the Drain would decrease with 2 of the pumps discharging to the Drain.

6.102 Although the Rural Water Corporation played the key role in the development of the project, it expressed the following views on the costs of the project in a Cabinet submission of August 1986:

"The basin is relatively expensive as:

- ▶ *it is located on high-value irrigation land rather than lower value dryland;*
- ▶ *it is a totally artificial storage (rather than a use of natural depressions which has tended to be the case previously in Victoria); and*
- ▶ *it has been conservatively designed as this is the first basin of this type in the region."*

"With the current cost estimates, the basin accounts for 84 per cent of the capital cost of the project, yet with its associated groundwater control pump offers protection to only 28 per cent of the area to benefit from the scheme, confirming the earlier perception that evaporation is an expensive way of disposal in the context of the Shepparton region."

6.103 Despite the above concerns the Corporation's recommendation to Cabinet was that the project proceed.

6.104 The Minister for Water Resources at the time received different advice from the Director-General of the former Department of Water Resources who concluded in September 1986 that:

"Completion of the entire scheme seems unjustified on economic grounds.

"There appears to be little to be gained from further research on such an economically unattractive scheme."

6.105 In October 1986 the Minister for Water Resources announced that it was the Government's intention to proceed with the project on the basis of:

- ▶ improved productivity of farms;
- ▶ the value of research obtainable from the scheme;
- ▶ the avenue provided to explore disposal options; and
- ▶ the opportunity to determine the viability of future projects of this nature.

6.106 Nevertheless, the Minister stated that the following concerns remained:

"... the project as a whole is a relatively expensive one considering the direct salinity mitigation benefits likely to be obtained ..."

"Given the pilot nature of the project, no cast iron guarantee on long-term performance can be given."

6.107 It is apparent from the above that widespread reservations were held by government agencies concerning the cost effectiveness of the project and by landholders on the future impact of the project on farm production.

Development and management of the project

6.108 A review of the project found that in addition to these early reservations:

- ▶ a detailed cost-benefit analysis including the project's potential environmental and social impacts was not undertaken;
- ▶ the total capital cost of the project was \$1.3 million compared with an original estimate of \$475 000;
- ▶ the primary beneficiaries of the scheme comprise only 17 landholders (3 per cent of total landholders in the Tongala Irrigation District), while the operation and maintenance costs are met by a levy on all irrigators in the District;
- ▶ an Environment Effects Statement required under the *Environment Effect Act 1978* was not prepared for the project;

- ▶ a consultant engaged by a local community group reported that the initial decisions appeared to have been made at an inter-departmental level without participation by those likely to be effected by the pilot project and public meetings were not held until after the government departments had agreed on their preferred option; and
- ▶ a definitive long-term strategy for the disposal of salt accumulating in the basin had not been developed.

6.109 The above shortcomings in the development and management of the \$1.3 million Girgarre pilot project serve to reinforce the importance of ensuring that the benefits, including environmental and social considerations, should clearly outweigh the costs involved with proceeding with this form of salt disposal.

■ *RESPONSE from managing agency*

In responding to the Nangiloc Colignan salinity management plan, the Government endorsed guidelines for evaporation basin design which included a commitment to assessing the environmental effects of the proposed basins and adherence to environmental and planning legislative requirements.

■ *RESPONSE from Budget Sub-Committee of SPAC*

Approval for the Girgarre pilot project was given by the Government in the early days of SPAC. Funding for this project had been obtained prior to the establishment of the SPPAC. SPAC sees the Girgarre evaporation basin as a very successful project where the research findings were better than expected and the performance of the evaporation basin exceeded expectations.

SPAC believes the auditors have failed to recognise that the pilot project was primarily a research program and its primary objective was to establish the benefit-cost analysis, including environmental and social factors, and believes that such as analysis could not have been done prior to the scheme.

The design of the evaporation basin and the care taken in its construction obviated any potential environment problems. Contingency plans were included in the design and there was a fairly extensive consultation process with the community.

In relation to the payment of operation and maintenance costs, this issue was addressed during the Rural Water Corporation's (RWC) Sub-surface Drainage Tariff Review. SPAC's recommendation, which was adopted by the RWC Board, will see the direct beneficiaries pay 41.5 per cent, local government pay 17 per cent and all landholders in the rating entity pay the remaining 41.5 per cent.

The evaporation basin was designed to harvest salt and to dispose salt to the Deakin Main Drain during periods of very high flows in the Murray. However, the rate of leakage from the evaporation basin appears to be optimal and the life of the basin will be greater than 100 years.

SPAC is amazed at the consultant's comment suggesting inadequate consultation had occurred. This proposition was put to a meeting of the Stanhope Girgarre LandCare Group on 8 October 1992. One of the landholders adjacent to the Basin, made the following comment:

"The degree of consultation was greater for this project than for any project I have seen or heard of. Every landholder was fully aware of the project and had input into the final design".

PART 7

Cost-Sharing

7.1 The Salinity Control Strategy includes specific cost-sharing principles which are designed to apply to the beneficiaries of the salinity measures implemented under the salinity management plans, or to parties whose practices are contributing to salinity problems. This section of the report discusses the cost-sharing principles in the context of the 4 plans examined during the review and addresses the following issues:

- ▶ an explanation of the concept of cost-sharing in terms of the *beneficiary pays* and *polluter pays* principles;
- ▶ benefits received by local industries;
- ▶ obligations of upstream communities under the polluter pays principle; and
- ▶ cost-sharing arrangements in relation to tree planting and drainage programs.

WHAT IS COST-SHARING?

7.2 The Strategy recognises that while the Government has a responsibility to provide resources for salinity control, regional and local communities need to be prepared to help themselves. With this focus in mind, **cost-sharing** represents a process whereby the costs of salinity management plans are to be shared by those individuals who derive benefits from control measures implemented to mitigate salinity within plan areas and those individuals who have contributed to an increase in salinity.

7.3 In referring to the beneficiary and polluter pays principles of cost-sharing arrangements, the Strategy states that:

"Contributions by communities at regional and local levels should reflect both the extent to which these communities derive benefits from salinity control (the beneficiary pays principle), and the relative inputs of local farming, water management and disposal systems to the worsening of the salinity problem (the polluter pays principle). The cause of salinity problems is often difficult to identify. Where current practices are known to contribute to problems, costs should be apportioned to discourage these practices."

7.4 In January 1989, the Government released cost-sharing guidelines to assist in the preparation of salinity management plans in irrigation areas. The principles contained in the guidelines were also deemed applicable to dryland areas. The guidelines indicate that the cost-sharing arrangements are to be based on the *beneficiary pays* principle and, where appropriate, the *polluter pays* principle. Under the guidelines, the beneficiary pays principle deals with circumstances where the beneficiary can be clearly identified. While it often may be difficult to identify individual polluters, the guidelines indicate that where individuals or organisations causing salinity can be clearly identified, they should bear the related costs, including costs of mitigation or losses incurred by others due to salinity.

7.5 The Government, in releasing the Strategy and cost-sharing guidelines, acknowledged that differences occur in the physical, economic, environmental and social attributes of sub-regions. As a consequence, guidelines can only be broadly based and the application of the guidelines would have to be on a case-by-case basis.

7.6 Under the guidelines, resolution of the cost-sharing issue will largely be based on identifying the primary beneficiaries of the various proposals. **Primary beneficiaries** are expected to meet their full share of costs while regional and local communities, as **secondary beneficiaries**, may contribute to the cost of salinity control measures on a voluntary basis. Beneficiaries, as defined in the guidelines, may include irrigation farmers who benefit through increased productivity and increases in land values, local government and the Government.

7.7 The guidelines are silent in terms of specifically addressing the contribution which may need to be made by local industries located in salinity prone areas of the State. In this context, experiences in the Shepparton irrigation sub-region serve to illustrate the benefits that are derived by local industries which benefit substantially from the implementation of effective salinity control measures.

BENEFITS RECEIVED BY LOCAL INDUSTRIES

7.8 The Shepparton irrigation plan identifies the significant impacts on the regional economy of production losses due to salinity. It further states that based on 1986 prices:

"The largest contributors to the Shepparton region economy come from dairy production, other food processing (meat works, soft drink manufacturers, bakers etc), horticultural product processing, building and community services. The irrigated agriculture component can be approximated to the sum of dairy, horticulture and other food processing. These combined make up \$1 698 million of output (64 per cent of all output), \$344.8 million of income (52 per cent of all income) and 21 708 jobs (55 per cent of all employment)."

7.9 Furthermore, the cost-sharing arrangements within the plan identifies:

"... the dairy and horticultural industries are receiving less than one-third of the benefits from salinity control. More than two-thirds accrue to the processors and other dependent industries. If the plan were not implemented, the corollary is that the processors and dependent industries would lose twice as much as farmers."

7.10 Despite this situation, the cost-sharing arrangements within the plan do not require the processors and dependent industries within the Shepparton irrigation sub-region to contribute directly to the cost-sharing arrangements of the plan. Rather, their contribution was deemed to be through the payment of municipal rates which is consistent with the approach applicable to the general rate payers.

7.11 Given the magnitude of benefits from salinity control measures that accrue to the processors and other dependent industries located in the area, the question arises as to whether these beneficiaries should be required to make a specific contribution over and above normal municipal rates.

7.12 Without adequate financial support by local industry, it could be said that contributions made by the farming community and government are, in effect, subsidising the local industries.

7.13 Where major industries across the State reap sizeable benefits from salinity control measures, audit is of the view they should be required to make specific contributions towards implementation of such measures. Some consideration, at least, needs to be given to whether the current cost-sharing arrangements are adequate.

- *RESPONSE from managing agency*

The cost-sharing guidelines emphasise the "beneficiary pays" principle and the plans are required to identify primary beneficiaries. Audit suggests that the fruit processing industry is a primary beneficiary. We believe that this is incorrect. The landholder primarily benefits from increased and sustained production, the cannery benefits by having a greater choice of fruit supply. The cannery is clearly a secondary beneficiary and therefore should contribute on a voluntary basis.

- *RESPONSE from Budget Sub-Committee of SPAC*

SPAC believes that the government guidelines clearly state that the processing industry is a secondary beneficiary and therefore should not be included in the cost-sharing.

SPAC also took the view that to levy the processing industry directly would place a disincentive for the industry to expand in the catchment and may even force processors out of the catchment. This was not considered desirable. About 70 per cent of the food processors are co-operatives and to levy them directly would either require the landholders to pay twice, or to pass the cost on. Given the competitiveness of the export market, the later option is not viable.

However, the Shires' agreement to accept a responsibility for 17 per cent of the operation, maintenance and renewal costs will mean the processing industry and the towns they support will contribute to the cost of implementing the plan as secondary beneficiaries.

SPAC brings to the attention of the auditor the positive role field staff employed by the processing industries have played in implementing the management plans.

SPAC also brings to the attention of the auditor that the Government has endorsed the cost-sharing arrangements for the management plans in the Goulburn-Broken catchment.

OBLIGATIONS OF UPSTREAM COMMUNITIES - POLLUTER PAYS PRINCIPLE

Salt accumulations from upstream communities

7.14 The general principles of the cost-sharing guidelines require that, where appropriate, the polluter pays principle should be applied in determining the cost-sharing arrangements for salinity management plans. Contributions by communities should reflect the relative inputs leading to the worsening of the salinity problem.

7.15 **Audit found that for the 3 irrigation plan areas included in the review, significant levels of salt originated in adjacent upstream communities.**

7.16 A measure of the impact of the accumulation of salt in each area can be derived from a comparison of salt entering and leaving an area in surface waters. The net impact on salt quantities is known as the "salt balance". Table 7A shows the total estimated annual salt balance in aggregate terms for the 3 irrigation plans examined by audit.

TABLE 7A. ESTIMATED ANNUAL SALT BALANCE FOR KERANG LAKES, SHEPPARTON AND THE CAMPASPE WEST SUB-REGIONS
(tonnes)

<i>Sub-region</i>	<i>Salt inputs</i>	<i>Salt outputs</i>	<i>Average annual salt balance</i>
Kerang Lakes	294 300	229 700	64 600
Shepparton	99 000	60 900	38 100
Campaspe West	11 100	9 100	2 000

Source: Kerang Lakes, Shepparton and Campaspe West salinity management plans.

7.17 With respect to the Kerang Lakes plan area, the major upstream contributors to the accumulation of salt are the:

- ▶ Barr Creek irrigated catchment (via the Barr Creek-Lake Tutchewop Diversion Scheme and Fish Point Weir);
- ▶ dryland and irrigated catchments of the Murray, Goulburn and Campaspe Rivers (entering with the irrigation supply via the National Channel and the Pental Island Pumps);
- ▶ Avoca dryland catchment (via the Avoca River);
- ▶ Tragowel Plains irrigated area (via Bullock Creek, Calivil Creek, Nine Mile Creek, and Pyramid No. 1 and 2 drains); and
- ▶ Boort Irrigation Area (via Wandella Creek).

7.18 In the case of the Shepparton irrigation area, over 70 per cent of the incoming salt load of 99 000 tonnes a year was derived from salt originating from the adjoining Goulburn dryland region.

7.19 In the Campaspe West area, the estimated net annual salt accumulation of 2 000 tonnes is mainly derived from salt in the irrigation channel deliveries that originate in the adjacent Southern Campaspe dryland area.

7.20 The draft Campaspe West plan describes the situation in the following terms.

"Because the level of salinity in the incoming channel supply is high, the options available for framing the plan were limited. The poor water quality is caused by dryland salinity in the upper catchment. Although this aspect is outside the Working Group's charter, in the long-term land water management in the upper catchment will need to be improved."

Scope for wider application of polluter pays principle

7.21 A mechanism to apply the polluter pays principle to those upstream communities contributing to additional volumes of salt in the Shepparton, Kerang Lakes and Campaspe West irrigation sub-regions has not been included in any of the plans.

7.22 As a result, the additional costs due to salt infiltrating the areas from neighbouring regions will have to be met by government and local irrigation communities rather than shared with those upstream communities who contribute to the salinity problem.

7.23 Audit was informed by the Chairman of SPAC that, in relation to the Shepparton irrigation area, efforts have been made to levy a standard charge on upstream communities. However, these efforts have not been successful. The Chairman also advised that efforts will be made to levy a standard charge on adjoining communities where any new activities contribute to increased salt loads in the Shepparton irrigation region.

7.24 Audit acknowledges the practical difficulties in determining the extent of salinity caused by historical practices compared with that of current practices, and in applying the polluter pays principle to upstream communities where their actions are found to be contributing to a salinity problem in downstream communities. It is also recognised that such a process of levying costs on upstream communities may not be cost-effective. Despite these factors, avenues under which upstream communities would be required to bear some portion of the costs of salinity control in terms of their current activities should be investigated.

7.25 Action along the above lines would be consistent with a recommendation contained in a report, issued in November 1991 by the Ecologically Sustainable Development Working Groups (3 groups formed to provide advice to the former Prime Minister on future policy directions on ecologically sustainable development and to focus on measures to encourage the integration of environmental considerations into decision making processes). This report states that "*one way in which governments can intervene to change individual behaviour and to achieve a more socially and environmentally desirable outcome is through mechanisms which alter the relative prices of inputs or outputs*". In the context of salinity, the report identifies that such a mechanism might take the form of a tax on salt output to encourage more efficient irrigation practices.

■ *RESPONSE from managing agency*

The principle espoused by audit is supported but there are many constraints on its practical implementation. The Government's cost-sharing guidelines recognises these constraints when the pollution is from ill-defined diffuse sources and where the pollution is a direct result of actions taken by previous generations. In the dryland areas, for example, the export of salt has resulted from the harvesting of timber for construction, gold mining and agriculture that has occurred since settlement. These practices were endorsed by the Government of the day. The time lag between these land use changes and its effect on downstream salinity is in the order of generations and virtually never less than 15 years.

To apply polluter pays principles, the proportioning of liability to landholders for downstream salinity would need to be under-pinned by a politically acceptable and technically sound hydrogeological relationship demonstrating the cause and effect. In this context, the practicability of achieving results from this recommendation is strongly questioned.

- **RESPONSE from Kerang Lakes Working Group**

The Kerang Lakes Working Group (KLAGW) had to plan within the framework of the Murray-Darling Basin Commission Salinity and Drainage Strategy, which adopts the concept of a "baseline". In future, individuals or groups who consciously act to worsen conditions compared to this baseline must offset that impact. This concept acknowledges that it is difficult to apportion blame and to ask the current generation to pay for the consequences of the decisions of the past.

Because all upstream users are polluters within irrigation and drainage systems, the Kerang Lakes area would be viewed as a polluter to some downstream areas, and would therefore be asked to pay as well. To avoid a protracted and potentially unsuccessful negotiation to gain contributions from upstream areas and pass a portion of these on to downstream communities, KLAGW elected to try to solve problems, caused by past upstream actions, within the project area. Such a negotiation would also have diverted considerable impetus away from getting solutions implemented on the ground.

While KLAGW agrees with the principle of polluter pays and also agrees with the audit review's contention that a mechanism needs to be established whereby upstream users contribute to the cost of downstream salinity mitigation, it was seen as a State-wide issue and could not be solved by a single group within the given time frame.

Although KLAGW opted not to apply the principle of polluter pays to existing salt inflows, it will apply the principle to future increases in salt load from upstream areas.

KLAGW believes strongly that its cost-sharing proposals and its attitude to "polluter pays" is responsible, equitable and affordable.

- **RESPONSE from Budget Sub-Committee of SPAC**

SPAC is concerned that the auditor does not have an appreciation of dryland salinity processes. SPAC believes it is technically impossible to implement the polluter pays principle because we cannot identify and rate landholders in the dryland who own property which contribute to salt loads.

In particular, SPAC draws the attention to the long time lag between cause and effect in the land management practices which eventually cause increases in salt loads.

- **RESPONSE from the Chairman, Campaspe West Implementation Group**

The original Campaspe West Report assumed that irrigation water of an average of 764 EC maintained beneath a maximum of 900 EC would have no significant impact on productivity. Salinity from the dryland catchment above irrigation area was only 511 EC average. The pollution cost is therefore relatively small while the cost of the collection of the tax would probably be prohibitive.

The Auditor-General's position that the current dryland owners contribute to the costs is also harsh because they didn't cause the problem initially, e.g. in most cases they didn't cut down the trees.

Current dryland owners require positive encouragement to take appropriate actions to ease the salinity problem. The imposition of penalties, taxes or sanctions will have a negative impact.

TREE PLANTING AND DRAINAGE PROGRAMS

7.26 In the Kerang and Campaspe West sub-regions, tree planting and drainage programs are a feature of the salinity control measures. Trees are planted to intercept local seepage flows into the groundwater from Rural Water Corporation irrigation supply channels.

7.27 In its Business Plan for the period 1990-91 to 1994-95, the Rural Water Corporation indicates that:

"For existing Water Services, our target is to recover the costs of operating, maintaining and rebuilding the water systems."

7.28 The Water Services program of the plan lists as one of its key considerations:

"major reform of tariff structures to promote water use efficiency and to assign service costs more equitably ..."

7.29 In late 1990, the Federal Government set up a series of working groups to examine the issue of Ecologically Sustainable Development. The Agriculture Working Group, which was established as part of this process, made the following comment in its final report in November 1991:

"Under valued or free resources are likely to be over used leading to possible degradation."

7.30 In discussing the pricing of irrigation water, the Agriculture Working Group reported that:

"Ideally, any environmental costs associated with supplying the resource, where they can be identified, should be recovered from all beneficiaries. These developments are likely to contribute to a more efficient use of the resource and to more rational decisions about future capital expenditure on infrastructure."

7.31 On this issue, the report recommends *"governments introduce pricing structures for water which encourage efficient use and reflect the full costs of administration and distribution, including capital replacement ..."*

7.32 These views were echoed in a report by the Economic Planning and Advisory Council, a body chaired by the Prime Minister. In the Council's April 1992 report entitled *"Managing Australia's Natural Resources,"* the following observations were made:

"... even when only direct financial costs are considered, users of irrigation water are receiving a significant subsidy from tax-payers ..."

"However, it should be noted that use of irrigation water can involve costs in addition to the direct costs of supply. For instance, intensive irrigation practices can lead to degradation of irrigated land, with run-off also contributing to salinity problems of downstream users of the river system concerned ..."

"Higher irrigation water charges that take into account the full economic and environmental costs of such supplies have the potential to increase economic efficiency and environmental amenity ..."

7.33 A review of the tree planting program in the Kerang Lakes area and the tree planting and drainage program in the Campaspe West area, associated with the Rural Water Corporation's irrigation channels, found that the capital costs will be predominantly met by the Government rather than the beneficiaries. In addition, the associated cost-sharing arrangements varied between the plan areas. This position is contrary to the direction taken in the above studies which strongly favours allocation of costs to beneficiaries.

7.34 In the Campaspe West situation, 25 per cent of the capital cost of the tree planting and drainage programs are to be met by local landholders, while the draft Kerang Lakes plan proposes to offer grants to farmers for 100 per cent of the cost of the trees and associated fencing materials. Given this variation in cost-sharing arrangements in the 2 areas, the proposed approach in the draft Kerang Lakes plan to fully subsidise local landholders should be reassessed prior to finalisation of the plan.

7.35 As the Corporation is clearly the polluter in these cases (in the sense that the Corporation owns and operates the channels which deliver the water to the region and which are leaking), audit is of the view that the costs associated with tree planting to intercept leakage from these channels and regional drainage should be borne by the Corporation. In accordance with the recent initiatives by the Corporation to move towards full cost recovery, these costs would then be brought to account and shared by the beneficiaries (that is the farmers) as a cost of delivering the water. In audit opinion, this approach is:

- ▶ equitable in that it would ensure that the beneficiaries of the Corporation's supply system contribute to the environmental costs of that system;
- ▶ consistent with government policy, the polluter pays principle, the directions of the Corporation's Business Plan and the principles underlying the recommendations of the Ecologically Sustainable Development Working Group and the Economic Planning and Advisory Council; and
- ▶ beneficial in that it will increase the incentives for more efficient use of irrigation water, thereby reducing accessions to the watertable and easing the salinity problem.

- *RESPONSE from managing agency*

A salinity management plan for a particular area specifies an integrated range of salinity control actions. Some actions require significant financial investment by landholders, e.g. laser grading, improved on-farm irrigation systems etc. Other actions require public works that have broader community benefits. Each component of the plan is costed and an economic, environmental and social analysis is undertaken. If the plan is acceptable, cost-sharing arrangements are developed to cover the total costs of implementing the plan. Once the cost-share for each beneficiary has been defined, appropriate mechanisms are identified for the efficient collection of each beneficiary's cost-share.

- *RESPONSE from Kerang Lakes Working Group*

The argument advanced in the audit review whereby the cost of planting trees to intercept seepage from Rural Water Corporation channels should not be funded through the Salinity Budget has merit and will be pursued by the Implementation Group.

PART 8

Central Management of the Strategy

PERFORMANCE MEASUREMENT

8.1 In its report "*Salt of the Earth: Final Report on the Causes, Effects and Control of Land and River Salinity in Victoria (October 1984)*", the Salinity Committee of Parliament reported that there was no overall evaluation and review of performance of the Salinity Control Program.

8.2 In the light of this criticism, the 1988 Salinity Control Strategy foreshadowed that regular monitoring would guide and evaluate the salinity management program by measuring factors such as:

- ▶ the extent of salt-affected land and water in the State ;
- ▶ groundwater depths and pressures; and
- ▶ the degree to which salinity control measures have been adopted by the local communities.

8.3 The Strategy, which includes 110 specific commitments, is complemented by various quantitative performance targets outlined in individual salinity management plans for sub-regions throughout Victoria.

8.4 The Strategy outlined a **government commitment to introduce a State-wide monitoring network by 1990** to measure the salinity of surface water and groundwater.

8.5 The Government also indicated in 1988 that the adequacy of the Strategy would be reviewed regularly by the then Natural Resources and Environment Committee of Cabinet. These reviews were to be based, in part, on progress towards program targets.

Monitoring and evaluation of performance

8.6 The audit revealed that **a State-wide monitoring scheme to evaluate the performance of the Salinity Control Program against its goals and objectives has not been established.** In other words, a process for State-wide periodic assessments of the outcomes of the salinity control measures in terms of physical status and trends in salinisation of land and water compared with trends in economic, environmental and social data has not been developed. This situation occurred even **though in excess of \$150 million has already been spent on the Salinity Control Program since 1985.**

8.7 To redress this deficiency in the Program, the Salinity Bureau originally intended to engage a consultant to develop an appropriate monitoring and evaluative network for the State. The draft brief for the consultancy, which was prepared in February 1991, included the following comments:

- ▶ Monitoring the extent and severity of salinity and the implementation and effectiveness of salinity control measures is undertaken by a number of government agencies for a variety of purposes. Some monitoring networks, such as river gauges and groundwater bores, have been in place for many years while others have recently been introduced in response to the needs of the Salinity Control Program (e.g. community-based measurements of salinity, watertable levels and plant indicator species have commenced through the Watertable Watch and Saltwatch projects);

- ▶ Salinity management plans include a proposal for a monitoring program to assess the effectiveness of implementation;
- ▶ In November 1990 the Government released its *"Annual Reporting Guidelines for the Implementation of Salinity Management Plans"* which specify the economic and environmental performance indicators required to assess the effective implementation of the plans;
- ▶ In northern regions of the State, monitoring must satisfy the needs of the Murray-Darling Basin Salinity and Drainage Strategy; and
- ▶ Reporting on the results of monitoring activity takes a number of forms including project specific reports by the responsible agency and an annual review of the program by the Salinity Bureau.

8.8 The significance of the proposed activity as indicated above was reinforced by the **major shortcomings in the existing network and availability of monitoring data** such as:

- ▶ a lack of State-wide periodic assessment of changes in groundwater levels and water quality and of the area of salt-affected land;
- ▶ the absence of systematic, long-term monitoring of economic, environmental and social parameters;
- ▶ river and stream monitoring which may not be yielding appropriate data for salinity management; and
- ▶ inconsistent data collection between dryland regions.

8.9 Against the above background, the proposed consultancy project was designed to collect data in order to answer questions such as:

- ▶ what changes to the salinity of land, rivers and wetlands are occurring throughout the State?
- ▶ what should be the State-wide priorities for salinity control?
- ▶ what is the rate of implementation of salinity control measures?
- ▶ how effective are the control measures?

8.10 However, despite recognition of this fundamental element of program delivery, the Government did not proceed with the consultancy.

8.11 The failure to appoint a consultant to develop a framework to monitor the Strategy was compounded by the fact that **a regular review of the adequacy of the Strategy had not been undertaken, and only limited oversight had been exercised by the Cabinet Committee in recent times, with the Committee meeting only twice in 1991-92 compared with 7 meetings in 1990-91.**

8.12 Without the development of qualitative and quantitative performance indicators and regular monitoring and evaluation of the program, audit is of the view that government is not in a position to assess whether measures have been effective in:

- ▶ preventing salinity problems developing in irrigation areas which have good quality groundwater;

- ▶ retarding the onset of salinity in irrigation areas with saline groundwater;
- ▶ helping communities adapt to higher saline conditions;
- ▶ overcoming salinity problems associated with localised groundwater systems in dryland regions; and
- ▶ protecting high value wetlands and other significant environmental features in salt-affected areas.

8.13 It is recognised that the full effects of the Salinity Control Program and Strategy will not be realised in the medium-term. **Nevertheless, attention needs to be given to the development of performance indicators to evaluate the extent to which the Salinity Control Strategy, through its 8 programs and 110 commitments, has been effective in improving or at least maintaining the productive capacity, environmental quality and social well-being of salt affected regions.**

8.14 Suitable measures should be established to periodically assess whether:

- ▶ equitable solutions have been found for individuals and communities where salinity is a problem;
- ▶ sustainable usage of land and water in salt-affected areas has been identified and promoted;
- ▶ social hardship is minimised while long-term sustainable solutions to salinity control measures are established;
- ▶ communities in salt-affected areas have been provided with the capacity to take responsibility for local salinity mitigation programs; and
- ▶ any adverse environmental effects of salinity control measures have been kept to a minimum.

8.15 Information provided by way of these performance measures needs to be monitored and evaluated by the Salinity Bureau and the Cabinet Committee in order to assess the extent to which the Strategy is meeting its goals and objectives, and to enable corrective action to be taken when necessary.

■ *COMMENTS provided from the Salinity Bureau during the audit review*

During the development of salinity management plans, managers intuitively monitor their plans to enable them to keep track of plan progress and to improve the effectiveness and efficiency of work done.

As a matter of course, all projects under the Salinity Control Program have also been required to report on progress as a condition of their funding. In addition, many salinity projects have incorporated a strong monitoring component.

The Salinity Planning Working Group produced "Annual Reporting Guidelines for the Implementation of Salinity Management Plans" in November 1990. These guidelines direct the implementation teams to monitor performance indicators and expenditure, making the plans more accountable. These guidelines ask for information regarding performance indicators and expenditure.

In October 1991, the Department of Agriculture initiated a project with SPAC to develop a methodology and to compile data to monitor the implementation of on-farm measures. Subsequently, annual reports were produced for the year 1990-91 for all salinity management plans being implemented over that period. These guidelines are presently being reviewed to make them more relevant to the increased number of plans starting their implementation.

In July 1991, the Department of Agriculture commenced a project to develop a baseline and method for monitoring implementation of on-farm management responses to salinity. During 1992 this project has been expanded, resulting in an agreed State-wide Salinity Monitoring Framework, to augment the Annual Reporting Guidelines. The Salinity Monitoring Framework will require that plans being implemented undergo effectiveness monitoring, as well as the financial and implementation monitoring that is mandatory at present.

Draft Regional Monitoring Guidelines have been prepared and detailed regional and State-wide monitoring plans are scheduled for completion by June 1993.

The project is being overseen by the Planning Working Group.

In addition to the above, the 1992-93 Co-ordinated Salinity Budget provides for the Office of the Environment to undertake a review of the non-salinity environmental performance of the Salinity Control Program and development of environmental monitoring criteria.

■ **RESPONSE provided by managing agency**

Work commenced in June 1992 to integrate the considerable, existing interstate, regional and sub-regional salinity monitoring arrangements already being undertaken in order to develop a monitoring strategy for the Salinity Control Program. Implementation of the monitoring strategy is planned to commence in June 1993.

A comprehensive review of the Strategy was planned for early 1992. Because of the announcement by the Auditor-General of his intention to proceed with a performance audit, the program review was deferred until the audit findings were available. A Program review will now proceed. In the meantime, planning for 3 elements of the review is well developed. A Strategic Workshop was held in November 1992 to review the Program's decision-making processes, a research review is to commence in March 1993, and a review of the "natural" environmental performance is provided for in the 1992-93 co-ordinated salinity budget. Work will begin on redefining the salinity strategy objectives in 1993, after the completion of the Program's comprehensive community-based salinity management planning phase which was finalised in December 1992.

Status of program commitments

8.16 The 8 programs in the Government's Salinity Control Strategy were planned to be implemented over a 10 year period from 1988 to 1998. As salinity may take many years to control, a long-term time frame has been set for the achievement of some 110 specific commitments earmarked in the Strategy.

8.17 During the audit a draft progress report was prepared by the Salinity Bureau in April 1992 which outlined the progress of the Salinity Control Program in meeting the specific commitments of the Strategy. The report indicated that 94 of the 110 commitments had been met, 14 commitments were to be met by 31 December 1992 and 2 commitments were identified as outstanding. Many of the commitments (74), which were regarded as having been met, did not have definitive timelines and were on-going or continuous in nature, e.g. continuing grant schemes and the undertaking of research. In relation to the 94 commitments regarded as having been met, **the report stated that a judgement as to the quality of service provided in meeting each commitment had not been formed by the Salinity Bureau.**

8.18 Information relating to each program in terms of expenditure for the period 1984-85 to 1991-92 and percentage of total expenditure on each program and related commitments of government are outlined in Table 8A. The scope of the audit did not involve verification that all commitments had been met.

TABLE 8A. PROGRAM COMMITMENTS

<i>Description</i>	<i>Expenditure, 1.7.84 to 30.6.92</i>	<i>Percentage of total expenditure</i>	<i>Number of program commitments (a)</i>	<i>Commitments achieved and those of an on-going nature</i>
Programs	(\$m)	(%)		
Regional planning and co-ordination	16	15	15	6
Farm improvement and assistance	47	43	14	12
Revegetation	13	12	9	8
Improved water use	1	1	11	11
Drainage and salt disposal	22	20	5	4
Environmental protection	5	4	7	7
Education and participation	6	5	15	15
Research and investigation (b)	-	-	31	29
Strategy implementation	-	-	3	2
Total	110	100	110	94

(a) 74 commitments do not have definitive time lines and are on-going in nature.

(b) Expenditure forms a component of the other programs of the Strategy.

Source: Information supplied by the Salinity Bureau.

Outstanding commitments

8.19 The 2 commitments that have been acknowledged by the Salinity Bureau as having not been met are considered by audit to be important elements of the Strategy and relate to the development of a State-wide monitoring scheme for the regular review of the adequacy of the Strategy (refer to comments in paragraph 8.6 of this Report) and the requirement to develop a salinity register of salt-affected land and water throughout the State (refer to comments in paragraph 8.21 of this Report).

■ *RESPONSE from managing agency*

Audit requested information on the implementation of the Salinity Strategy. The Strategy identifies 110 specific commitments. Many of these relate to the continuation of on-going agency activities, e.g. extension, research and investigation activities. The Salinity Bureau, in consultation with participating agencies, undertook to assist the audit by quickly reviewing the status of each commitment. Where the particular commitment related to continuing an agency program and that program was still continuing, the commitment was recorded as having been met. The Salinity Bureau and participating agencies accepted that simply counting the commitments in this way provided little meaningful information and cautioned audit that the "quality" of the commitment had not been assessed in this exercise.

The "quality" of meeting the commitments is best assessed by a detailed review of the "on-going" programs. The Salinity Control Program is committed to such reviews to ensure that the agency programs continue to be relevant to the needs of the Salinity Program. Such reviews are likely to recommend ways of increasing the relevance of agency programs (rather than assigning a "quality" value to the program) as more information about the salinity problem and salinity control activities become available. This information is generated by the salinity management planning process and by the periodic reviews of on-going programs.

Over the past 3 years the Department of Conservation and Natural Resources' Landcare support and the Department of Agriculture and Rural Water Corporation extension services have been reviewed by agencies. A review of incentives to landholders and a review of government and community cost-sharing are under way. The Salinity Program will commence a review of the salinity research effort in March 1993. The review will be completed by October 1993.

In addition to these activities, all salinity projects are assessed, either by the regional community groups or the State-wide working groups during the budget development process. These groups report to the Landcare and Salinity Standing Committee and the Cabinet Committee.

SALINITY REGISTER OF LAND AND WATER BODIES

8.20 The Salinity Control Strategy set a 10 year target in which to characterise, model and assess the most significant salt-affected sub-regions within the State.

8.21 **Audit found that, despite the 1988 commitment, a salinity register consolidating the salt-affected land and water throughout the State had not been prepared by the Salinity Bureau.**

8.22 In audit opinion, priority should have been given to a thorough investigation at various points of time of salt-affected sub-regions within the State, prior to the development of salinity management plans for specific areas. The absence of a State-wide analysis of trends in salinity inhibits identification of those areas requiring priority funding by government.

8.23 Consideration should be given to the development of a State-wide salinity register to ensure that funding is directed to salt-affected areas requiring immediate attention. The practicality and cost of developing and maintaining a central environmental databank containing this information would need to be assessed against other competing demands on the salinity funds available to the Program.

- *COMMENTS provided from the Salinity Bureau during the audit review*

A statement of the total area affected by dryland salinity has been prepared by the DCE Centre for Land Protection Research in Bendigo. Further work is required to compile additional data following a survey of the Mallee and South Western Victoria and more detailed surveys throughout the State. The report documents 100 000 hectares of land affected by dryland salinity in Victoria.

It is technically difficult to estimate salinity risk accurately. However, this work is being undertaken as part of the preparation of salinity management plans and regional salinity strategies being prepared for dryland areas. By the end of 1992, 72 per cent of the State has been covered by a salinity management plan. A discussion paper has been prepared that documents the future extent of salinity in Victoria and assesses the relative significance of the salinity problem between regions.

While the guidelines for preparing salinity management plans do not require an historical assessment of salinity, this assessment is being conducted as part of most plans.

- *RESPONSE from the managing agency*

"Salt Action: Joint Action" clearly defines the main sub-regional priority areas within the State where salinity management plans are being, or have been, prepared. Each of these plans defines areas currently affected, or at risk, from salinity and the economics of control or management. The status of land and water bodies in significantly salt-affected areas is documented in the annual reports of salinity management plans.

SALINITY BUREAU

8.24 The Salinity Bureau, which was established in the early 1980s, has a staffing base of 5 officers. Between 1990 and 1991, 3 additional officers were temporarily employed to assist with the preparation of the *Decade of Landcare Plan* and a fourth additional officer was employed to prepare a document relating to the Salinity Control Program. The Salinity Bureau operated on an annual budget of \$518 000 for 1990-91 and \$430 000 for 1991-92.

8.25 The Government's Salinity Control Strategy provided that the Salinity Bureau, which was then situated in the Department of the Premier and Cabinet, was responsible for co-ordinating and monitoring the implementation of the Strategy and advising the Cabinet Committee of progress made in achieving program targets. The Cabinet Committee had the responsibility of overseeing the operations of the Bureau.

Implications of transfer of responsibility

8.26 The rationale for locating the Salinity Bureau within the Department of the Premier and Cabinet was that it would:

- ▶ establish direct reporting links to the Premier and the Cabinet Committee;
- ▶ enable the Bureau to operate within a neutral department; and
- ▶ give the Bureau a degree of prominence within the structure of government.

8.27 The neutrality of the Bureau has enabled it to play an important role in framing the Co-ordinated Salinity Budget and provided an independent source of information for community working groups and the wider community.

8.28 Following a March 1992 Cabinet decision, ministerial responsibility for the Salinity Bureau transferred from the Premier to the Minister for Agriculture, who also had responsibility for one of the 3 key lead agencies involved in implementing the Salinity Control Strategy.

8.29 A message frequently conveyed to audit by a number of community members was that they were concerned with this transfer. These community members considered the framework in place prior to the transfer of the Salinity Bureau provided independence and prominence to the Bureau's work as the overall co-ordination and monitoring role was performed by a unit which was separate from the agencies involved in program implementation.

8.30 Audit notes that the current Government has announced that the overall co-ordination of salinity control will return to the Department of the Premier and Cabinet.

- *RESPONSE from the managing agency*

The Government has relocated the Salinity Bureau to the Department of the Premier and Cabinet.

Limited authority of the Bureau

8.31 Although it has a vital co-ordinating and monitoring role, **the Bureau in the past has not had the necessary authority and staffing to ensure that the objectives and commitments outlined in the Strategy are efficiently and effectively met.** As an illustration, if an annual report is not prepared for a salinity management plan, the Bureau does not have the authority to require the report to be prepared. By way of another example, the Bureau does not have the power nor the technical resources to examine whether grants have been spent efficiently and effectively.

8.32 In audit opinion the Salinity Bureau, while undertaking its co-ordinating function, has not been adequately established to perform its monitoring role in a satisfactory manner.

8.33 Audit is of the view that there is a need for the new Government to re-assess the structure of the Salinity Bureau, in terms of its powers and the extent of technical expertise, to ensure it has the expertise and authority to effectively undertake the monitoring role envisaged by the Salinity Control Strategy.

RESEARCH AND INVESTIGATION

8.34 The Salinity Control Strategy recognises that a prerequisite to formulating reliable and effective salinity control measures is the need to conduct research and investigations into the causes and effects of salinity. The Program includes surveys, laboratory research, field studies, development of techniques and pilot tests which have been undertaken by government agencies and specialised research institutes.

8.35 Research and investigation into salinity gained momentum when the accelerated Salinity Control Program commenced in the mid 1980s and has been undertaken within salinity control regions of the State, as part of the process of developing salinity management plans and during the implementation phase.

Risk of duplicating research projects

8.36 From a State perspective, the Research and Investigation State-wide Working Group met on a frequent basis prior to 1990-91 and assessed all research projects throughout the State. **However, the Group convened only once during 1990-91 and 1991-92 to assess proposals for State-wide research projects and did not review research project proposals for individual salinity management plans.**

8.37 While an audit review of a number of research projects undertaken throughout the State did not highlight any evidence of duplication, audit considers that **the State-wide Research and Investigations Working Group should assess each research proposal forwarded to the Salinity Bureau to avoid duplication or the undertaking of unnecessary projects.**

- *RESPONSE from managing agency*

Since 1990 the assessment of salinity project proposals has taken place at the regional and sub-regional level. This ensures accountability to the regional community and greater integration of research with other "on-ground" projects. A research review is planned to begin in March 1993. The review will, among other issues, assess the effectiveness of the current decision-making processes for research funding.

ACCOUNTABILITY FOR ENVIRONMENTAL PERFORMANCE

8.38 The Salinity Control Program involving approximately \$150 million of Federal and State funding since 1985, has not in audit opinion been subject to an appropriate level of accountability. Such accountability should concentrate on key features of performance in salinity control and be aimed at measurement and quantification of progress against targets, showing trends in salinity levels and associated economic, environmental and social factors.

Annual reporting

8.39 Annual reporting is the accepted mechanism of informing Parliament of the achievements or results of a particular government program. The former Conservation and Environment Committee of Cabinet, on behalf of the Government, had overall responsibility for the Salinity Control Strategy. The Committee's role was to ensure the implementation of the Strategy through the annual State Government Co-ordinated Salinity Budget and to act as the focus for co-ordinating the activities of government agencies.

8.40 In terms of reporting, the Strategy committed the Cabinet Committee to periodically release progress reports. Progress in the control of salinity was also to be summarised in the Government's "*State of the Environment*" reports and in the annual report to Parliament on the State Conservation Strategy.

8.41 Following the launch of the Strategy in May 1988, guidelines for annual reporting by community working groups on the implementation of individual plans and financial reporting were issued by the Salinity Bureau in November 1990. Annual reports for the entire program were prepared for 1987-88, 1988-89 and a draft report only for 1989-90. These reports included:

- ▶ details relating to the administration of the Salinity Program;
- ▶ comments regarding the 8 programs that comprise the Salinity Control Strategy;
- ▶ trends in salinity; and
- ▶ comments on publications, budget components and membership of community working groups.

8.42 A progress report was prepared by the Salinity Bureau in February 1991 which included information regarding the status of the Salinity Control Program in terms of the Salinity Control Strategy's program components. Annual reports for salinity management plans in the implementation phase were prepared for the Shepparton Irrigation, Goulburn Dryland and Tragowel Plains sub-regions of the State. During the audit a draft progress report in relation to performance compared to the commitments outlined in the Strategy was prepared by the Salinity Bureau in April 1992.

8.43 Audit found, however, that **only limited oversight was exercised at the Cabinet Committee level, an annual report for the Salinity Program had not been finalised for any of the past 3 financial years and an annual report had not been prepared for the Barr Creek salinity management plan since implementation was approved in March 1987.**

8.44 The Salinity Bureau guidelines for annual reporting did not require individual annual reports to be prepared in relation to salinity management plans that were in the developmental phase. However, in November 1989 the Cabinet Committee agreed that each management planning group should submit an annual report describing its progress in developing salinity management plans. To date, annual reports on the development of salinity management plans have not been submitted.

8.45 In addition the audit revealed that **consolidated annual financial statements had not been compiled for the Salinity Program on a State-wide basis.**

8.46 As a consequence, audit is of the view that, although limited government reporting does occur through the annual reporting mechanism of the lead agencies involved in the program and these figures are subject to audit under the *Annual Reporting Act 1983*, financial and operational accountability for the expenditure of public moneys on a State-wide basis is lacking for the Salinity Control Program.

8.47 The Salinity Bureau advised audit that, in future years, sub-regional performance information will be consolidated on a State-wide basis in order to develop a State-wide annual report.

8.48 As annual reporting relating to the Parliament in respect of the Salinity Control Program is currently far from satisfactory, prompt action should be taken to upgrade the quality and timeliness of information presented to the Parliament on the Program. As a minimum, Parliament should be provided with an annual report on the consolidated activities and achievements of the Salinity Control Program on a State-wide basis. The annual report should include financial and non-financial performance data including technical information arising from Federal, State and local government funding and contributions from local communities, including landholders.

■ *RESPONSE from managing agency*

The Salinity Control Program supports the need for timely preparation of annual reports. With the Government endorsement of management plans in May 1990, new reporting arrangements were instigated (see Annual Reporting Requirements for the Implementation of Salinity Management Plans). These resulted in 4 sub-regional reports being completed for 1990-91. Five are planned for 1991-92 and 13 for 1992-93. A process is being developed by the Salinity Bureau to ensure the production of a timely consolidated State-wide report. This process replaced the earlier annual reporting process, initiated by the Salinity Bureau, which resulted in the preparation of descriptive reports that did not attempt to measure the Program's performance against objectives.

In addition to the Program's reporting initiative, each agency reports on its salinity control activities through annual reports to Parliament as required by legislation. The Salinity Control Program has also complied with reporting requirements under the Conservation Strategy. An annual report has been completed for 1989-90 (and is available on request from the Salinity Bureau) and consolidated reports for 1990-91 and 1991-92 will be available by the end of March 1993.

Nearly all salinity management plans required are now either completed or in their final stages of preparation.

PART 9

Salinity Management Plans

9.1 As explained in paragraph 4.14, a key element of the strategy to control salinity in Victoria involves a community-based approach to preparation and implementation of salinity management plans, with each plan including information relating to the extent of salinity in a sub-region and control measures to be implemented to address the problem.

9.2 A pilot program within the Goulburn-Broken region of Victoria, which included an irrigation component (Shepparton irrigation sub-region) and a dryland component (Goulburn dryland sub-region), was completed in 1990. The 4 salinity management plans selected for examination by audit included the plans developed under this pilot program for these 2 sub-regions.

9.3 This part of the Report discusses issues relating to:

- ▶ development of the pilot program;
- ▶ community-based approach to sub-regional planning adopted under the Salinity Control Strategy;
- ▶ regional planning;
- ▶ use of integration consultants;
- ▶ salinity control measures adopted in salinity management plans; and
- ▶ overall viability of certain salinity management plans.

PILOT PROGRAM

9.4 In October 1985, a Ministerial Task Force on salinity established a pilot program within the Goulburn-Broken region of Victoria. An Establishment Team, a Pilot Program Management Team and a Community Working Group were established to develop the pilot program. The Conservation Strategy for Victoria released in June 1987 announced a government commitment to:

"... use the pilot program in the Goulburn-Broken catchment to demonstrate the most effective methods of salinity control within a region and to establish ways for the community to participate in decision-making and management."

9.5 The audit revealed that although a draft report was prepared, **a formal report on the pilot program was not finalised or issued after the project was completed in 1990.**

9.6 Although information regarding the pilot program was conveyed to the Cabinet Committee and was disseminated throughout the community in various forms, the failure to issue a comprehensive report may have led to some regions not gaining valuable information about salinity control programs in a readily accessible form.

9.7 **In order to maximise the benefits from the pilot program, information gained from the pilot program should have been disseminated throughout the various irrigation and dryland regions of the State in order to be of assistance to the on-going salinity control programs throughout Victoria.**

- *RESPONSE from the managing agency*

The program supports this finding. Considerable information has already been generated by the pilot program through annual reports, salinity management plans and other feedback mechanisms. The Draft Final Report on the pilot program will be released in early 1993.

- *RESPONSE from the Budget Sub-Committee of SPAC*

SPAC accepts a final report should have been published and the Draft Report prepared at the time is currently being edited with a view to publishing in early 1993.

However, SPAC believes that the success of the pilot program was not diminished by the failure to publish a Final Report and believes that the lessons learnt from the pilot program were incorporated in the Salinity Control Program.

SPPAC had regular meetings with the Cabinet Committee and Ministers. SPPAC was in close contact with the Salinity Bureau, the Planning Working Group and Standing Committee and produced 2 interim reports.

SPAC believes that the SPAC management plans and the Government response were, in many ways, the final report for the pilot program.

COMMUNITY-BASED PLANNING APPROACH

9.8 Community involvement in the planning process has been a cornerstone of the Salinity Control Strategy. The Strategy advocated an extensive community consultation process and, as such, has created a milestone in government by directly involving the community in the task of planning the most appropriate salinity control measures to be adopted in their respective local areas. Although costs are involved in implementing a community consultation process, in a program which may involve government decisions (which will seriously affect a citizen's rights, livelihood or property), the consultative approach, while initially time-consuming, may in the long-run prove the most effective in implementing change.

9.9 Under the Strategy's joint planning framework involving the community and the Government, a community working group is formed through a nomination and selection process, to develop each salinity management plan. The overall aim of the community-based planning approach is to foster community ownership of the salinity problem. After plans are endorsed by government, the control options and related infrastructure works are put into place through an implementation phase which may extend over a time frame of between 10 and 50 years. As such, the Salinity Control Strategy is a clear example of a government program involving long-term strategic management of resources.

Achievements in the planning process

9.10 A positive feature of all 4 plans examined by audit was the significant level of enthusiasm displayed by the community representatives and agency staff in the development and implementation of the plans. In addition, the processes followed for development of the 4 plans were characterised by a strong spirit of co-operation, with community and agency representatives contributing substantial energy and unpaid time to plan development.

Shepparton irrigation salinity management plan

9.11 The Shepparton irrigation salinity management plan was one of the initial plans developed to address large-scale irrigation salinity problems. The planning framework consisting of the committees and working parties created to address salinity problems in the area has, to a large degree, been successful in framing a salinity plan which, subject to a number of refinements requested by the Government, has the support of the local community.

9.12 **The consultative approach to planning was instrumental in securing a significant financial commitment from local landholders of some \$400 million or 45 per cent of the total costs of implementing the plan over 20 years.** The inclusion of local government in the cost sharing arrangements, a feature of the Shepparton plan, is regarded by the local community and government as a positive achievement. Local government has agreed to meet 17 per cent of the operating and maintenance costs of the Rural Water Corporation's surface and sub-surface drainage works segment of the plan into perpetuity.

9.13 The audit also disclosed that the co-operative planning process has had an impact on changing the attitude of the regional community to the extent that:

- ▶ whole farm plans are now accepted by the community as a prerequisite for many of the incentives; and
- ▶ municipalities have agreed to prepare uniform planning guidelines for salinity control works and to use their planning and rating powers to assist with the implementation of the plan.

9.14 Audit was advised by the Chairman of the community working group that the plan has also been successful in enlisting the support of locally-based food processing industries whose field staff are an important source of information and advice for farmers in relation to farming matters.

Kerang Lakes salinity management plan

9.15 In the Kerang Lakes area the community-based planning approach facilitated a rebuilding of the relationship between the community and government agencies, particularly the Rural Water Corporation. In the early to mid-1980s, the serious concerns relating to the proposal to develop the Mineral Reserves Basin Scheme adversely affected the community's perceptions of the government agencies involved. In facilitating a framework within which both groups have worked closely in the process of plan development, this relationship has significantly improved according to the Rural Water Corporation.

9.16 The management of any natural ecosystem such as that found in the Kerang Lakes area is an inherently complex task. The complexity of the interactions between the geological, hydrogeological and particularly sensitive environmental features in the plan area makes management even more difficult. Given these factors, audit acknowledges the extent of research conducted during the planning process to improve the understanding of the natural system and thus more effectively plan for its future management.

Some difficulties associated with the community-based planning approach

9.17 In examining the processes followed in implementing the community-based approach to salinity planning, the audit revealed that although development of a salinity management plan by a community working group may take up to 5 years, **interim reviews of progress in plan development had not been undertaken by government.**

9.18 Regular monitoring or oversight by government in the development of certain salinity management plans may have prevented the following problems from occurring:

- ▶ significant delays and resultant cost increases in finalising plans;
- ▶ inadequate selection processes for members participating on a community working group;
- ▶ insufficient training of community members; and
- ▶ apathy by certain segments of the local community in the preparation of the Campaspe West plan.

9.19 The above matters were raised by audit with the respective community working groups and government and positive recommendations were offered by audit to overcome these problems.

Significant delays and costs in plan finalisation

9.20 The significant delays in finalising the 4 plans examined by audit are illustrated in Table 9A.

TABLE 9A. COSTS OF AND DELAYS IN COMPLETING PLANS

<i>Salinity management plan</i>	<i>Costs of preparing plan (a)</i>	<i>Target for plan completion</i>	<i>Date plan endorsed by government</i>	<i>Time taken in planning process</i>
	(\$m)			(years)
Shepparton irrigation	3.3	1989	June 1990	4
Goulburn dryland	1.1	1989	June 1990	3
Kerang Lakes	3.4	1989	(b)	5
Campaspe West	0.5	1988	(b)	5

(a) Information supplied by Salinity Bureau.

(b) Salinity management plans not yet endorsed by government.

Shepparton irrigation and Goulburn dryland salinity management plans - Pilot program

9.21 The target date for completion of the Shepparton irrigation salinity management plan was exceeded by almost 12 months and, in endorsing the plan, the Government required that a number of amendments be made. It is audit's view that many of these amendments, which were in the form of variations to proposed salinity control measures, should have been identified by government prior to the submission of the draft plan for endorsement. This process would have minimised the additional costs that are now required to revise the plan in line with the Government's endorsement.

9.22 The target for completion of the Goulburn dryland salinity management plan was also exceeded by around 12 months.

Kerang Lakes salinity management plan

9.23 During the parliamentary inquiry into salinity that preceded the acceleration of the Salinity Control Program, it became evident in September 1984 that salinity had contributed to substantial production losses and environmental damage in the Kerang Lakes plan area. Some 2½ years later in May 1987, a proposal for the development of a salinity management plan for the area was released by the Rural Water Corporation which set a time frame for plan completion of a further 2 years (mid-1989). **Many delays were encountered in the preparation of the plan and the first draft was not issued for community comment until March 1992, nearly 3 years after the initial deadline.**

9.24 Audit was advised by the Chairman of the community working group that the draft Kerang Lakes plan area contained a series of sensitive and complex environmental features which have contributed to making the planning process particularly difficult. These features, together with the extensive research associated with the environmental issues to be addressed in the plan, were significant factors in delaying finalisation of the plan.

9.25 Notwithstanding the reasons discussed above, **it is disturbing that 8 years after the extent of the problem was revealed in a report to a Parliamentary Committee, a salinity management plan for the region had still not been finalised.** Audit is of the view that the delays encountered to date have been excessive.

9.26 These delays have contributed substantially to the \$3.4 million already expended in developing the draft plan for public comment and additional funds will be required in order to amend the plan to reflect the results of consultation with the community. Given that this cost is equivalent to employing some 22 people full-time for 5 years, **audit is of the view that the planning process for the Kerang Lakes plan has not been efficient.**

9.27 In addition to the costs directly associated with the planning process, the consultant engaged to assist the parliamentary inquiry into salinity estimated that annual losses of \$24 million occurred in the entire Kerang region (which included the Barr Creek and Tragowel Plains sub-regions) from salinity. Some portion of this annual loss in agricultural production may have been avoided if the plan had been finalised at an earlier date.

Campaspe West salinity management plan

9.28 Development of the Campaspe West salinity management plan commenced in February 1987. According to the time frame set by the Government the plan was to be completed in 1988. When the initial community working group commenced the final period of intensive community-wide consultation in mid-1988 (a process which normally takes around 3 months), it was on target to meet this deadline. However, the plan was not officially released by the Government for public comment until August 1989. This delay of around one year was due, in part, to difficulties associated with the community consultation process and by a government decision to withhold the plan for several months until the Goulburn-Broken plans were completed to enable a joint release.

9.29 After considering the plan and submissions, the Government announced its qualified support for the draft plan in June 1990. While supporting the farm management measures in the plan, it did not support the compulsory pumping and summer re-use of groundwater throughout the sub-region. In place of these control options the Government supported the staged implementation of groundwater pumps, starting in the north of the plan area, with the saline groundwater to be re-used in the northern area and the Bamawn drains.

9.30 In January 1991 the Government formed an implementation group of 6 community members, with a majority from the objectors to the original draft plan, who were given the task of re-working the original draft into a plan acceptable to the majority of landholders in the area (Further comment in relation to the plan's rejection by the community is contained in paragraphs 9.39 to 9.41 of this Report). **Some 2 years later, this task had not been completed.**

9.31 In view of the above, it is not surprising that **more than 5 years after the commencement of the government-sponsored planning process and the expenditure of some \$550 000, a salinity management plan for the region is yet to be finalised.**

9.32 In addition to the \$550 000 already expended in developing the draft plan for public comment, further public funds will be required to amend the plan to reflect the results of community consultation. Given that the cost of the planning process has been equivalent to employing some 3 people full-time over a 5 year period, **audit is of the view that the planning process for the Campaspe West plan has not been particularly efficient.** Furthermore, based on the annual agricultural losses of \$600 000 estimated in the draft plan, considerable losses in agricultural production may have been incurred in the Campaspe West area as a result of the overrun of some 4 years.

Overall audit comment

9.33 If the concept of community involvement in the planning process is to be retained, in audit opinion **there is a need in future for government to be involved to a greater extent in decision-making during plan formation.** Where public moneys are involved, government should exercise more control over the decisions made during the plan development stage. As a general principle, in a process where the community is driving the development of a plan over a long time frame and government is contributing to the costs, **frequent reviews of plan development and associated problems should be undertaken by government.** Such a process would enable government feedback to be built into the plan at the earliest possible stage rather than after substantial time and effort at the community planning level. In addition, this level of government involvement would maximise the benefits of community participation and enhance a positive reaction to any subsequent changes.

9.34 Processes need to be established to ensure that as much of the research data required for plan formation is collected before a community working group commences its task. Where financial, environmental and social losses from an area are known or expected to be significant, management plans should be developed at the earliest possible time. At the commencement of the planning process government agencies and community working groups should enter into an agreement specifying progressive targets for completion which will place greater emphasis on the timely completion of plans. **The Salinity Bureau should take a more pro-active role in ensuring adherence to planning deadlines. Progress needs to be closely monitored against predetermined milestones and, if progress falls behind schedule, the following actions should be considered:**

- ▶ **discontinuing community involvement in the planning process; or**
- ▶ **reducing the extent of funding relative to other priority plans.**
- *RESPONSE from managing agency*

The Salinity Control Program supports the need for timely completion of salinity management plans. Lead agencies for the planning task are required to prepare a Cabinet Committee submission outlining the salinity problem, the timetable and resources required for addressing the problem, and the process for involving the community. All agencies have conformed to this requirement.

In all cases, plan development has extended past the initial deadlines. There are many legitimate reasons for this. They include:

- *The difficulty associated with defining the salinity problem. For example in Kerang Lakes the planning timetable was based upon dealing with the management of the water bodies, but as the plan developed the importance of the related issues of land management and surface drainage became apparent.*
- *The Salinity Program sought to accelerate planning in many areas around the State, with many plans in development at the one time the available technical resources to support the plans were stretched.*

As part of the Program's on-going review of its activities the desirability of an accelerated planning phase for areas where the salinity problem is relatively simple was recognised in December 1989. The timetable for preparing salinity management plans in dryland areas was shortened so that Plans for all salt-affected dryland areas will be completed by December 1992. It was recognised that a "best bet" approach would be needed to overcome technical uncertainties where a prolonged planning phase could not be justified by the scale of the salinity problem and nature of the solutions (i.e. individual on-farm action).

The audit comments indicate some misunderstanding of how the community-based planning process should be managed. It is important to note that the principal objective of the Program's planning exercise is to develop a plan that has widespread community support. The process adopted by the Program is as follows:

- Community planning groups develop a draft plan that represents the community's preferred salinity control options. The Group is assisted by government technical experts and the plan must conform to planning guidelines.*
- The draft plan is released for public comment and agencies have an opportunity to formally comment on the draft plan.*
- The community group formally considers all responses and prepares a draft for government consideration, this draft represents the aspirations of the community and is based on the community group balancing all the responses to their plan.*
- The Government formally responds to the community plan. Because detailed technical information has been collected to support the community's preferred plan, any modifications to the plan by Government can be carried out efficiently.*

Community groups do not prepare plans in isolation from the Government. The technical details of the plan are prepared by Government agencies in accordance with the planning guidelines. The agencies also provide the executive support for the Working Groups. Feedback is an ongoing process.

Kerang Lakes salinity management plan

The salinity planning process faces complex trade-offs between options for sustainable agriculture, flood mitigation, riparian environmental protection, recreational use of water bodies and other interests in the community. Often (e.g. Kerang Lakes area) these objectives can not be mutually solved. It is not possible to accurately forecast the timing of each stage of plan development if the objective of maintaining genuine community acceptance of the draft plan is to be achieved.

Prolonged planning in the Kerang Lakes area was a symptom of technical, social and environmental complexity involving trade-offs within the community. Although the long-term success of the current approach remains to be seen, it is believed that any further accelerating of the planning phase would have been detrimental to the success of implementation.

We do not accept that discontinuing community involvement in the planning process is an option if plan development takes longer than proposed. If community ownership is to be achieved, community involvement in the planning process cannot be discarded.

■ **RESPONSE from the Kerang Lakes Working Group**

The Kerang Lakes Working Group (KLawG) acknowledge that the Plan development was a learning process and it must be recognised that in 1987 there was little trust between the agencies, and almost none between the RWC and KLawG. Trust and mutual respect has now been developed largely as a result of the skills displayed by the middle managers of the responsible agencies and the community members on KLawG. This has come at a cost in dollar terms and timing terms, however, the benefits both to the draft Kerang Lakes plan and to other plans still in the process of development have been great. These benefits should be recognised by audit.

The comments expressed by audit come with the considerable benefits of hindsight, and to attack the decisions taken in good faith and responsibility at the time by agencies and volunteers appears to be unreasonable. One should ask "if it had been done differently would the result have been less costly or better than the result achieved?" In most cases the answer is not yes, or maybe, but "probably not".

The audit review rightly points to the need to conduct planning in an efficient manner, but given the legacy of community issues and division on salinity, KLawG saw that attempting to accelerate the process and being perceived to be curtailing community input carried a very real and high risk of any resulting plan being rejected by the community.

It is recognised by all parties, and by the audit review, that the Kerang Lakes Area is particularly complex and involves major agricultural, social and environmental problems due to salinity. The extent of these problems was unknown and hence no one could target a completion date in 1987. This problem was exacerbated by a finite number of experts on the ground within the agencies, and finite budget restraints. With the preparation of 4 other plans at the same time, and the development of state-of-the-art modelling and groundwater drilling programs, the resources were simply not available to meet the time frames imposed in 1987. It is considered by KLawG that to have met the time frame would have been an abdication of its responsibility and a waste of public moneys. It would have resulted in a plan which called for a further plan. In this respect, audit's comments in regard to sustainable salt disposal are noted to be in conflict with its comments expressed in this item.

The audit review highlighted that monitoring of performance and expenditure was deficient and that there was a need for greater government involvement in decision-making during the formation of the plan.

KLawG is of the view that government involvement was adequate through formal agency reviews and the annual budget process. KLawG also believes that systems of review were in place through the agencies, the Salinity Bureau, the budget process and the Cabinet Committee.

KLawG agrees that monitoring could, however, be improved and regular 6 monthly updates are now requested from agencies by the lead agency.

■ **RESPONSE from Chairman of the Campaspe West Implementation Group**

It would be more constructive to recognise the limits of the policy of community involvement adopted by the Government and also recognise that in the early parts of the process much of the expenditure was directed to carrying out research, collecting information and establishing procedures which were of benefit to other working groups. The Report does not recognise that this is a plausible outcome of the Government's chosen approach to community-based planning.

To adopt the auditor's model would be to embrace a joint approach for the easy tasks and to impose a government decision when the options are not endorsed by the community. This would be seen as a token approach to community involvement for the most difficult issues - exactly the areas where community ownership is vital to successful implementation in the long-term.

Selection of members of community working groups

9.35 The pilot project for the Goulburn-Broken region found that the optimal approach to selecting community representatives was by a process involving community nomination, review by a project establishment team and finally approval by a Ministerial Task Force. However, a formal voluntary election process was adopted to select members of the community working group for the Kerang Lakes plan area rather than the Government endorsing final appointments. This approach resulted in a number of unsatisfactory features in that:

- ▶ it was not possible for the Government to ensure that selected individuals possessed the full range of skills and abilities required to successfully undertake the responsibilities of the position; and
- ▶ the election proved to be a time consuming and expensive process which extended over 4 months at a cost of \$20 000.

9.36 The election of community working group members should involve nomination by the community and final selection by government in preference to election by the community. The appointment process should provide for the assessment of the suitability and skills of nominated candidates.

■ *RESPONSE from managing agency*

There is no one "correct" method of selecting community representatives. The choice of approach adopted is determined by the type of salinity problem faced by the sub-region, the size of the sub-region and the history of salinity control within the sub-region. It should be noted that the approach recommended by audit has been used on all occasions except for appointment of members to the Kerang Lakes group.

■ *RESPONSE from the Kerang Lakes Working Group*

The election process was established by virtue of the agency-prepared Development Proposal for the Kerang Lakes Area Management Plan, and in 1986 was a reasonable approach to the appointment of members of the Kerang Lakes community working group. This is particularly the case where distrust existed between the agencies and the community. With greater acceptance of the community working group concept since that time, based possibly on the Kerang Lakes Area experience, more recent community working groups have been formed more efficiently. This is seen as one of the benefits of the Kerang Lakes Area experience.

If community ownership of the plan and its implementation is to be achieved, then the community needs to be seen to be in control. Where the government makes the appointment such community control is questionable.

Absence of training of community members

9.37 Successful completion of the salinity planning process requires that community working groups collectively possess adequate skills in particular areas. Ideally, skills held by working groups should include public speaking, analytical expertise, ability to assimilate a large volume of technical data and concepts, negotiation techniques and a capacity to provide an effective channel of communication to and from the community it represents.

9.38 Audit was advised by the Salinity Bureau that a substantial period of orientation for community representatives takes place where the purpose of each plan and salinity control options are explained at length. **However, for the 4 salinity management plans examined during the review, formal training programs to assist newly elected community representatives to address the necessary planning and administrative skills were not in place.**

RESPONSE from managing agency

The Salinity Control Program supports the recommendation and has attempted to provide new community members of planning and implementation groups with a comprehensive orientation program. The audit suggestion for formalising this process will be examined by the Program.

Lack of community involvement

9.39 At the time of the election of the initial community working group for the draft Campaspe West salinity management plan, very few people in the south of the plan area were interested in seeking a place on the community working group and a large proportion of the landholders did not understand the significance of the salinity problem and the implications for the future. These factors may explain the reluctance of the landholders from the southern areas to become involved in the original planning process.

9.40 Despite the issue to the community of a substantial amount of educational material, most meetings were poorly attended and as a consequence the community working group received only minimal feedback on the community's opinions of the plan. In audit opinion, the initial community working group did not convince the entire Campaspe West community that there was a need for the plan.

9.41 As the initial draft plan was rejected by the community, the Government in January 1991 formed an Implementation Group to re-work the original draft into a plan which was acceptable to the majority of landholders in the area. The date set for plan completion is 15 February 1993.

- *RESPONSE from managing agency*

The Campaspe West plan covers a small highly productive irrigation district near Rochester. The plan area, in terms of the number of landholders involved, is the smallest in the Salinity Control Program. This also resulted in a range of new challenges. During the community consultation phase it became clear that most of the local community were opposed to the sub-surface drainage component of the plan. This component has since been rewritten by the community implementation group and was released for public consultation in December 1992.

The Salinity Control Program agrees that community education is an essential element of plan preparation and implementation.

The Salinity Control Program is based on the need for community ownership and support of the plan. Plans involve trade-offs between competing interests and some farmers may be far from happy with the plan proposal and choose to express this by ignoring the plan.

- *RESPONSE from Chairman, Campaspe West Implementation Group*

It needs to be recognised that there is a lot of community money involved as well as government money. Rural industries are quite depressed at the moment and farmers need to be quite sure that their contributions to the plan will be well spent.

REGIONAL APPROACH TO PLANNING

9.42 To simplify the management of salinity in the State, the Salinity Control Strategy categorises Victoria into 9 "Salinity Control Regions".

9.43 Audit observed that a co-ordinated regional-wide approach to salinity planning, which was successful in the pilot program and consistent with the Salinity Control Strategy, was not adopted in the Campaspe region (of which the Campaspe West irrigation area is a sub-region) and the Loddon-Avoca region (of which the Kerang Lakes area is a sub-region).

9.44 It is interesting to note that the current Government's Water Policy advocates an integrated catchment approach to water and salinity management.

- *RESPONSE from managing agency*

A major finding of the regional pilot program, reported in 2 pilot program annual reports and the final submission of management plans to government, was the need for a catchment perspective in salinity management planning.

In October 1990, the Government endorsed the establishment of Regional Salinity Forums, where existing sub-regional groups would meet on a catchment basis to address salinity issues.

The on-going need for, and role of the Forums will be reviewed in context of the Decade of Landcare regional recommendations.

- *RESPONSE from Kerang Lakes Working Group*

To gain government support and to have the potential to move to widespread plan adoption and implementation, community acceptance and "ownership" were seen as essential.

To achieve this, the Kerang Lakes working group considered a wide range of salinity management options and selected a package of measures which were considered to be technically appropriate and which would be accepted by the community.

INTEGRATION CONSULTANTS

9.45 Integration consultants were responsible for integrating the results of a number of diverse technical reports into one cohesive plan. A review of the use of integration consultants in the development of the 4 plans examined by audit disclosed that some aspects of the management process could have been improved.

9.46 With regard to the draft Kerang Lakes plan, **the consultancy was terminated after 34 months (19 months after the nominated deadline), at a cost of \$321 000 (30 per cent over the initial budget).**

9.47 In a letter to the former Effectiveness Review Committee in November 1990, the Rural Water Corporation indicated that:

"... extensions to this consultancy have been due to the fact that government agencies involved in the project have not been able to provide the necessary technical inputs within the originally estimated time frames, largely because the complexity of the salinity problems in the Kerang area were not known when these time frames were drawn up."

9.48 The audit found that these delays resulted in additional costs to the State of some \$74 000 which arose as the consultant was required to maintain contact with the planning group, attend meetings and keep abreast of progress by the various departments while the necessary technical inputs were provided by the respective government agencies.

9.49 The Rural Water Corporation determined to engage a consultant even though experienced staff were employed by the agencies involved in the program. In addition, while the Corporation was responsible for the engagement, it did not prepare a contract for the consultancy and the community working group played a major role in the selection process.

9.50 An integration consultant was also engaged in the Shepparton irrigation plan area by the Rural Water Corporation. The consultancy, which cost \$388 000, exceeded the original contract sum by 12 per cent. The audit revealed that **delays were experienced in commencing and implementing the consultancy project** and were due, in part, to late input of government agency technical information and the results of the consultation process involving the Government and the community.

9.51 **Government agencies should ensure that the full extent of the work of integration consultants is completed in a timely manner. Assigned tasks need to be scheduled in such a way to ensure that consultants will not be delayed by untimely provision of material. In addition, use of any consultants within the Salinity Control Strategy should occur only where it is clear that the required skills are not available within any public sector agency.**

- **RESPONSE from managing agency**

The Program accepts that some inefficiencies have occurred in the provision of technical data to consultants. However, every endeavour has been made to provide material on time. Precise information needs and time required to obtain complex technical data cannot always be accurately predicted in advance.

The pool of personnel, from the public and private sectors, with appropriate skills for integrating land and water resource management projects is particularly small. At the time of letting the Kerang Lakes consultancy, personnel within agencies with the skills necessary for integrating the Kerang Lakes salinity management plan were already fully committed on other priority tasks within the Program.

- **RESPONSE from the Kerang Lakes Working Group**

The Kerang Lakes Working Group (KLawG) believes that the use of an "integrating consultant" gives community ownership to a plan and distances the agencies from the final document. The consultant should simply assemble the developed options etc. into the final draft plan and integrate the work of the agencies.

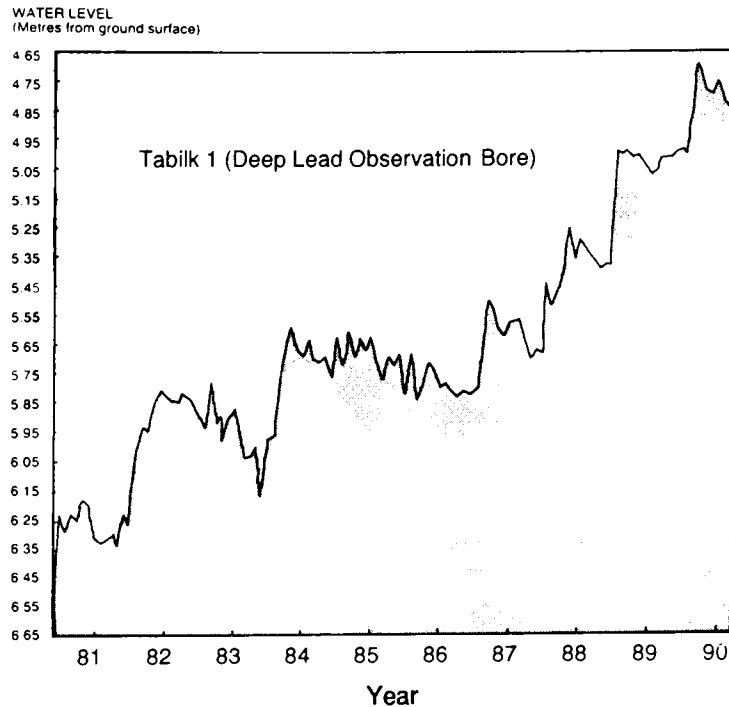
KLawG believes that the integration consultant had an important role to play, but because of the learning process and complexity of issues being researched, the full value of the consultant was not obtained. It is agreed that the consultant was employed too early in the planning process and was therefore limited in his role because information was not made available on time. The cost overrun cannot be attributed to the consultant and KLawG believes, with hindsight, that deferral of services until the information was available, may have been a better option.

SALINITY CONTROL MEASURES - GOULBURN DRYLAND PLAN

Groundwater pumping as a control option

9.52 According to the Rural Water Corporation, groundwater pumping around the Riverine Plains area (Nagambie region) of the Goulburn dryland sub-region is considered an essential element in containing the increasing groundwater levels. Groundwater research undertaken by the Corporation has shown that the watertable within this area is increasing at an alarming rate. To illustrate this point, Chart 9B highlights the increases in groundwater levels as disclosed by the Corporation's observation bore (referred to as Tabilk 1) within the Nagambie district.

CHART 9B. INCREASE IN GROUNDWATER LEVELS IN THE NAGAMBIE DISTRICT



Source: "Salinity Threatens the Nagambie District" -
Goulburn/Broken Salinity Pilot Program.

9.53 Although the use of groundwater pumping was considered a potential control option during development of the Goulburn dryland plan, it was not preferred because of the absence of research on its overall effectiveness. Audit considers that groundwater pumping should have been further investigated during the planning phase, given that the Rural Water Corporation regarded its use as essential in containing rising groundwater levels within the Nagambie area.

9.54 Although audit was advised that the viability of groundwater pumping as a salinity control measure is to be investigated during the implementation of the plan, any delay in the use of the measure may lead to significant additional costs.

9.55 Audit was informed by the community working group that groundwater levels are also increasing in other districts apart from Nagambie and as such it was recognised that the plan was never intended to be a static document.

9.56 The Dryland sub-committee of SPAC, with the assistance of the relevant government lead agencies, should identify the areas that require groundwater pumping as a control option. Any costs involved in implementing the control measure should be included in the economic evaluation of the plan.

- *RESPONSE from managing agency*

The potential for groundwater pumping within northern Victoria is regulated by the Murray-Darling Basin Salinity and Drainage Strategy which tightly controls discharge considerations. The community group is now developing broad options for dryland pumping. Their work indicates that a second phase of plan development is required where technical details are assessed and economic, cost-sharing and salt disposal implications are considered.

- *RESPONSE from the Budget Sub-Committee of SPAC*

SPAC agrees that the use of groundwater pumping should have received further investigation during the planning phase. SPAC has submitted a proposal to government through the Planning Working Group on this matter and this is currently being considered. SPAC hopes the Planning Working Group notes the auditor's comments and addresses the issue of groundwater pumping on the Riverine Plain as a matter of urgency.

SPAC agrees with audit that, as a consequence of this omission, the anticipated cost of the implementation of the plan has been underestimated. However, SPAC believe the benefit-cost ratio will actually improve with the inclusion of this technique.

Extent of on-ground works

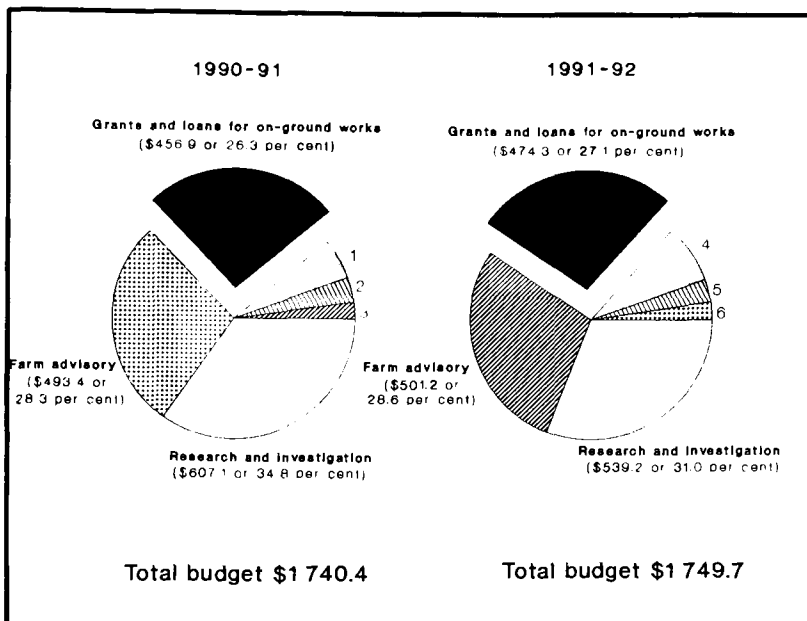
9.57 The Goulburn dryland plan identifies the following on-ground works to reduce rainfall accessions and to treat salt-affected land:

- ▶ high density tree establishment;
- ▶ low density tree establishment;
- ▶ perennial pasture establishment; and
- ▶ rehabilitation of discharge areas.

9.58 In implementing salinity control options after government approval for implementation of plans, it is important that a significant proportion of funding be applied to on-ground works in order to enable the impact of salinity control measures to be realised in a timely manner. Audit observed that funding for on-ground works as a percentage of total funding ranged from 30 per cent to 47 per cent in plans that had moved into the implementation phase.

9.59 However, with regard to the Goulburn dryland plan, the extent of government funding appropriated to on-ground works as a percentage of total funding was only 26 per cent in 1990-91 and 27 per cent in 1991-92. Chart 9C provides relevant details.

CHART 9C. BREAKDOWN OF APPROPRIATIONS
(\$'000)



Source: Co-ordinated Salinity Budget.

Legend:

- (1) Regional Planning and Co-ordination - \$95.0 or 5.5 per cent.
- (2) Education and Participation - \$48.0 or 2.8 per cent.
- (3) Environmental Protection - \$40.0 or 2.3 per cent.
- (4) Regional Planning and Co-ordination - \$139.0 or 7.9 per cent.
- (5) Education and Participation - \$54.0 or 3.0 per cent.
- (6) Environmental Protection - \$42.0 or 2.4 per cent.

9.60 Audit is of the view that unless greater emphasis is placed on the extent to which on-ground works are funded within the management plan, there is a risk that the impact of the salinity control measures will not be realised in a timely and effective manner.

9.61 The community working group advised audit that farm advisory services are related to on-ground works and thus increase the proportion of the funding involved in on-farm activities. The group expects that over time, the level of funding devoted to on-ground works will increase as research funding is reduced.

9.62 While audit is aware that the implementation phase is in its early stages, it is important that consideration be given to increasing the extent to which the allocation identified within the Co-ordinated Salinity Budget is directed towards on-ground works. Such consideration should also entail a continual review of the required mix of all elements within the budget to ensure the plan is implemented in the most efficient manner.

■ *RESPONSE from managing agency*

The Program has given, and will continue to give priority to "on-ground" works and appropriate extension programs. As the remaining management plans are finalised, clear work programs will be identified and resources transferred from planning to implementation activities. In relation to the Goulburn dryland plan, the level of funding for "on-ground" works compares favourably with other dryland regions. The plan carries a large research component. Many of the research activities have State-wide benefits and the community group has sought to have this fact recognised.

■ *RESPONSE from Budget Sub-Committee of SPAC*

SPAC supports the auditor's view that on-ground works should be a greater percentage of the budget during the implementation phase and this is in fact SPAC policy. SPAC believes this percentage should be increased but argues the transformation from planning to implementation and the reduction in funding over the last 2 years has exacerbated this problem.

OVERALL VIABILITY OF GOULBURN DRYLAND SALINITY MANAGEMENT PLAN

9.63 Within the Goulburn dryland plan, 4 salinity control options were considered. An economic evaluation of the viability of each of the options was undertaken by the community working group and the preferred option involved:

- ▶ revegetating recharge areas with high and low density trees or perennial pasture;
- ▶ rehabilitating discharge areas;
- ▶ undertaking incentive schemes;
- ▶ pursuing identified research needs; and
- ▶ providing community education.

The economic rationalisation for this preferred option is outlined in Table 9D.

**TABLE 9D. ECONOMIC EVALUATION
FOR THE PREFERRED OPTION**

Discounted benefits (\$millions)	14.32
Discounted costs (\$millions)	30.14
Benefit-Cost ratio	0.47:1

Source: Goulburn dryland plan.

9.64 Examination of the plan revealed that, **contrary to the Strategy, an evaluation of the intangible costs and benefits in the context of environmental and social factors had not been undertaken in the plan formation.**

9.65 Audit was advised by the community working group that the benefits quantified in the plan were restricted to salinity-related benefits. There were, however, other benefits to the community in the context of minimising erosion, nutrient flooding, algae blooms and turbidity of streams which would be a costly exercise to measure while other benefits to the habitat and the aesthetic value of the environment were immeasurable.

9.66 **On the basis of the economic evaluation and in the absence of any other quantifiable environmental and social benefits to the contrary, the plan is clearly uneconomic.**

9.67 The Government determined that the Goulburn dryland plan was to proceed into the implementation phase, notwithstanding that the plan was clearly not economically sound. Without questioning the merit of this decision, it is audit's view that **the Government should undertake a detailed analysis to fully address the potential for non-economic salinity benefits considered attainable, on environmental and social grounds, in the sub-region. In relation to other dryland plans, a thorough analysis of the social and environmental effects of salinity should be undertaken prior to the finalisation of these plans.** Guidelines for such an analysis need to be developed by the Salinity Bureau in accordance with the commitment made by the Government in 1988. Such an analysis complementing the quantified evaluation on economic grounds would enable all relevant information, as envisaged by the Strategy, to be evaluated by the Government which would place the Government in a far better position to make progressive decisions involving the impact of salinity in the sub-region and the future direction of the plan.

■ *RESPONSE from managing agency*

Dryland salinity management planning introduces a range of new issues to the salinity management planning process. These issues, highlighted during the development of the Goulburn dryland plan, include:

- establishing a "community of interest" across such a vast area;*
- identifying the cause and effect relationship between recharge and discharge for control of regional groundwater systems; and*
- developing cost-sharing arrangements where cause and effect relationships may be diffuse and spatially separated.*

In addition to these issues, the plan could not be justified solely on monetary grounds. Other factors, notably downstream impacts, long-term environmental protection and improved agricultural productivity in recharge areas, justified the government support for the plan.

The Salinity Control Program agrees that an analysis of social and environmental effects of salinity should occur in dryland areas prior to plan finalisation. Based on the experience with the Goulburn dryland plan, additional resources have been provided to other dryland plans to enable a detailed environmental analysis to be undertaken.

■ *RESPONSE from the Budget Sub-Committee of SPAC*

The Goulburn dryland salinity management plan understates the economic benefits of the plan. SPAC sees this primarily as an issue of accurately measuring the benefits rather than casting doubt as to whether the benefits are there.

SPAC draws the auditor's attention to the current review of the dryland plan which will address the issue and attempt to provide some quantifiable measure of the other benefits associated with the plan. However, many of the environmental and social benefits are not measurable and therefore cannot be included in the analysis.

Appendix A

Glossary of terms

GLOSSARY OF TERMS

<i>A, B, C, D soils</i>	A classification of soils, first developed for the Tragowel Plains area in northern Victoria, whereby A class soils are the least salt-affected and D class soils are those suffering severe productivity decline due to the affects of salinity.
<i>accession</i>	Addition of surface water to the watertable via infiltration beyond the plant root zone.
<i>agroforestry</i>	System of sustainable land management that involves the integration of forestry and agriculture on the same land unit.
<i>aquifer</i>	An underground water-bearing layer of permeable rock, sand or gravel which is capable of supplying water to bores or springs.
<i>backflushing</i>	A process used primarily in terminal lakes to reverse waterflows by transferring low quality water to another upstream destination.
<i>benefit/cost ratio</i>	An analysis comparing the costs of a project with the resultant benefits.
<i>bore</i>	A hole of uniform diameter (usually 150 to 160 millimetres) drilled vertically into the ground to tap an aquifer. It contains a pipe through which groundwater can be pumped or can flow to the surface by pressure.
<i>CAMBA</i>	The China-Australia Migratory Birds Agreement was agreed to in 1987 by both nations and both countries have agreed to protect the environments of certain birds.
<i>capillary action</i>	Phenomenon caused by surface tension and resulting in the elevation or depression of the surface of a liquid in contact with a solid.
<i>catchment</i>	The area of land from which rainwater or melted snow drains into a stream, pond, lake or reservoir.
<i>community drains</i>	Smaller and more shallow than those constructed by the RWC which rely on landholders for their construction and on-going operation and maintenance.
<i>deep lead waters</i>	Groundwater extracted from the deep lead aquifer. The deep lead aquifers occur at depths of 60 metres below the surface and are several kilometres wide and up to 60 metres thick. They are the major regional aquifers under the Loddon, Campaspe and Goulburn Plains.
<i>discharge area</i>	The area in which there is upward movement of groundwater and where groundwater is discharged from the soil surface. Groundwater escapes via springs, evaporation, transpiration and surface drainage.
<i>discounted</i>	A means of discounting future funds to a single amount in current value terms.
<i>drying cycle</i>	In relation to naturally intermittent lakes, that period during the natural cycle when the lake dries up.

<i>dryland farming</i>	Farming without irrigation.
<i>ecosystems</i>	System involving interaction of plant and animal communities with non-living environment.
<i>EC units</i>	Electrical conductivity units, measurement of salinity in water.
<i>evaporation basin</i>	A shallow lake or pond into which saline surface water or groundwater is deposited to allow it to evaporate, leaving behind a concentrated saline residue.
<i>extension</i>	The process of communicating ideas and information to land managers with the goal of achieving improved land management activities.
<i>farm gate value</i>	The amount received by a landholder for the farm's unprocessed produce.
<i>flushing</i>	To flood with water for cleansing purposes.
<i>geological</i>	Concerning the origin, structure or composition of the earth.
<i>groundwater</i>	All free water found below the surface, in the layers of the earth's crust.
<i>groundwater pumping</i>	Method of removing groundwater from a suitable aquifer via a bore. Produces broad scale watertable control.
<i>high density trees</i>	Method of revegetation by planting trees in large numbers per hectare.
<i>high watertables</i>	Watertables within 2 - 3 metres of the surface.
<i>horticulture</i>	In the context of the Kerang Lakes Plan, horticulture refers to the cultivation of fruit trees and grape vines.
<i>hydrogeological</i>	Describes the interaction of water and the earth's crust.
<i>infiltration</i>	Process by which a fluid passes into the pores or spaces of the ground.
<i>interceptor</i>	Something that acts to stop groundwater.
JAMBA	The Japan-Australia Migratory Birds Agreement recognises that certain species of birds migrate between Australia and Japan and that some of these are endangered in one or other country. Part of the agreement is that the 2 countries will conserve the habitats of these species.
<i>landforming</i>	Moving topsoil to create an even sloping gradient in a paddock in order to facilitate more efficient irrigation and water use.
<i>lead agency</i>	The government department or agency responsible for the co-ordination of the salinity management plan for a sub-region. The role involves providing administrative support to the Community Working Group and co-ordinating the activities of the other agencies.
<i>localise</i>	To restrict or confine to a particular area.
<i>low density trees</i>	Method of revegetation by planting trees in low numbers per hectare.
MDBC	Murray-Darling Basin Commission

<i>mg/l</i>	Milligram per litre, as a measurement of salinity in water.
<i>mitigate</i>	To make or become less severe; to moderate.
<i>Murray River median salinity at Morgan, in South Australia</i>	MDBC Salinity and Drainage Strategy established the current Murray River salinities as the baseline for apportioning responsibilities for future changes. The reference point for measuring changes is at Morgan, South Australia.
<i>numerical modelling (of groundwater)</i>	The process of creating a mathematical model of the groundwater flows in an area for use in assessing the effects of proposed actions (such as building an evaporation basin).
<i>on-farm works</i>	Works undertaken on the farms within the region and include planting trees and pasture, fencing and land management practices.
<i>perennial</i>	Plants that live for several years.
<i>perennial pasture</i>	As opposed to annual pasture, pastures comprising plants which have a life-cycle lasting greater than one year.
<i>Ramsar Convention</i>	An international agreement under which signatories agree to protect important waterbird habitats within their boundaries. The agreement arose from a 1971 convention in Ramsar, Iran.
<i>recharge area</i>	Where rainfall infiltrates into and through the soil at a rapid rate. These areas usually have thin soils and are quite rocky. The vegetation on these areas is usually unable to use all of the available water and the excess water goes into the groundwater.
<i>recurrent</i>	Day-to-day operating expenses.
<i>re-use</i>	System of retrieving excess irrigation water through surface or sub-surface drainage and re-using for further irrigation on the same crop or more salt tolerant crops.
<i>revegetation</i>	The re-establishment of plants on an area of ground that is depleted or devoid of vegetation in order to provide protection against erosion, improve water cycling and improve flora and fauna values.
<i>RWC drains</i>	Drains constructed, operated and maintained by the Rural Water Corporation.
<i>saline</i>	Containing salt.
<i>salinity</i>	The content of salts in soil or water; in sufficient quantity, these can be detrimental to plants and animals.
<i>salinity management plan</i>	A comprehensive document on the salinity and proposed control options for salinity for a particular sub-region.
<i>salinity mitigation works</i>	Works undertaken to reduce or reverse a salinity problem.
<i>salt load</i>	The amount of salt leaving a region in the surface waters.
<i>salt tolerant</i>	Able to withstand saline conditions.

<i>SPAC</i>	Salinity Program Advisory Council (formerly the Salinity Pilot Program Advisory Council).
<i>SPPAC</i>	Salinity Pilot Program Advisory Council.
<i>structural adjustment</i>	Process of changing the present land use to another, generally with suitable incentives/compensation for the landholder.
<i>substrata</i>	Any layer lying underneath another; typically used to refer to soil structure.
<i>sub-surface drainage</i>	Method of removing excess moisture from below the ground's surface. Examples include groundwater pumping and tile drainage.
<i>surface drainage</i>	Measures to remove excess water from the land's surface through a system of natural or man-made drains.
<i>tile drainage</i>	A system of pipes located underground for drainage purposes.
<i>transferable water entitlement</i>	The ability to sell the unused portion of a water right on the open market.
<i>transmissivity</i>	A measure of the ability to transmit fluid through a material.
<i>water harvesting</i>	Collecting drainage water for re-use.
<i>waterlogging</i>	Saturation of land with water.
<i>watertable</i>	The upper surface of the zone of soil saturation by groundwater.
<i>wetlands</i>	Area of land subject to permanent or ephemeral (temporary) water cover.
<i>whole farm plans</i>	A mechanism aimed at improving irrigation management and farm development which includes: <ul style="list-style-type: none"> ▶ all aspects of the physical layout such as channels, drains, paddocks and re-use features; and ▶ agronomic, environmental planning and financial management.
<i>works and services</i>	Maintenance and purchase of capital items.

Appendix B

List of individuals and groups that were consulted during the audit review

**SUMMARY OF INDIVIDUALS AND GROUPS WITH WHOM DISCUSSIONS WERE HELD
DURING THE REVIEW**

Community groups

- Mr J. Alexander - Australian Conservation Foundation
- Mr A. Arbethnot - President, Victorian Farmers' Federation
- Mr T. Fisher - Australian Conservation Foundation

Individuals with particular knowledge of salinity

- Mr P. Ekins - international environmental economist
- Dr C. Errol - an irrigation engineer who has been involved in the education of non-English speaking farmers in the Shepparton and Sunraysia areas about salinity
- Dr B. Finlayson - The University of Melbourne
- Mr G. Hunter - former Manager of the Salinity Bureau and research co-ordinator for the Parliamentary Salinity Committee
- Prof. T. McMahon - The University of Melbourne
- Mr I. Morton - former head of the Rural Finance Corporation
- Dr J. Patterson - former Director-General, Department of Water Resources
- Mr B. Steggall - MLA (Swan Hill)

Representatives of local communities

The audit team met with the community working groups in the Goulburn-Broken region (Salinity Program Advisory Council), Campaspe West (Campaspe West Community Working Group) and Kerang (Kerang Lakes Area Working Group) areas, and individually with the following:

- Mr W. Ault - member, Campaspe West Community Working Group
- Mr J. Dainton - former SPAC Chairperson and current Chairperson Irrigation Sub-committee of SPAC
- Mr I. Elder - Chairman, Dryland Sub-committee of SPAC
- Mr J. Gaylard - Chairman, SPAC
- Mr A. Gardiner - Chairman, Campaspe West Community Working Group
- Mr N. Goulding - Chairman, Barr Creek project team
- Mr C. Madden - SPAC councillor
- Ms D. McPherson - Chairperson, Community Education Sub-committee of SPAC
- Mr S. Simms - Chairman, Kerang Lakes Area Working Group
- Cr R. Smith - Chairman, Tragowel Plains Community Working Group
- Mr J. Whitten - SPAC councillor

Representatives of government agencies

The audit team met with numerous staff of the relevant government agencies at both regional and head office locations. Discussions were held with the following officers:

Department of the Premier and Cabinet

Mr P. Kirby - former Secretary
Mr G. David - Manager, Salinity Bureau
Mr D. O'Neill - Salinity Bureau

Rural Water Corporation

Head Office

Dr J. Langford - Managing Director, Rural Water Corporation
Mr K. Collett - Investigations Branch
Mr G. Earl - Investigations Branch

Kerang Office

Mr D. Flett - Regional Manager
Mr J. Ginnivan

Tatura Office

Mr M. Rankin - Regional Manager
Mr W. Trehwella

Department of Agriculture

Head Office

Mr M. Blamey - former Director-General
Mr P. Sutherland - Manager, Sustainable Development Unit

Institute of Sustainable Agriculture, Tatura

Dr C. Piggin - Director
Dr C. Noble

Various other staff including, Dr P. Jerie, Dr C. Norman, Dr P. Rengasamy and Dr D. West

Echuca Office

Mr K. Samson - Salinity co-ordinator, Campaspe West area
Mr P. Wilson - Salinity project officer

Shepparton Office

Mr W. O'Kane - Executive Officer of SPAC
Dr R. Wildes - SPAC irrigation plan co-ordinator
Mr R. Standen

Benalla Office

Mr P. Box - Departmental SPAC dryland plan co-ordinator

Department of Conservation and Natural Resources

Head Office

Dr G. Griffin - former Director-General

Mr D. Saunders

Mr C. Fitzpatrick and Mr S. Critchell - Water Resources Branch

Mr A. Thatcher

Bendigo Land Protection Research Centre

Mr P. Dyson - Director

Benalla Office

Mr B. Garrett - SPAC dryland plan co-ordinator

Interdepartmental bodies

Salinity Planning Working Group

Salinity Standing Committee

Appendix C

Bibliography

Salinity Management Plans

- Goulburn Dryland Salinity Management Plan*. Salinity Pilot Program Advisory Council, August 1989.
- Shepparton Land and Water Salinity Management Plan*. Salinity Pilot Program Advisory Council, August 1989.
- Salinity Management Plan Campaspe West Draft*. Campaspe West Sub-Regional Working Group, August 1989.
- The Kerang Lakes Area Draft Management Plan*. The Kerang Lakes Area Working Group, March 1992.

Other publications

- Annual Reporting Guidelines for the Implementation of Salinity Management Plans*. Government of Victoria, November 1990.
- Campaspe Irrigation District Objectors - Comments to the Campaspe West Salinity Management Plan*. Kelliher Consulting Pty Ltd.
- Campaspe West - Planning for its Future, Supporting Technical Works, Draft Salinity Management Plan*. Campaspe West Sub-regional Working Group, August 1989.
- Cost Sharing Guidelines for Salinity Management Plans in Irrigation and Dryland Areas*. Government of Victoria, January 1989.
- Departmental Annual Reports, *various*.
- Ecologically Sustainable Development*. Australian Conservation Foundation, Greenpeace (Australia), The Wilderness Society, World Wide Fund for Nature - Australia, August 1990.
- Ecologically Sustainable Development Working Groups Draft Report - Executive Summaries*. Australian Government Publishing Service, Canberra, August 1991.
- Ecologically Sustainable Development Working Groups Final Report - Agriculture*. Australian Government Publishing Service, Canberra, November 1991.
- Final Report - Pilot Program*. Program Co-ordinator.
- Goulburn Broken Salinity Program Advisory Council Annual Report 1990-91*.
- Guidelines for Environment Assessment and the Environment Effects Act 1978*. Ministry of Planning and Environment, April 1986.
- Guidelines for the Preparation of Salinity Management Plans*. Government of Victoria, August 1988.
- Kerang Irrigation Region - Problems Potential Productivity*. Salt Force.
- Managing Australia's Natural Resources*. Economic Planning Advisory Council, Council Paper No. 49, April 1992.
- Media releases, *various*.
- Ministerial Task Force on Salinity - Regional Salinity Control Pilot Program*. September 1985.
- Moran, R. *Salinity Monitoring in Victoria*. Department of Water Resources, September 1986.
- Newspaper clippings, *various*.
- Non English Speaking Background Farmers in Shepparton East - Cultural Barriers to Extension*. SPAC. 1992
- Proposal for Development of a Kerang Lakes Area Management Plan*. Rural Water Commission, May 1987.
- Protecting the Environment - A Conservation Strategy for Victoria*. June 1987.
- Regional Salinity Impacts - a Preliminary Discussion Paper prepared for the Salinity Planning Working Group Victoria, March 1992 (Salinity Bureau Internal Document)*.
- Review of Hydrogeological Evaluation and Numerical Modelling of the Mineral Reserve Basins*. Department of Industry Technology and Resources, 1986.

- Salinity and Drainage Strategy*. Murray-Darling Basin Ministerial Council, 1989.
- Salinity Program Annual Review 1989-90*. Salinity Bureau.
- Salinity Program Status Report*. Salinity Bureau, Department of the Premier and Cabinet, February 1991.
- Salinity Threatens the Nagambie District*. Salt Force, Prominent Press.
- Salt Action : Joint Action*. Government of Victoria, Government Printer Melbourne, May 1988.
- Salt Harvesting at the Mineral Reserve Basins*. Caldwell Connell Engineers Pty. Ltd. for the State Rivers and Water Supply Commission of Victoria, April 1984.
- Salting Threatens Victoria*. Salt Force, Creative Solutions, April 1991.
- Study for a Salinity and Catchment Planning Package*. Prepared for the Mid-Goulburn Catchment Co-ordinating Group by John Bennet and Associates, April 1990.
- The Social Impact of Salinity in the Shire of Deakin and Waranga*. A report for the Goulburn Regional Advisory Council by Urban Ministry Inc., December 1989.
- Towards sustainable land use*. A discussion paper prepared for public comment by the Decade of Landcare Plan Steering Committee, May 1991.
- Tree Victoria Action Plan*. Land Protection Division, Department of Conservation and Environment, August 1990.
- Victorian Government Support for Salinity Management Plans - Tragowel Plains Area, Campaspe West Area, Shepparton Irrigation Region and Goulburn Dryland Catchment*. Government of Victoria, 6 June 1990.
- Victorian Salinity Program Co-ordinated Salinity Budget 1990-91*. Salinity Bureau, Department of Premier and Cabinet, 1990.
- Victorian Salinity Program Co-ordinated Salinity Budget 1988-89*. Salinity Bureau, Department of Premier and Cabinet, March 1989.
- Victorian Salinity Program Co-ordinated Salinity Budget 1991-92*. Salinity Bureau, Department of Premier and Cabinet, November 1991.
- Victorian Salinity Program Co-ordinated Salinity Budget 1992-93*. Salinity Bureau, Department of Food and Agriculture, August 1992.
- Victorian Salinity Program Second Annual Review 1988-89*. Salinity Bureau, Government Printer Melbourne.
- Victoria's Decade of Landcare Plan*, February 1992.
- Victoria's Salinity Control Strategy Draft Progress Report*, April 1992 (Salinity Bureau Internal Document).
- Wilkinson, R. and Barr, N. *An Evaluation of Community Planning Methodologies used in the Victorian Salinity Program*. Department of Food and Agriculture, 1992.

Australian Bureau of Statistics

- Victorian Year Book, 1992*. Australian Bureau of Statistics.
- Year Book Australia, 1991*. Australian Bureau of Statistics.

Committees

- Causes, Extent and Effects of Salinity in Victoria*. A Report for the Salinity Committee, Parliament of Victoria, by ACIL Australia Pty. Ltd. in association with Australian Groundwater Consultants Pty. Ltd., Gutteridge Haskins and Davey Pty. Ltd. and Melbourne University School of Agriculture and Forestry, November 1983.
- Final Report from the Parliamentary Public Works Committee on Lake Corangamite*. W.M Houston Government Printer, Melbourne, 1956.

- Final Report from the Parliamentary Public Works Committee on the Flooding of Lakes Corangamite, Gnarpur and Murdeduke Inquiry.* A.C. Brooks Government Printer, Melbourne, 1965.
- Final Report: Irrigation and Water Resource Management. Public Bodies Review Committee - Future Structures for Water Management.* Volume 4, Twelfth Report to the Parliament, November 1984.
- Financing Salinity Control in Victoria.* A discussion paper prepared for the Salinity Committee of the Victorian Parliament, by Michael Read & Associates, March 1984.
- Progress Report on the Barr Creek Catchment, Mineral Reserve Basins and Lake Tyrrell Schemes.* First Report to the Salinity Committee, Parliament of Victoria, December 1982.
- Salinity Control in Northern Victoria.* A Strategic Study for the Salinity Committee, Parliament of Victoria, by Dwyer Leslie Pty. Ltd. in association with Maunsell and Partners Pty. Ltd., September 1984.
- Salt of the Earth: Final Report on the Causes, Effects and Control of Land and River Salinity in Victoria.* Salinity Committee Third Report to Parliament, October 1984.
- The Application of Salinity Control Techniques in Victoria.* A Report prepared for the Salinity Committee, Parliament of Victoria, by Gutteridge Haskins and Davey Pty. Ltd., 1983.
- The Organisation and Management of Salinity Control in Victoria.* A discussion paper prepared for the Salinity Committee of the Victorian Parliament, by M. Mackay & Associates, March 1984.

References

- Common, M. *Natural Resource Accounting and Sustainability.* Centre for Resource and Environmental Studies Australian National University.
- Evans, R.S. *Saline Water Disposal Options in the Murray Basin.* BMR Journal of Australian Geology and Geophysics 11, 167-185.
- Finlayson, B.L. and McMahon, T.A. *Funding and Conduct of Environmental Research.* Centre for Environmental Applied Hydrology University of Melbourne, 1992.
- Heuperman, A. *Trees in Irrigation Areas - the Bio-pumping Concept.* Trees and Natural Resources Vol 34 No.1, 1992.
- Jacobs, M. *The Green Economy.* Pluto Press 1991.
- Multi-criteria Analysis as a Resource Assessment Tool.* Resource Assessment Commission, Research Paper Number 6, March 1992.
- Pamminger, F. *Lake Corangamite Project - A study of the Physical Effects of Altering the Operating Rules of the Woody Yaloak Diversion Scheme.* Hydrology and Surface Water Resources Section Investigations Branch Technical Services Division Investigations Branch Report No. 1991/5, February 1991.
- Pearce, D.W. *Cost-Benefit Analysis Second Edition.* March 1983.
- Powell, J.M. *Watering the Garden State - Water, Land and Community in Victoria 1834-1988.* Allen & Unwin, 1989.
- Smallwood, R. *Hard to go Bung : World War II soldier settlement in Victoria 1945-1963.* Hyland House, Melbourne, 1992.
- Sugden, R. and Williams, A. *The Principles of Practical Cost-Benefit Analysis.*
- Williams, W.D. *The Biological Status of Lake Corangamite and Other Lakes in Western Victoria.* Department of Zoology University of Adelaide. A Report to the Department of Conservation and Environment, Colac, April 1992.

