Salinity Information Kit: Volume 1

A Local Government Planning Guide for Dryland Salinity

Department of Conservation and Natural Rescources

October 1995

Salinity Information Kit

A Local Government Planning Guide For Dryland Salinity

Department of Conservation
and Natural Resources

October 1995

Table of Contents

List of Figures

List of Tables

Acknowledgements

The Local Government Salinity Implementation Project has been made possible with the funding support from the National Soil Conservation Program and the following organisations:

- Former Campaspe Community Working Group
- Former Loddon Community Working Group
- Former Loddon-Campaspe Regional Planning Authority (L-CRPA)
- Former Shire of Bet Bet
- Former City of Castlemaine
- Former Shire of East Loddon
- City of Greater Bendigo
- Former Shire of Kara Kara
- Former Shire of Korong
- Former Shire of Kyneton
- Former Shire of Maldon
- Former Shire of McIvor
- Former City of Maryborough
- Former Shire of Metcalfe
- Former Shire of Rochester
- Former Shire of Tullaroop.

The Consultative Reference Committee for this document comprised:

- Mr Grant Scale, Department of Planning and Development
- Mr Bernie Young, Department of Conservation and Natural Resources
- Ms Caroline Osborne, Former Shire of Korong
- Mr Phil Hannah, City of Greater Bendigo
- Mr Luke Shannon, Former Shire of Romsey

Sincere thanks are extended to the Catchment Management Committee of the L-CRPA for vetting the model overlay area control in its early stages, the membership of which comprised:

- Dr Ian McBean (Chairperson), L-CRPA Community Representative
- Mr Neil Burns, Coliban Region Water Authority
- Mr Ken King, Department of Conservation and Natural Resources
- Cr Greg McIntyre, Former Shire of Kyneton
- Cr Merv Mason , Former Shire of Korong
- Cr Roley Simmons, Former Shire of Maldon
- Mr Don Walsgott, Agriculture Victoria
- Cr Vern Wilson, Former Shire of East Loddon.

The Project, including the preparation of this document has been managed and co-ordinated by Ms Farah Bach.

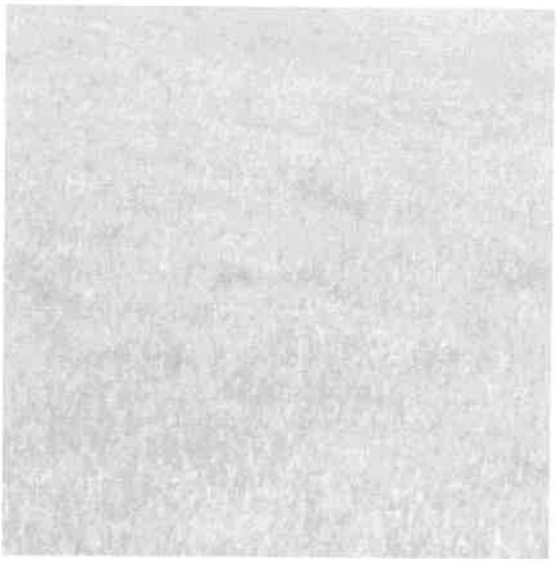
The services of Mr Lindsay Briggs of Eljaybee Drafting Services Pty Ltd were invaluable in the production of high recharge and discharge maps for each of the municipalities.

The contribution and assistance received from the following persons in the preparation of this document is also acknowledged:

- Ms Margaret Allan, Centre for Land Protection Research
- Mr Simon Banfield, Consultant Planner (Formerly of Trevor Budge and Associates Pty Ltd.)
- Mr Chris Bannon, Former Shire of Romsey (previously)
- Mr Andrew Chappell, Environmental Consultant
- Mr Craig Clifton, Centre for Land Protection Research
- Mr Peter Davies, City of Greater Bendigo
- Mr Chris Day, Centre for Land Protection Research (previously)
- Mr Bob Discan , Department of Conservation and Natural Resources
- Mr Philip Dalton, Consultant Planner (USE Consultants Pty Ltd.)
- Mr Colin James, Former Shire of Rodney (previously)
- Mr David Johnston, Department of Planning and Development
- Mr Adrian Kennelly, Department of Agriculture Victoria
- Mr Kim McGough, Loddon-Campaspe Region Planning Authority (previously)
- Ms Shelley McGuiness, Department of Conservation and Natural Resources (previously)
- Ms Kerryn Scott, Department of Conservation and Natural Resources
- Mr Colin Smith, Department of Conservation and Natural Resources
- Mr Greg Sheehan, Environment Protection Authority
- Mr Peter Thomas, Department of Conservation and Natural Resources
- Mr Larry White, Consultant Agricultural Scientist

John Bennett & Associates and Peter Lambert Design of Ballarat prepared the document for publication.

The first diagram that appears in this document was sourced from another publication and drawn by Paul Morris of Bendigo.



Foreword

High watertables and the resulting salinisation of land are natural phenomena that have been exacerbated by the impact of human activities on the landscape, in particular clearing and irrigation both of which dramatically change the water balance.

Over the last ten years the Victorian and Commonwealth Governments have devoted a lot of resources to investigating the causes, effects and control of dryland and irrigation salinity. As a result of this research and community participation, we now understand a lot more about the types of activities which lead to impacts on groundwater levels and salinity, and about the areas that are affected by salt.

In the light of this information, it would be irresponsible to continue to allow the types of development that are likely to cause a rise in groundwater levels, or to allow some types of development in areas already affected by rising watertables and salt.

Careful planning can significantly reduce the risk of new areas of salinity arising, and reduce the possibility of damage to buildings and infrastructure in areas that are already affected by salinity. In this way, the issue of planning and salinity can be compared to the regulation of development in areas that are prone to flooding or erosion.

The model planning provision in this document is intended to assist local government regulate land use and development in areas that are salt-affected, or are likely to contribute to salinity problems because of their physical landscape characteristics.

It is hoped that through the introduction of planning controls that we can prevent damage to new developments from high water tables and salinity, prevent new developments causing salinity, protect environmental values and water quality, and preserve the rights of individuals.

David Clark, Chairperson
Loddon Implementation Working Group

Glossary

This glossary has been derived from the "*Loddon Catchment Salinity Management Plan*" prepared by the Loddon Community Working Group, in 1992.

Aquifer
an underground water-bearing layer of permeable rock, sand or gravel which is capable of supplying significant quantities of water to bores or springs (see **Deep lead**)

Bore
a hole of uniform diameter (usually 150 to 160 mm) 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 artesian pressure (see also **Pressure**).

Capillary fringe
the region immediately above the watertable, in which the capillaries (fine channels) in the rock or soil are filled with water.

Capillary movement
the movement of water in unsaturated soil towards drier soil. The movement can occur in any direction, but it is upwards capillary movement from a watertable that is of most significance in soil salting.

Capillary zone
the zone of soil above a watertable in which capillary movement occurs. The capillary fringe forms the lower part of the capillary zone.

Catchment
the area of land from which rainwater or snow melt drains into a reservoir, pond, lake or stream.

Deep lead
an aquifer at great depth formed by the filling in of ancient river valleys by sand and gravel. Deep leads originate in the slopes of the Great Divide and were worked for gold during the 19th century. They occur at depths of at least 60 m and are several kilometres wide and up to 60 m thick. They are the major regional aquifers under the Loddon, Campaspe and Goulburn Plains.

Discharge
the volume of water flowing past a given point of a stream or channel, per unit of time eg megalitres per day.

Discharge area
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 (see **Recharge area**).

Dryland salting
all areas of salting where irrigation is not present and may be due to natural or induced causes or some combination. Dryland salting is further subdivided on the basis of location in the terrain and predominant cause.

EC
electrical conductivity (see **Salinity**, measurement of).

Evaporation
the process of water changing from a liquid to a vapour (gas).

Evapotranspiration
a composite term expressing the loss of water resulting from both transpiration by plants and evaporation from soil (see **Transpiration**)

Groundwater
all free water found below the surface, in the layers of the earth's crust.

Hectare
a measure of land area, being 100 metres x 100 metres or 10 000 square metres; 100 ha = 1 Square Kilometre.

Leaching
the removal of soluble material (mainly salts) from soil, by the passage of water through that soil.

Pasture
annual pastures consist of annual species, ie. plants that live only for one growing season.

native pastures consist of annual species of grasses, clovers and medics that are native to the area.

perennial pastures consist of perennial species, ie. plants that live for several years.

Permeability
this refers to the capacity of a substance (eg. soil or rock) to allow water to pass through it. Sand, for example, is said to have high permeability.

Pressure
in confined aquifers (those which are overlain by a confining layer), the groundwater is stored under pressure. If this groundwater is intercepted, by a bore for example, the groundwater rises under pressure, to a level above the top of the aquifer.

Recharge area
the area in which surface water (from rainfall, irrigation or streams) infiltrates into the soil and is added to the groundwater (see also **Discharge area**)

Salinisation
the accumulation of salts in the root zone, usually due to capillary rise of saline moisture from a shallow watertable.

Salinity
the content of salt in soil or water, in sufficient quantity, these can be detrimental to plants and animals.

Measurement of salinity: the salinity of water is usually described as the concentration of dissolved salt in milligrams per litre (mg/L). It can also be described in EC (electrical conductivity) units, which refer to the capacity of a medium to pass an electric current. In an aqueous solution, the EC measurement increases with the concentration of ions and hence the concentrations of total dissolved salts. Other measurements include total dissolved salts (tds) in water, total soluble salts (tss) in soil and parts per million (ppm). Typical salinities of water are as follows: Melbourne's water supply - 50 mg/L, seawater - 35 000 mg/L, human taste threshold for salts in water - 1000 mg/L.

Salts
soluble mineral substances present in soil and water. The salts most commonly observed in the Victoria are common salt (Na Cl), gypsum and lime.

Transpiration
the process by which water is extracted from the soil, transmitted through the plants, and evaporated from the leaves.

Water balance
an estimated state of equilibrium within the soil moisture regime based on rainfall, evapotranspiration, runoff, drainage and soil moisture storage.

Watertable
is the surface of the groundwater, beneath which all the air spaces are filled with water.

Waterlogged
the condition of the soil which is saturated with water and in which most or all of the soil air has been replaced. The condition, which is detrimental to most plant growth, may be caused by excessive rainfall, irrigation or seepage, and is exacerbated by inadequate site and/ or internal drainage.

Introduction

Background

Salinity is not just another environmental problem. Currently in Victoria, there are 435000 hectares of land known to be affected by salinity (Victorian Auditor-General's Office, 1993). Refer to Figure 1. This figure is likely to be higher as there are salt-affected areas that have not been mapped. Moreover, the area of land affected by salinity is expected to double in 50 years, at a growth rate of about 2 percent a year, if nothing is done to control the problem now (Department of Food and Agriculture, et al. 1992). Many of Victoria's rivers and creeks which supply water for stock, irrigation, industrial uses and domestic consumption, carry high salt loads. Salt affects agricultural land, natural environments and urban areas and has been described as the single greatest threat facing Victoria's environment, in the State's Salinity Strategy (1988). At this stage, the effects on agricultural production, wetlands, and forests are well documented, but ultimately these effects are also felt socially and economically at a community level and in urban centres.

Furthermore, due to the nature of the salinity problem, there are no quick fixes. The current control strategies, particularly for dryland salinity, are characteristically long-term.

Figure 1 Salt affected land in Victoria (Source: Hooper, J. "Saltpak 1- Saltland in Victoria", 1991)

'Salt Action-Joint Action', the Victorian Strategy for managing land and water salinity, was released in 1988. It outlined a framework for involving Community Working Groups to address the causes of salinity and to determine and prioritise actions to be undertaken to control the problem. The Community Working Groups comprise of ten to twelve members representing professional and part-time farmers, and urban interests. The Groups also have technical support from officers of the Department of Conservation and Natural Resources, Agriculture Victoria and Rural Water Corporation. There are ten major river catchments throughout the State which have been operating within this framework, of which the Loddon and Campaspe are two. Community Working Groups were

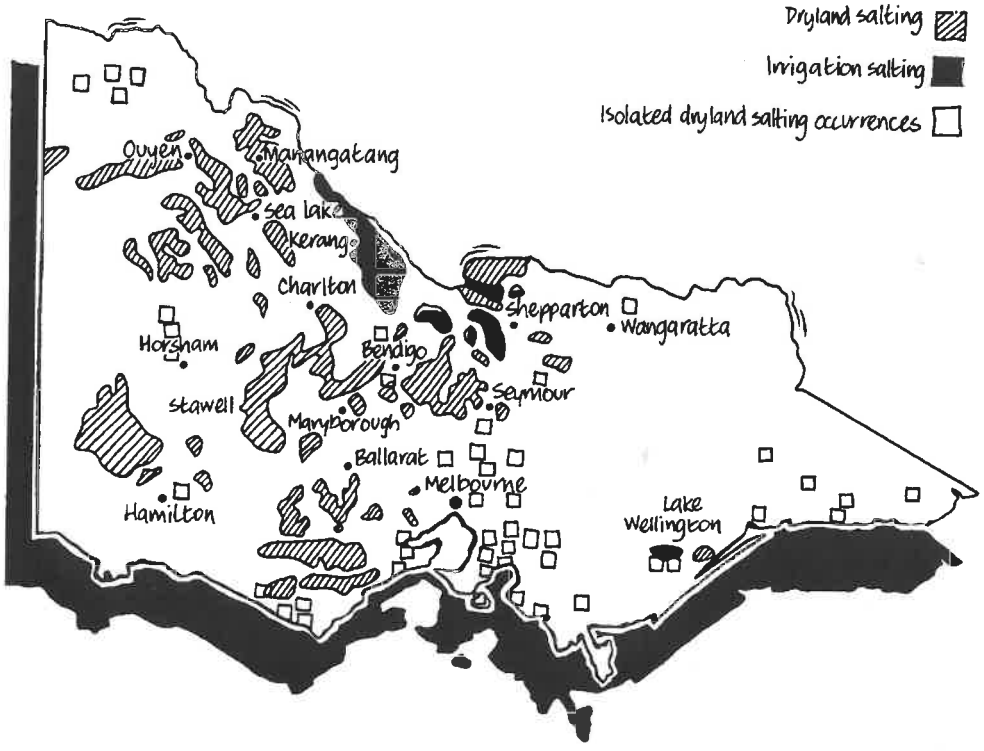


Figure 1 Salt affected land in Victoria (Source: Hooper, J. *"Saltpak 1- Saltland in Victoria"*, 1991)

formed in the Loddon and Campaspe Dryland Catchments in 1991. Both of the Community Working Groups have subsequently produced a Catchment Salinity Management Plan for their respective regions. These plans made recommendations as to the management of land within the catchments and set priorities for the distribution of funds between research, planning, monitoring, works on the ground, extension, community education and institutional changes.

This guide, and model overlay control have been prepared as part of the Local Government Salinity Implementation Project in the Loddon and Campaspe Dryland Catchments. The Project was initiated by the former Loddon-Campaspe Regional Planning Authority in conjunction with the Department of Conservation and Natural Resources, as a direct result of recommendations outlined in the Loddon and Campaspe Catchment Salinity Management Plans. The Salinity Management Plans defined several areas in which Local Government could participate in controlling salinity:

- The provision of incentives through rate rebates and differential rating to encourage landholders to revegetate high recharge areas and improve land management practices (Trial City of Greater Bendigo,1995);

- The prevention through planning schemes of further clearance of vegetation on sites with potentially high recharge;

- The restriction of inappropriate development and land uses on high recharge and discharge areas through planning schemes;

- The prevention of urban development in areas that will not be serviced with reticulated sewerage;

- The planning of future subdivision and development so it does not infringe on or alienate prime agricultural land and consolidates existing areas available for urban and rural residential development;

- Land use planning is undertaken in accordance with the land capability; and

- The adoption of drainage controls, which require works that alter the natural flow of water be subject to a planning permit, by municipalities in the lower parts of the two catchments.

Until its closure in October 1994, the Loddon-Campaspe Regional Planning Authority was a regional organisation which consisted of State Government and community representatives, as well as councillor representatives from many of the municipalities in the Loddon, Campaspe and Avoca Catchments. The Authority made policy and planning decisions on issues which affected the region or sub-regions. It provided an effective forum in which to run the Local Government Salinity Implementation Project. The Project aims to ensure that the recommendations stated above, relating to local government, are implemented across the two dryland catchments. The newly established Catchment and Land Protection Boards will perhaps fulfil this particular function in the future.

The project has run for over twelve months and has demonstrated that there is scope for an ongoing role in the implementation of these recommendations. To date the project has focused on the production of planning controls for discharge and high recharge areas, salinity education for local government, the preparation of discharge and high recharge maps on a municipality basis for rural areas, and the introduction of rate rebates for the revegetation of high recharge areas. In order to ensure the efficacy of the work that has already been undertaken, further efforts should be focused on upgrading the skills of local government engineers and planners to enable them to interpret technical land capability information that may affect the land management decisions that they make. Priority should also be given to investigating and mapping dryland salinity in urban areas.

Volume 1: Part of a package

The Salinity Information Kit comprises two volumns. These have been designed to accompany and complement each other as two parts of a package.

Volume 1: *"A Local Government Planning Guide For Dryland Salinity"* provides a process for preparing planning scheme controls, considering applications for the use and development of land in discharge and high recharge areas, and provides guidelines and conditions for permits.

Volume 2: *"The Effects, Causes, Identification and Control of Salinity"* provides information about salinity, its effects, its relationship with other catchment issues, how to recognise discharge areas and high recharge areas, and current salinity management options.

It is strongly advised that Volume 2 is read before dealing with permit applications. It is not overly technical and will give the reader a good understanding as to why the model overlay control requires a site capability report to be undertaken, and why the guidelines require the planning officer to consider certain aspects of the development. It will also assist those embarking on site inspections.

There is a reference guide for finding useful information at the end of each volume.

The package is intended to be relevant to all local government and agency staff involved in land use planning in dryland catchments that have areas of high recharge and/or salinity. **The two documents have been specifically written for the Loddon and Campaspe Dryland Catchments, but have scope for wider application.**

The package is particularly useful to municipalities, which are responsible for the preparation, administration, and enforcement of planning controls over the use and development of land.

Planning Context

What is the Role of Planning in Salinity Control?

We all live in a catchment. The catchment concept starts with the water that falls as rain, hail or snow, which runs off mountains and hills, over lowlands, and into streams, creeks, wetlands, lakes, and rivers, and eventually into the ocean. Water moves through the landscape as surface drainage above ground, or as groundwater below the surface. It can therefore be said that all land is linked by water cycling through the catchment.

This concept becomes very important when we consider land use and management in the context of the catchment. If all land is linked by the movement of water, it follows that land uses and activities farther up in the catchment can have a bearing on land and water quality lower in the catchment. Unfortunately, often that effect is a negative one.

This is very much the case when we focus on the issue of salinity, since saline discharge occurs as a result of an imbalance in the water cycle (See Volume 2). Inappropriate land uses and management practices in the upper parts of the catchment can affect land and water quality many kilometres away. Planning can help to minimise the potential negative effects of new land uses and developments and protect land and water quality downstream. This is a very significant and under-utilised tool considering how important land and water resources are to the community now and in the future.

Planning helps to ensure that community resources, including natural resources, are used effectively, efficiently and equitably, in order for the community to service basic needs for fresh air, clean water, sanitation, open space, and access to services. Planning also helps to protect the 'common good', so that the activities of one individual do not adversely affect others.

Communities are simply groups of individuals living together in the same area. In any organised society, there will always be some restriction on the actions of individuals, particularly if those actions threaten or jeopardise the resources or amenity of the community or of another individual. Although planning is often seen to be unduly restrictive, it is essential for our society to have some regulation over land use so as to avoid the chaos that would occur if all individuals were allowed to simply do what they liked. In this respect planning regulations have evolved for the same reasons as other laws, to protect the resources, rights and needs of the greatest number of individuals in that community.

Planning can help to protect the community and individual landholders from the potential effects and costs of salinity, caused by the land management activities of other individuals in another part of the catchment.

Planning is also important in the configuration of land uses, and the placement of land uses in relation to one another and the landscape. Land use planning needs to take into account the social, economic and environmental characteristics of the area. As part of this process, land capability assessments provide planners with important information about the physical characteristics of the land that may affect the choice of land use for a particular area. Optimally, planners should attempt to match the requirements of the land use to the ability of the land to sustain that use, in order to prevent land and water degradation. Conversely, if a less optimal land use is designated, then appropriate means for overcoming the land capability constraints or improved land management practices should be implemented to ensure that problems do not occur.

In recent years, the availability of land capability information has improved enormously, and it is expected that the quality of land use planning decisions will also improve. Incorporating land capability information in land use decision-making facilitates better risk management assessment, and is specifically aimed at reducing the risk of potential land degradation. The Local Government Salinity Implementation Project has initiated the supply of discharge and high recharge mapping information to municipalities specifically for the purpose of helping planners make better decisions about the types

of new land uses and developments in areas of high salinity risk and areas which contribute to high watertables bringing salt to the surface.

Planning Schemes

In Victoria, the *Planning and Environment Act (1987)* regulates the use and development of land. The purpose of the Act (Section 1) is:

> *to establish a framework for the use, development and protection of land in Victoria in the present and long term interests of all Victorians...*

Under the Act, each municipality has a Planning Scheme, which applies to all public and private land within the municipality except for land that is permanently reserved under the *Crown Land (Reserves) Act (1978).*
All Ministers, government departments, public authorities, municipal councils and individuals must adhere to the provisions in the Planning Scheme with the exceptions of Commonwealth government departments, and the Victorian Ministers for Conservation, Natural Resources, Education, and Health.

The preparation of Planning Schemes and planning controls is undertaken by planning authorities and is discussed under ëPreparing Planning Scheme Controlsí. The administration of Planning Schemes, which involves processing planning permit applications, is carried out by a responsible authority which in most cases is the relevant municipal council.

Section 7(1)(a)(b) and (c) of the Act specifies that each Planning Scheme may have provisions in three sections:

- the State Section;
- the Regional Section; and
- the Local Section.

The State Section contains provisions which apply to the whole of Victoria and is the same for all Planning Schemes. The State Section prevails over the Regional and Local Sections, if any discrepancies between the sections exists.

The Regional Section contains provisions that apply to a prescribed region which the Minister for Planning must declare under Section 10(e) of the Act. The Minister must also appoint a body to be the regional planning authority for the area, and that body is responsible for the administration of the provisions within this Section. Provisions within the Regional Section prevail over those in the Local Section, however this Section is rarely used because of the administrative difficulties of prescribing an area and coordinating a regional section amendment.

The Local Section exists in every Planning Scheme, and regulates the use and development of land within each municipality. The purpose of the Local Section is to cater for differences between individual municipalities, and contains provisions which are relevant to that specific area. In practice, however, many provisions between municipalities are very similar.

In theory, planning provisions for salinity management could be implemented through any of these Sections in the Planning Scheme. It is however probably inappropriate to incorporate such a provision in the State Section, as it would not apply to all areas, particularly not to metropolitan Melbourne. A Regional Section Amendment would be more appropriate, but is exceedingly difficult to implement.

It is most likely, that the provisions will be instituted through the Local Section of Planning Schemes for those municipalities which find dryland salinity to be an issue. This may occur on either an ad hoc basis, or alternatively a group of municipalities could agree to individually adopt the same provision.

Policy Context

The concept of applying planning controls to land use and development in high recharge and discharge areas was recommended in the Loddon and Campaspe Catchment Salinity Management Plans. The Plans specifically recommended that the Loddon-Campaspe Regional Planning Authority prepare model planning controls to address this issue, and the Authority undertook this task as part of the Local Government Salinity Implementation Project.

The preparation of planning controls for salinity management coincides with an increase in community awareness and a change in community attitude to environmental degradation issues. This change is also reflected in the current State Government policy initiatives listed below:

State Section Clause 3-8- retention and re-establishment of native vegetation

- State Section Clause 3-11- the protection of high quality productive agricultural land;
- Ministerial Direction No. 6 - rural residential subdivision.

These policies emphasise the importance of assessing land capability and the potential for land degradation when making land use decisions.

The *Planning and Environment Act (1987)* also makes direct reference to the protection of natural resources and the sustainable use and development of land as a planning objective for Victorian planning schemes. All planning authorities must act in accordance with these objectives, set out in Section 4 of the Act, and provide sound, strategic and coordinated planning.

Under Section 6 of the Act, planning schemes must seek to further these objectives and may make provisions which relate to the use, development, protection and conservation of any land in the area. Planning schemes are the primary mechanism for land use regulation, and provide an important means of preventing the inappropriate use and development of land that is salt-affected or potentially contributes to salinity problems.

The recently introduced Catchment and Land Protection Legislation will also have implications for planning schemes in the future. Nine Catchment and Land Protection Boards are being established under the new legislation and will be able to designate Special Area Plans for land that is highly degraded, or land that contributes to problems in other parts of the catchment, if it is inappropriately managed. The Special Area Plans will set out suitable land use and management recommendations for these areas, and planning schemes and planning decisions will need to reflect these recommendations as a statutory requirement.

The preparation of the planning controls for high recharge and discharge areas is a logical extension of the recent policy developments. It is envisaged that the planning control for salinity management presented in this document could be used as the basis for a standardised provision which encompasses a range of catchment and environmental issues. These standardised provisions are being prepared by the State Government in response to the Perrott Committee Recommendations and the Minister's Statement "Planning a Better Future for Victorians. New Directions for Development and Economic Growth" (August, 1993).

Salinity Management Roles of Other Organisations

The organisations tackling salinity in Victoria are:

- ***Department of Conservation and Natural Resources (DCNR)***
  DCNR are the lead agency in dryland salinity management. They are responsible for the overall implementation of the Catchment Salinity Management Plans and are answerable to the Community Working Groups who prepared the Plans and now make decisions on salinity funding priorities. DCNR undertakes research, monitoring, grant allocation, catchment advisory, catchment planning, community education, and extension functions. The Centre for Land Protection Research, as a sub-organisation of DCNR, also undertakes research and mapping on recharge and discharge areas.

- ***Department of Agriculture Victoria (DAV)***
  DAV are responsible for the research and extension of agricultural land management practices that can be used to combat salinity and increase production on farms. Their role is very significant given that farmers manage 60% of the land and use 70% of the water in the State. They are also the lead agency for irrigation salinity management.

- ***Rural Water Corporation - Hydrotechnology Section (RWC)***
  RWC are responsible for monitoring salinity and rates of flow in watercourses, and mapping watertables. They are no longer responsible for floodplain or waterway management as a consequence of the Victorian water industry reform program.

- ***Environmental Protection Authority (EPA)***
  EPA are responsible for the licensing and monitoring of point sources that discharge saline effluent.

- ***Regional Water Authorities***
  Regional Water Authorities are responsible for the supply of water, and the treatment and disposal of wastewater. Through the implementation of pricing mechanisms and community education, water authorities can influence rural and urban water use.

- ***Landcare Groups, Farm Advance Groups, and Farm Tree Groups***
  Community groups such as these listed above are responsible for undertaking salinity management trials and works on private property, and are increasingly involved in the monitoring of watertables, water quality, and salinity. They also provide group extension opportunities for DCNR and DAV staff.

The major sources of funding available for salinity management in the Loddon and Campaspe Catchments come from the Victorian Government Salinity Bureau, the Federal Government's "*National Landcare Program*", and the "*Natural Resource Management Strategy*" organised by the federally funded Murray-Darling Basin Commission.

The ***Catchment and Land Protection Board*** for the Loddon, Campaspe, Avoca, and Avon-Richardson Catchments will be responsible for coordinating and prioritising research, works, and monitoring programs for salinity and other integrated catchment issues.

Local Government should consult with the ***Catchment and Land Protection Boards***, ***Department of Conservation and Natural Resources***, ***Department of Agriculture Victoria*** , and local ***Landcare***, ***Farm Advance*** and ***Farm Tree Groups*** when preparing a planning scheme amendment relating to land use and development in high recharge and discharge areas.

The ***Department of Planning and Development (Office of Planning and Heritage)*** can also assist by giving general advice about the format and application of new planning controls, and by approving planning scheme amendments.

Preparing Planning Scheme Controls

Who can prepare amendments to Planning Schemes?

Before drafting the planning control it is important to decide who will prepare the amendment to the planning scheme(s). This will provide some indication of the level of detail required in the planning control, and may have implications for administration and implementation.

Under Section 8 of the *Planning and Environment Act (1987)*, the following persons or bodies are authorised to prepare planning schemes or amendments to planning schemes:

The Minister for Planning may prepare planning schemes or amendments to any section of a planning scheme for any municipal district or other area of Victoria.

A regional planning authority (as identified in Section 10 of the Act) may prepare amendments to the Regional or Local Sections of any municipalities' planning scheme within its prescribed region, and may also amend the State Section with the consent of the Minister for Planning.

A municipal council may prepare amendments to the Local Section of the planning scheme for its municipal district, and may also amend the State and Regional Sections with the consent of the Minister for Planning.

Any person that the Minister for Planning authorises under Section 11, including any other Minister or public authority, may prepare an amendment to any section of any planning scheme in Victoria.

The Minister for Planning may also authorise a municipal council to prepare an amendment to the local section of a planning scheme applying to an area adjoining its municipal district.

Although all these options for preparing planning scheme amendments are theoretically possible, the most common amendments are Local Section Amendments prepared by municipal councils or State Section Amendments prepared by the Minister for Planning. Generally, the other options are administratively difficult to coordinate and implement, and may not be politically feasible. For the purpose of a salinity planning control, three practical options exist:

- The Minister for Planning could prepare a Local or a Regional Section amendment for all municipalities that have high recharge or discharge areas.
- Municipalities that have high recharge or discharge areas could individually or collectively prepare Local Section Amendments.
- The Minister for Planning could authorise the Ministers responsible for the ***Department of Conservation and Natural Resources*** to prepare a Local or Regional Section amendment for all municipalities that have high recharge or discharge areas.

In drafting the model overlay area control contained in this document, it was assumed that individual municipalities would make Local Section Amendments to their planning schemes and were responsible for administering and implementing the planning control.

Preparing The Control

Step 1: Setting the Objectives

In preparing the planning scheme controls, it is important to clarify the objectives that are expected to be achieved. The planning controls should endeavour to further the objectives of salinity management, which are:

- To minimise the risk of salinity and rising watertables on private and public land, whether it be in rural or urban areas, or in areas of environmental significance;
- To undertake actions that will prevent existing salinity problems from spreading; and
- To prevent salt loads in waterways from increasing.

Step 2: Identifying Discharge and High Recharge Areas

The introduction of a planning control to guide the appropriate use and development of high recharge and discharge areas relies on the adequacy and accuracy of the available mapped information.

Currently, maps are available for most municipalities in the Loddon and Campaspe Dryland Catchments. These maps have been prepared by the ***Centre for Land Protection Research*** and the ***Loddon-Campaspe Regional Planning Authority***, and depict potential high recharge and actual discharge areas on a cadastral base at a scale of 1:100,000 for each municipality (Refer to Figure 2). The maps provide adequate detail for the purpose of a planning scheme overlay at 1:100,000.

The planning control can also relate to **high recharge** as identified on the Land Capability Assessment Maps prepared by the ***Centre for Land Protection Research***. These maps are currently available for the former Shire of Newham and Woodend, and some parts of the Greater City of Bendigo. These maps form part of a series identifying important land capability information for each of the municipalities and are prepared at a scale of 1:25,000. Information on discharge areas may need to be sourced from DCNR maps which have been produced at 1:25,000 for the Loddon and Campaspe Catchments.

At this stage there has been no attempt to map high recharge or discharge in urban areas at a sufficiently detailed scale to be useful for planning purposes, but it is envisaged that planning controls for these sensitive areas will also be applied in urban situations to urban land uses and developments. This mapping could be undertaken by municipalities at a later date, and incorporated as a further amendment.

It is extremely important to recognise the limitations of the existing maps. The information depicted on the maps is only accurate at 1:100,000 and 1:25,000 respectively, and is therefore only indicative. Be aware that any drafting of recharge and discharge information that is undertaken to accompany the planning control, should maintain the scales of the original information, as the maps will be less accurate if it is redrafted at a more detailed scale. There is no requirement for the map depicting discharge and high recharge areas to be at the same scale as existing zoning or overlay maps in the planning scheme.

Local knowledge is a very valuable resource and should be utilised to verify the information on the maps. Landcare Groups often have detailed maps of their own. Some groups have access to GIS facilities and maintain very sophisticated databases. Municipalities with GIS systems can also forge contacts with local groups to collect and enter land degradation information. In this way, existing information can be checked and new information can be added, as it becomes available.

Once the discharge and high recharge information has been located and confirmed with DCNR, it can be drafted as **Salinity Management Areas** or **SMA** onto a map that will form part of the planning scheme amendment. Alternatively, the maps that have been prepared as part of the Local Government Salinity Implementation Project can be incorporated without changes into the planning scheme, in which case the areas will be delineated by two types of cross hatching for high recharge areas and discharge areas.

Due to the limitations of the current maps, it will be necessary for the landholder to collect more detailed information about the high recharge and discharge areas on the subject land. To reflect this, the planning control should require the applicant or developer to supply detailed information, and demonstrate how the design of the works or development takes account of the identified high recharge or discharge areas, and attempts to minimise the environmental impact.

Planning officers will need to learn how to recognise high recharge areas and salinity in order to undertake field inspections to substantiate the information presented in permit applications. The last part of the Salinity Information Kit (Volume 2) pertains to the field identification of salt-affected and high recharge areas. Consulting with neighbours can often be a useful tool for identifying areas, also.

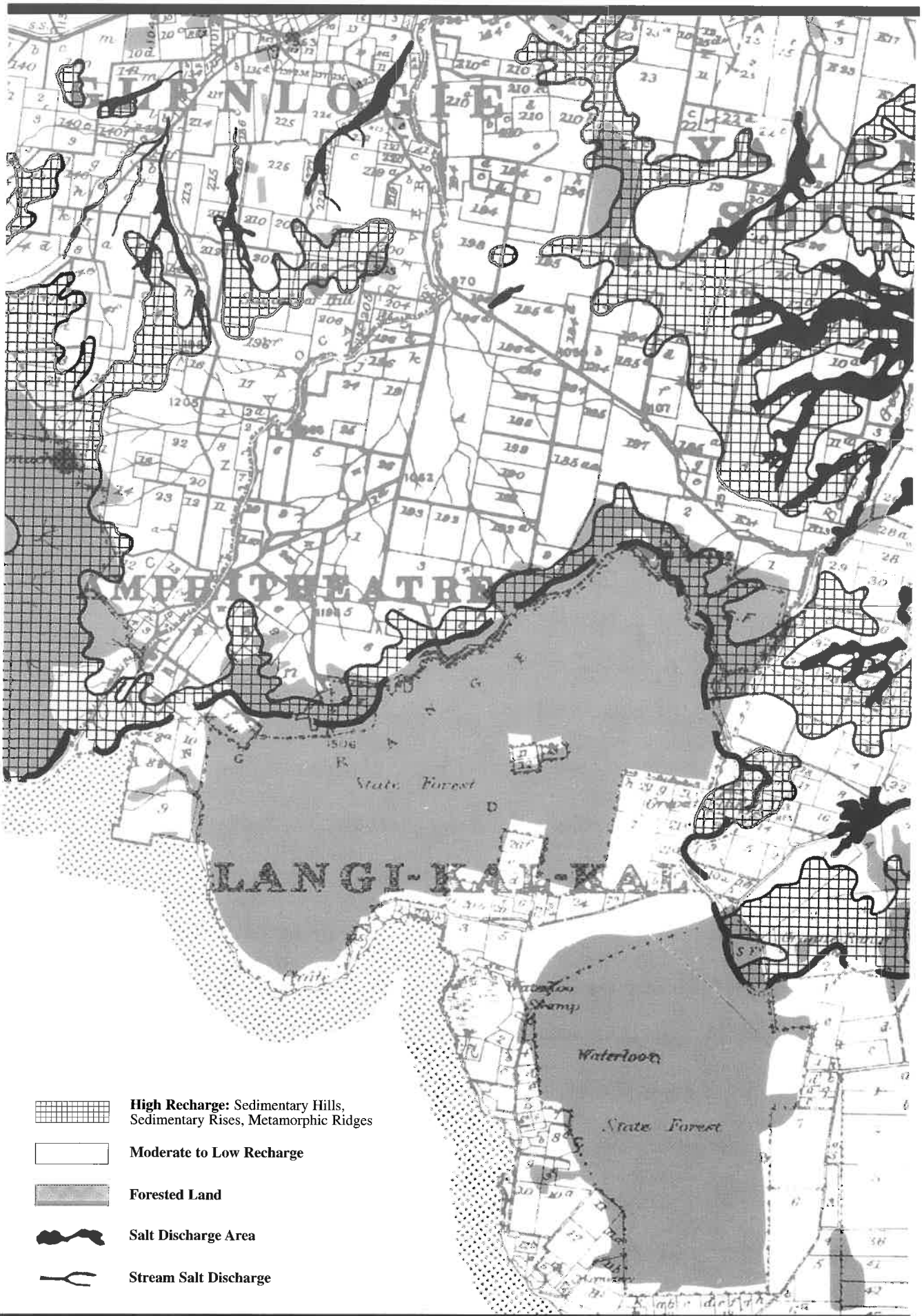


Figure 2: Potential High Recharge and Discharge Map prepared as part of the Local Government Salinity Implementation Project. *(Source: Loddon-Campaspe Regional Planning Authority and Centre for Land*

Step 3: Assessing Salinity Risks

The assessment of high recharge areas for their potential to contribute to salinity problems either on or off site requires certain training. Similarly, the assessment of discharge areas and the potential for further salinity problems due to high watertables should also be undertaken by suitably qualified and experienced person. These types of assessments are currently carried out by ***DCNR*** or ***Centre for Land Protection Research***, although a qualified consultant should also be able to undertake such a task.

When assessing potential high recharge areas, the following factors need to be considered:

- Soil
- Geology
- Topography
- Soil percolation rates
- Rainfall
- Amount and type of vegetation
- Land use and on-site water and wastewater disposal requirements
- Location of dams, water bodies, and water courses.

When assessing discharge areas, the following factors need to be considered:

- Soil
- Geology
- Topography
- Depth to watertable
- Rainfall
- Amount and type of vegetation
- Land use, development type, and on-site water and wastewater disposal requirements
- Location of dams, water bodies, and water courses
- Soil and water salinities.

Step 4: Deciding the appropriate Use and Development of High Recharge and Discharge Areas

In deciding which possible land uses and developments are appropriate in high recharge and discharge areas, consideration must be given to furthering the following aims:

- Minimise the infiltration of water in high recharge areas and in and around discharge areas;
- Increase the water use in high recharge areas before the water infiltrates into the groundwater system;
- Protect and re-establish perennial vegetation (indigenous where possible) in high recharge and discharge areas;
- Encourage the stabilisation of discharge areas through revegetation; and
- Prevent saline runoff from polluting waterways.

It is important to note that some uses and developments do not pose a significant problem by themselves, but cumulatively they can produce a notable effect.

There are essentially four potential (but not necessarily mutually exclusive) approaches to regulating land use and development in high recharge and discharge areas in order to further these aims:

Prohibit land uses and developments

One means of preventing further salinity problems through the use of planning controls would entail prohibiting all or some land uses and developments in these sensitive areas. The downside to this approach is that it stifles development opportunities in both rural and urban areas resulting in a possible drop in the land values, and misses the opportunity to use the planning permit process in order to set conditions that would lead to positive control and management actions being taken to help prevent existing salinity problems from spreading. This would be an unfavourable and unrealistic approach, given the large expanses of high recharge and discharge areas in some municipalities and does not account for changes in technology and information that might enable certain uses or developments to proceed without causing detrimental effects.

Regulate all land uses and developments
In this case, all new land uses and developments in high recharge and discharge areas would be required to undergo the planning permit process, and demonstrate that they will not contribute to a salinity problem. This approach is comprehensive and provides flexibility in the types of solutions that may fulfil this requirement. However, there needs to be some base criteria established to ensure that there is consistency in the assessment of permit applications and the setting of permit conditions . The disadvantage with this approach is that all applicants would have to fulfil the onerous and expensive requirements of the control, even if the use or development is unlikely to have any significant effect on recharge and discharge. The workload for planning staff and referral authority staff would also be heavy, and for the most part bring little benefit.

Regulate those land uses and developments that are most likely to contribute to or be affected by salinity
As a variation to the option above, land uses and developments that are most likely to increase recharge and discharge would be required to go through a permit process and demonstrate that they will not contribute to a salinity problem. In this way, the greatest benefit can be achieved without requiring an increase in the expense and workload for all prospective land uses and developments in these areas. This planning control option has one disadvantage in that it is not comprehensive, and some unforeseen developments not regulated by the control may proceed, and cause problems, however, it is anticipated that this will be the exception.

Set performance criteria for land uses and developments in high recharge and discharge areas
This approach sets out a number of performance criteria and development standards that land uses and developments in high recharge and discharge areas are required to meet in order to by-pass the permit process. Those uses and developments that do not meet the criteria, are required to apply for a permit. This option makes the development application and approval process much simpler, however a greater level of enforcement is required to make it work effectively, ie. to ensure the use or development complies and performs satisfactorily.

Whatever approach to regulating land use and development in high recharge and discharge areas is taken, the following *principles* apply as a guide to deciding if a development or use is appropriate in these areas.

- The construction of buildings for any type of use or development is inappropriate in a discharge area as high watertables will detrimentally affect foundations. If building envelopes cannot be located outside a discharge area, appropriate engineering solutions must be implemented to prevent the foundation from becoming wet, if the building is to be permitted.

- The establishment of any use or development that requires irrigation is inappropriate in a high recharge area, whether the irrigation is associated with agriculture, effluent disposal, or a sportsground, because the application of water may lead to a rise in watertables. Alternatively, the development should demonstrate by means of a Water Balance Report (See Appendix 1) that it will be managed in a way that does not increase recharge to groundwater systems.

- The establishment of any use or development that requires irrigation is inappropriate in a discharge area, whether the irrigation is associated with agriculture, effluent disposal, or a sportsground, because the application of water may lead to a rise in watertables. Saline discharge will also negatively impact on the potential success of the development. Alternatively, the development should demonstrate by means of a Water Balance Report (See Appendix 1), that it will be managed in a way that prevents watertables from rising, and is sustainable.

- The construction of dams, water storages, or settling ponds in high recharge areas is inappropriate as the leakage from dams contributes to groundwater recharge. If dams must be located inside the high

recharge area, engineering solutions must be implemented to ensure the dam is sealed to the highest possible standard.

- The construction of dams, water storages, or settling ponds in discharge areas is inappropriate as the leakage from dams causes watertables to rise, and saline groundwater accessions can pollute the water in the dam.

- Land uses that require the on-site disposal of liquid or solid wastes that may pollute surface or ground water are inappropriate in high recharge and discharge areas as they may contribute to groundwater recharge, or experience groundwater accessions.

- In areas of high recharge, all efforts must be made to retain vegetation, particularly trees, and in those high recharge areas that have been cleared, perennial vegetation (preferably indigenous) should be reestablished.

- Works that alter drainage and create a back-up of water in a discharge area or a high recharge area should be avoided.

- Setbacks of 30m from waterways and major water storages should be observed. Setbacks that are vegetated with trees, shrubs, or perennial pastures are most effective.

Step 5: Drafting the Control

The type of planning control that is incorporated into planning schemes will ultimately be contingent on the state government policy for the future structure and content of planning schemes, the nature of the existing planning scheme, and the standard of high recharge and discharge mapping available for the municipality.

Currently, planning schemes address issues of environmental sensitivity through the application of overlay area controls. An overlay area control requires additional conditions to be met for certain uses and developments over and above those contained in the actual zone. The control applies to those areas defined in the planning scheme on an overlay map. If there is any conflict between the objectives or conditions of the zone and the overlay area control, the objectives of the latter prevail. This approach is considered to be the most appropriate for the management of high recharge and discharge areas for the following three reasons:

- consistency with the currently acceptable approach;
- ease of incorporating the control into planning schemes;
- ease of implementation.

Any planning control that aims to regulate land use and development in discharge and high recharge areas whether it be in an urban or rural context should include:

- the purpose or objectives of the control;

- a defined area to which the controls apply;

- the types of use and development affected by the control;

- matters and performance criteria which should be taken into account by the responsible authority when considering permit applications;

- referral of applications to relevant authorities where appropriate.

Model Planning Scheme Control

Explanatory Notes

This planning scheme control has been prepared as a model for municipalities in dryland catchments to demonstrate how control of land use and development in discharge and high recharge areas can be achieved. It aims to provide local government with a uniform approach for tackling the prevention of salinity through the use of planning provisions in planning schemes.

The control is intended to focus on those land uses and developments which are most likely to have a detrimental impact on other individuals or the environment, and where possible provide opportunities to maximise the standard of development whilst minimising the potential impacts. The major emphasis is to introduce and provide guidance to development in these sensitive areas, rather than being unduly prohibitive.

The implementation of the control will provide opportunities for the stabilisation of areas affected by salinity, and the revegetation of areas which significantly contribute to salinity, through the application of permit conditions. It will also ensure that development is undertaken in accordance with the land capability and the retention of native vegetation is maximised.

The planning scheme control is designed to be adopted as an amendment to the Local Section of planning schemes, and has been prepared as an 'overlay' to existing zoning.

The control stipulates additional information requirements for permit applications in those areas affected by the overlay, and may require some types of use or development to submit a permit application, despite the base zone provisions which may indicate that no permit is required.

XX Salinity Management Area

Planning Scheme Map:

Marked SMA (or as marked on 1:100,000 scale municipal maps depicting discharge and potential high recharge areas)

Purpose

- To identify the approximate area subject to groundwater discharge or high groundwater recharge.
- To control land use and development in areas identified as discharge areas or high recharge areas.
- To facilitate the stabilisation of areas affected by salinity and the revegetation of areas which contribute to salinity.
- To ensure development is compatible with the site capability and the retention of native vegetation.
- To ensure land is used and developed in a manner that does not significantly increase water infiltration to the groundwater systems (ie. does not exceed amount of recharge calculated as 10% of annual rainfall), and does not significantly increase salt loads in waterways, wetlands and drainage lines.
- To prevent damage to buildings and infrastructure from saline discharge and high watertables.

XX-X Use and Development

XX-X.X Requirements

Despite other provisions contained in this Scheme, a permit is required for the use and / or development of land in a SMA designated as a discharge area, for the following purposes:

- Building (except fences, walls, outbuildings, or a boat or pontoon which is permanently moored or fixed to land)
- Irrigated land uses
- Waste disposal works
- Works (including laser leveling and dam construction).

Despite other provisions contained in this Scheme, a permit is required for the use and / or development of land in a SMA designated as a high recharge area, for the following purposes:

- Irrigated land uses
- Waste disposal works (except for septic tank systems with a capacity under 1000L per day)
- Works (including laser levelling and dam construction).

XX-X.X Subdivision

A permit is required to subdivide land. Land in an SMA may be subdivided in accordance with the minimum lot size or density specified in the underlying zone.

XX-X.X Reports

Any application must be accompanied by a **Site Capability Report and Use and Development Report** prepared by a suitably qualified and experienced person to the satisfaction of the Responsible Authority. The scale of any accompanying plans should be appropriately detailed between 1:100 to 1:5000 according to the proposed development and the area of the land.

The site capability report must identify:

- Title and ownership details.
- Topographic information including natural contours of the land, highlighting significant ridges, hilltops and crests, slopes in excess of 25 percent (1:4), low lying areas, drainage lines, watercourses, springs, dams, lakes, wetlands and other environmental features on or in close proximity to the subject area.
- Geology types.
- Location and area of outcropping bedrock.
- Soil types.
- Size and location of high recharge areas from site inspection, soil types, soil depth, and soil percolation rates/ infiltration rate.
- Size and location of discharge areas and areas of high salinity risk from a site inspection, including the identification of shallow watertables within 3m of the surface (depth to watertable), and soil salinity from

soil tests or vegetative indicators.

- Area of land and proportion of development site identified as high recharge or discharge areas.
- Location, species and condition of existing vegetation (both native and exotic species).
- Existing degraded areas and recommendations for land management practices and remedial works required to overcome any existing or potential land degradation.

The use and development report must identify:

- Suitable sites and locations for any buildings, dams, access roads, drainage works, and lot boundaries (subdivisions), on-site effluent disposal (if applicable).
- Source of water supply.
- Water use and effluent or water disposal requirements.
- Any existing vegetation to be removed.
- The number, density, species and location of any proposed planting and landscaping.

XX-X.X Referral of Applications

Before deciding on any application for the following types of uses and developments in a Salinity Management Area, the Responsible Authority must refer the application and accompanying Site Capability and Use and Development Reports to the Department of Conservation and Natural Resources under Section 55 of the *Planning and Environment Act, 1987*:

- Irrigated land uses
- Waste disposal works (except for septic tank systems with a capacity under 1000L per day)
- Subdivision.

The Responsible Authority must notify the Department of Conservation and Natural Resources of any permit applications for mining in a Salinity Management Area and must include any conditions proposed by the Department of Conservation and Natural Resources that pertain to the purpose of this provision on any permit that is granted.

XX-X.X Guidelines for Permit

Before deciding on an application the Responsible Authority must consider:

- The State Environmental Protection Policy, "Waters of Victoria".
- The Regional Landcare Plan applicable to the particular catchment.
- The Catchment Salinity Management Plan applicable to the particular catchment.
- "Salinity Information Kit - A Local Government Planning Guide For Dryland Salinity".
- The need to augment tree planting and the establishment of deep-rooted, high water-use pasture species to reduce rainfall accessions to the watertable in high recharge areas.
- The need for planting of salt-tolerant species to stabilise and lower groundwater levels in discharge areas.
- The need for stock-proof fencing of discharge and high recharge areas to enable effective stock management for site stabilisation.
- Proposed landscaping and the need to preserve existing remnant vegetation, particularly in high recharge areas and discharge areas.
- Any land management plan, works program, or farm plan applicable to the land.
- The purpose of the zone within which the land is situated.
- The adequacy of the vegetation, site capability or geotechnical assessment of the development site.
- The design, siting, and servicing of the development and the extent of earthworks.
- The appropriateness of the proposed use or development having regard to the sensitivity and constraints of the land and the capability of the land to accommodate the use or development.

Definitions
In this clause:

Building includes:
(a) A structure and part of a building or a structure; and
(b) Fences, walls, out-buildings, service installations and any other appurtenances of a building; and
(c) A boat or a pontoon which is permanently moored or fixed to land.
(As defined in the *Planning and Environment Act, 1987)*

Development includes:
(a) The construction or exterior alteration or exterior decoration of a building; and
(b) The demolition or removal of a building; and
(c) The construction or carrying out of works; and
(d) The subdivision or consolidation of land, including buildings or airspace; and
(e) The placing or relocation of a building or works on land; and
(f) The construction or putting up for display of signs or hoardings.
(As defined in the *Planning and Environment Act, 1987)*

Drainage line means a feature with defined bed and banks that flows water some of the time. (also see Watercourse)
(Note: blue lines shown on **Vicmap 125000 Topographic Map Series** can be considered as meeting the definition of watercourse or drainage line unless an on site inspection suggests otherwise.)

Irrigated land uses means any land use that requires irrigation including:
- horticulture
- viticulture
- plant nurseries
- irrigated pasture
- sportsgrounds.

Land includes:
(a) Buildings and other structures permanently fixed to land; and
(b) Land covered with water; and
(c) Any estate, interest, easement, servitude, privilege or right in or over land.
(As defined in the *Planning and Environment Act, 1987)*

Native vegetation means plants that are indigenous to Victoria, including trees, shrubs, herbs and grasses.
(As defined in the State Section of Victorian Planning Schemes.)

Subdivision means the division of land into two or more parts which can be disposed of separately.
(As defined in the *Planning and Environment Act, 1987)*

Use in relation to land includes use or proposed use for the purpose for which the land has been or is being or may be developed.
(As defined in the *Planning and Environment Act,1987)*

Waste disposal works includes works associated with the disposal of liquid or solid wastes on-site including sewage, effluent, sullage, and refuse. The waste may be generated on or off-site by a dwelling, industry, intensive animal industry, subdivision, commercial premises, winery, mining, water authority, public authority, or municipal council.

Watercourse means a stream of water, a river or creek, an artificial channel to carry water, and includes the bed or channel of any stream, river or creek.
(Note: blue lines shown on **Vicmap 1:25,000 Topographic Map Series** can be considered as meeting the definition of watercourse or drainage line unless an on site inspection suggests otherwise.)

Works includes any change to the natural or existing topography of land including the removal, destruction or lopping of trees and the removal of vegetation or topsoil.
(As defined in the *Planning and Environment Act, 1987)*

Considering Applications

for the Use and Development of Land in High Recharge and Discharge Areas

The following procedure will assist applicants and council staff to fulfil the requirements of the Overlay Area Control for Salinity Management Areas as presented in the model.

Step 1: Does all or part of the site fall within a salinity management area?

If any part of the site falls within a Salinity Management Area (SMA), the requirements of the overlay control apply to the area contained within the SMA. The requirements ensure that all environmentally sensitive areas within the SMA are identified at a scale relevant to the site and the development, as the 1:100 000 maps can only provide an indicative guide.

There are two types of SMA:

Potential High Recharge Areas

Areas which have the potential to allow a relatively high level of water to infiltrate into the groundwater system. These areas generally display a combination of the following features:

- Soil depth of less than 35cm; and/or
- More than 10% of outcropping bedrock; and/or
- Infiltration rate of over 200mm per day; and/or
- Soil type consisting uniform sands, loamy sands, sandy silty loams or shallow duplex soils; and/or
- Tendency to occur higher in the landscape, eg crest of hills.

(Kevin and Day, 1994)

Discharge Areas

Areas which are salt-affected or have a watertable within 2 metres of the ground's surface, and can generally be recognised by the following characteristics:

- Changes in vegetation, including leaf discolouration and poor plant health, disappearance of salt-sensitive plants, the emergence and dominance of moisture and salt-tolerant species, and finally the disappearance of plants altogether; and/or
- Tendency to be located lower in the landscape around the break of the slope, and around drainage lines; and/or
- Surface moisture; and/or
- Bare soil; and/or
- Salt stains.

(Allan, 1994)

If a new planning scheme overlay map has been prepared at a scale consistent with existing planning scheme maps, the two types of SMA should be distinguished on the map by differing cross-hatching/ shading patterns.

The maps supplied to municipalities as part of the Local Government Salinity Implementation Project (see Figure 2) have designated these areas with a standardised cross-hatching or shading at a scale of 1:100 000 and may alternatively be used as an existing planning scheme map.

Step 2: Does the use and/ or development require a permit ?

The types of activities listed in the model planning scheme control (See page in model overlay section) are considered to be the most likely to lead to a detrimental impact. They are therefore required to undergo the planning permit process, and meet the requirements of the overlay area control.

If the use or development does not appear on the list, it may proceed without a permit. Check that the subdivision, use or development does not require a permit or is not prohibited under any other provision in the planning scheme ordinance.

If the application is required to undertake the permit process in accordance with this control, there are three possible outcomes:

- The permit may be granted if the application has demonstrated that it will have little or no impact.

- The permit may be granted with conditions to reduce the impact of the development.

- The permit may be refused if the application is considered to have a high impact which cannot be ameliorated by the use of conditions.

The aim of the permit process is to ensure a high standard of development that minimises the salinity impacts on the environment. It is not aimed at preventing development from occurring, unless the proposal represents an unacceptable increase in risk of salinity.

Step 3: Meeting the information requirements of the Site Capability Report.

If the subdivision, use or development does require a permit, the overlay area control requires the applicant to provide specific information on site conditions in order for the planning officer to assess the potential environmental impact of the proposed development.

Certain site conditions are known to be associated with high recharge areas and discharge areas. The information that is required in the Site Capability Report will help the applicant and the planner to identify these conditions in detail. These areas can then be addressed in the design presented in the Use and Development Report, thereby reducing the risk of a salinity impact.

The elements of the Site Capability Report have been selected because of their relevance to:

- identifying high groundwater recharge areas;
- identifying groundwater discharge areas.

Tables 1 and 2 highlight the physical characteristics of high recharge areas and discharge areas, and can be referred to when preparing or assessing the Site Capability Report. Normally, a combination of a few of the listed characteristics will indicate the presence of these areas. Applicants should present the information in the report in a way that it can be easily cross referenced to the relevant table. This will expedite the assessment of their application.

Some information is available in mapped form, but a detailed site inspection is still required to verify the mapped data.

The text "*Soils. Their Properties and Management. A soil Conservation Handbook for New South Wales*" is an extremely useful reference for the classification of soils, soil sampling techniques and field tests, and land capability interpretation for both rural and urban development.

*(Refer to Tables 1 and 2)
The Rural Land Mapping Project commenced in 1977. It covered topics such as: agricultural quality, land capability, erosion risk, salting and depth to watertable, fire hazard, geological hazard, mineral and stone resources, native vegetation significance, conservation significance, water resources and flood potential. The mapping and data was of variable quality and reliability and some of it is out of date, however the maps may provide an indicative guide. The maps are usually available for inspection from the municipality.

Information Requirements	Characteristics of a High Recharge Area	Where to Find Information
Natural contours of land highlighting: – significant ridges – hilltops and crests – slopes in excess of 25%	High in the landscape Slopes in excess of 25% (Soil layer generally thinner on steep slopes)	Topographic maps 1:25,000 Site survey
Geology type Location and area of outcropping bedrock	Tends to occur on - metamorphic aureoles/ridges - granite hill country (Devonian) - sedimentary hill country (Ordovician) Greater than 10% of outcropping rock (calculated over area of the property)	Site inspection Preferably determine **Land Capability Map Unit** from a Land Capability Study if one has been prepared for the municipality by the Centre for Land Protection Research. Determine **Land System** from: *A Study of the Land in the Campaspe River Catchment* *Groundwater and Salinity Processes in the Uplands of the Campaspe River Catchment* *Land Inventory of the Loddon River Catchment - a reconnaissance survey* Rural Land Mapping Project*
Soil type Soil depth Infiltration/ permeability rate	Soil types consisting of: - uniform sands - loamy sands - uniform loams - sandy silty loams - red and whole coloured duplex soil Less than 35 cm Greater than 200 mm/day	As above. Looking for Uc, Um, Gc soil classifications. *Soils. Their Properties and Management.* *A Soil Conservation Handbook for NSW.* Infiltration information available from Suitability for Effluent Disposal Maps as part of Land CapabilityStudies prepared by the Centre for Land Protection Research. Infiltration tests.
Location, species and condition of existing vegetation (both native and exotic species)	Annual pasture species Trees and shrubs cleared	Site inspection Flora Information System (lists rare species) - DCNR Native Vegetation Map from Rural Land Mapping Project* Vegetation cover from aerial photographs *Census of the Vascular Plants of Victoria* *Native Trees and Shrubs of South-Eastern Australia*

Table 1: Assesment Table for High Groundwater recharge Areas. (Step 3)

Information Requirements	Characteristics of a Discharge Area	Where to Find Information
Natural contours of land highlighting: - low lying areas - drainage lines - watercourse - dams - lakes - springs - wetlands	Low in the landscape Break of slopes Drainage lines Stream banks Below dams Lake margins and near waterbodies Hillside seeps Flats and depressions	Topographic maps 1:25,000 Site survey
Size and location of discharge areas and high salinity risk from a site inspection	Surface moisture - free water or dampness Soil blackening Bare soil Salt encrustation	Site inspection
Soil salinity from soil tests or vegetative indicators.	Soil salinity class EC 1 . . . . .300 - 600 2 . . . . .600 - 1400 3 . . . . .>1400	Soil test or vegetative indicators (Refer to *Spotting Soil Salting*)
Depth to watertable within 3m	Watertable is within 2 to 3m of the surface = areas at high risk of salinity.	Test depth to watertable with hand auger Centre for Land Protection Research - bore information *Soils. Their Properties and Management. A Soil Conservation Handbook for NSW.*
Location, species, and condition of existing vegetation (both native and exotic species)	Salt-tolerant plant species present or dominant Salt-sensitive plant species experience slow growth rates, incomplete life cycles, yellowing and stunting, susceptibility to disease, and decreased germination, and finally death Tree dieback	Site inspection (refer to *Spotting Soil Salting*) Flora Information System (listing rare species) - DCNR Vegetation cover from aerial photographs Rural Land Mapping Project* *Census of the Vascular Plants of Victoria* *Native Trees and Shrubs of South-Eastern Australia*

Table 2: Assesment Table for Groundwater Discharge Areas. (Step 3)

Information Requirements	High Risk Activities in Discharge Areas and High Recharge Areas
Suitable sites for: - buildings	Construction of buildings in discharge areas
- dams or water storages	Construction of dams or water storages in high recharge areas or discharge areas
- access roads	
- drainage works	Works that alter drainage and create a backup of water in a high recharge area or discharge area
- on-site effluent disposal (if applicable)	Effluent disposal in high recharge or discharge areas
- lot boundaries (subdivisions)	Subdivision designs which create lots that lead to any of the above activities
Source of water supply	Unsewered urban and residential development with reticulated water supply in high recharge or discharge areas
Water use and effluent or water disposal requirements	Developments that involve high water usage and effluent and water disposal requirements (average over 1000 Litres per day) in high recharge or discharge areas
Any vegetation to be removed	Clearing of native vegetation in high recharge or discharge areas Clearing of vegetation within 30 m of permanent and intermittent drainage lines and watercourses
Any areas to be irrigated (agriculture, horticulture, sporting grounds)	Irrigation in high recharge or discharge areas

Table 3: High Risk Activities in Discharge Areas and High Recharge Areas. (Step 4)

High Risk Activity	Minimising Impacts
Construction of buildings in a discharge area	Incorporate engineering specifications applicable to wet saline conditions in all building construction. If the planner or developer is unsure of what these are, advice should be sought from the building and engineering staff.
Construction of dams or water storages in high recharge areas or discharge areas	Construct dam or water storage to sound engineering specifications incorporating an impermeable membrane suitable to conditions i.e. synthetic lining in saline conditions and clay lining in non-saline conditions
Works that alter drainage and create a back-up of water in a high recharge area or discharge area, for example access roads, or drainage works.	All works demonstrate that they minimise the disruption to the natural flow water
Effluent disposal in a high recharge area	Install pump out systems Effluent can be disposed if it can be demonstrated to the satisfaction the Responsible Authority that the amount of water that will be applied is equal to the amount of water that the plants require and the amount water that the soil can hold by means of a Water Balance Report (See Appendix 1). The effluent must be irrigated to trees or deep-rooted perennial pastures.
Unsewered urban and residential development with reticulated water supply	Install pump out systems and arrange off-site disposal
Developments that involve high water usage or disposal requirements	Install pump out systems and arrange off-site disposal
Clearing of native vegetation Clearing of vegetation within 30 m of permanent and intermittent drainage lines and watercourses	Areas of native vegetation greater than 0.4 hectares require a permit under State legislation already. If areas less than 0.4 hectare are cleared, replacement planting must be carried out on the land preferably in a high recharge area; around discharge areas, or within a buffer strip of 30 m from a drainage line or watercourse.
Irrigation	Irrigation must demonstrate to the satisfaction the Responsible Authority that the water that will be applied is equal to the amount of water that the plants require and the amount that the soil can hold by means of a Water Balance Report (See Appendix 1).

Table 4: Minimising the impacts of high risk activities in high recharge and discharge areas. (Step 4)

Step 4: What land use or development activities are being proposed?

Once the high recharge and discharge areas have been identified, the Use and Development Report requires the applicant to provide specific details of proposed works. These plans should demonstrate how they have addressed these areas in design and layout in order to minimise the risk of a salinity impact. Table 3 outlines the types of high risk land use and development activities that should be avoided in these areas because they are known to:

- increase the amount of water infiltration into the groundwater system;
- increase the salt loads in waterways, wetlands and drainage lines;
- increase the risk of damage to buildings and infrastructure from saline discharge and high watertables.

Preferably, high risk activities should be located outside the areas identified and detailed as high recharge or discharge areas in the Site Capability Report. However, there may be situations where it is not possible to avoid undertaking these activities within a high recharge or discharge area, for example, if the whole of the site is identified as a high recharge area or discharge area. Table 4 provides a framework of the types of measures that must be applied to minimise the impact, if these land uses and development activities have to proceed in a high recharge area or discharge area.

If high risk activities do proceed in high recharge or discharge areas, annual monitoring of watertables and surface water salinity in watercourses and drainage lines, should be required as a condition of the permit. The monitoring results must be submitted to the Responsible Authority.

If the monitoring does identify an increase in salinity or height of watertable, the Responsible Authority should take steps to find out if the increase relates to the use or development in the high recharge or discharge area, and work with the landholder and the Department of Conservation and Natural Resources to come to an agreed course of action.

Step 5: Does the application meet the following performance criteria?

If the proposed development or land use meets the following performance criteria where applicable, the permit can be approved without the application of permit conditions.

- All high recharge areas as identified in Step 3 are fenced and revegetated with trees (at a density of 200 trees per hectare) or deep rooted perennial pasture. In the case of a subdivision this area can form part of the 5% open space requirement.

- All discharge areas as identified in Step 3 are fenced and revegetated with salt-tolerant vegetation.

- Buffer zones of 30 m around drainage lines and waterways are fenced and revegetated with trees, shrubs, or perennial pastures. In the case of a subdivision this area can form part of the 5% open space requirement.

- Remnant native vegetation in high recharge areas and discharge areas is retained and fenced.

- All high risk activities listed in Step 4 are located outside the high recharge and discharge areas identified in Step 3.

Model Permit Conditions

Applying Permit Conditions

The application of permit conditions is sometimes necessary to prevent or overcome detrimental effects which may be associated with an otherwise acceptable proposal. Therefore, the approval of the planning application becomes contingent on the applicant fulfilling certain actions.

The *Planning and Environment Act, 1987* sets out guidelines for the application of permit conditions. Some of the key points are that conditions must have a planning purpose, relate to the planning permission being granted, and accurately convey their intended effect. Conditions should only be included if they are the best way of achieving a particular action or result, and must be enforceable (Department of Planning and Development, 1994).

Under the *Planning and Environment Act, 1987*, a planning permit can be granted subject to certain conditions which can be set:

- by the responsible authority *Section 62 (2)*
- by the referral authority *Section 62 (1)(a)*;
- by the Administrative Appeals Tribunal *Section 85 (1)(b)(ii)*; or
- or in accordance with the planning scheme *Section 62 (1)(a).*

The responsible authority is not able to include a condition that conflicts with the conditions required by a referral authority or the planning scheme. Applicants can appeal against the conditions on the permit at the Administrative Appeals Tribunal (Department of Planning and Development, 1994).

The following section provides examples of permit conditions which can be adapted to individual situations. All the italicised words that appear within the examples may be substituted or deleted according to the situation. Conditions on a permit to use and/ or develop land in an SMA may include the following:

The provision of more information to assist in the identification of areas subject to groundwater discharge or high groundwater recharge.
If the applicant has not provided enough information in the Site Capability Report or the quality of the information is doubtful, the Responsible Authority or Referral Authority can require the applicant to provide more information on one or many of the topics listed in the Site Capability Report.

Example:
Before the *use and/or development* starts the applicant must provide more detailed information on *(to be specified)* to the satisfaction of the Responsible Authority in accordance with the requirements of the Site Capability Report.

The provision of more information to accurately identify the impacts of the development or use.
If the Use and Development Report does not provide enough information about the proposal in order to assess the impacts, the Responsible Authority or Referral Authority may require the applicant to provide more information on one or many of the subject areas listed in the Use and Development Report. In the case of use or development that requires irrigation or effluent disposal over 1000 Litres per day, the Responsible Authority is advised to require a Water Balance Report (Refer to Appendix 1) as these types of developments must demonstrate that they will not contribute to recharge.

Example 1:
Before the *use and/or development* starts the applicant must provide more detailed information on *(to be specified)* to the satisfaction of the Responsible Authority in accordance with the requirements of the Use and Development Report.

Example 2:
Before the *use and/or development* starts the applicant must provide a Water Balance Report to the satisfaction of the Responsible Authority, detailing water use and disposal requirements associated with the proposal, rainfall, the expected water uptake of any vegetation to be irrigated, runoff, irrigation and drainage management, and the ability of the soil to hold moisture.

The retention of existing trees or native vegetation.
The retention of vegetation, particularly in high recharge areas, is a key area in the control of salinity. Existing policies require all types of native vegetation (i.e. grasses, shrubs, and trees), unless they are classified as a weed, to be retained for biodiversity and habitat purposes, particularly if they are indigenous to the locality. In addition, existing exotic trees can also be retained for their water use value. The Responsible Authority should use its discretion to decide whether the retained vegetation requires fencing from stock or general development work depending on the proposal.

Example 1:
All *existing trees and/ or native vegetation* shown in *high recharge areas, discharge areas, or within 30 m of a watercourse* on the endorsed plans must be suitably marked before any development starts on the site and that vegetation must not be removed, destroyed or lopped without the written consent of the responsible authority (Department of Planning and Development, 1994).

Example 2:
All areas of *existing trees and/ or native vegetation* shown on the endorsed plans must be fenced to exclude stock to the satisfaction of the Responsible Authority.

Planting to compensate for the removal of existing trees or native vegetation.
There may be cases where the removal of vegetation is warranted for example as an exemption under the State Native Vegetation Retention Legislation. In these situations, it may be appropriate to include a condition relating to planting to replace the vegetation removed.

Example:
For every existing tree removed as a result of the *use or development* on the endorsed plan, five trees must be planted *within a high recharge area, discharge area, or within 30m of a watercourse* to the satisfaction of the Responsible Authority.

The revegetation of high recharge areas.
Every opportunity to include this condition should be seized as this is a high priority action for salinity management. Once again it is up to the discretion of the Responsible Authority as to whether the planted area should be fenced depending on the type of use or development.

Example:
Before the *use and/ or development* starts, high recharge areas as identified in the accompanying Site Capability Report must be:

(a) planted with trees that are indigenous to the locality at a density of 200 trees per hectare or deep-rooted perennial pasture species to the satisfaction of the Responsible Authority; and

(b) fenced from stock *(if applicable)* to the satisfaction of the Responsible Authority.

The stabilisation of discharge areas.
Every opportunity to include this condition should be seized, as this is action helps to contain the growth of discharge areas. Once again it is up to the discretion of the Responsible Authority as to whether the planted area should be fenced depending on the type of use or development.

Example:
Before the *use and/ or development* starts, discharge areas as identified in the accompanying Site Capability Report must be:

(a) planted with deep-rooted, salt-tolerant vegetation to the satisfaction of the Responsible Authority; and

(b) fenced from stock *(if applicable)* to the satisfaction of the Responsible Authority.

Introducing a buffer zone around watercourses, drainage lines, and wetland.
A planted buffer zone can help to reduce the level of the watertables around the drainage lines and prevent saline groundwater accessing the water in the watercourse or wetland. It also helps to filter surface water and prevent erosion around the watercourse, drainage line or wetland. The distance of 30 m has been used as it appears in the planning guidelines for native vegetation retention and in regards to water supply catchments. This distance should be adhered to wherever possible, but the Responsible Authority may use its discretion to reduce the buffer if it is unfeasible. In doing so, the Responsible Authority should insist on a high density of planting (500 trees per hectare).

Example:
Before the *use and/ or development* starts a buffer zone around *wetlands, waterways and drainage lines of 30m* specified in the Site Capability Report, must be designated. This buffer must be planted with appropriate native vegetation indigenous to the locality at a density of *200* trees per hectare, to the satisfaction of the responsible authority.

Subdivision - Land set aside for public open space.
Subdivisions are required by legislation to provide open space for recreational areas. This provides opportunities to exclude building from high recharge areas, discharge areas or watercourse or wetland buffer zones, retain and augment existing vegetation, which in turn creates an attractive passive recreation facility. In this way, both development and environmental objectives can be achieved simultaneously.

Example:
The plan must set aside an area of public open space equivalent to *five* percent of all the land in the subdivision. This area of public open space must incorporate *high recharge areas, and/ or discharge areas, and/ or buffer zones around watercourses, drainage lines, or wetlands,* as identified by the Site Capability Report.

Preventing damage to buildings and infrastructure from saline discharge and high watertables.
If building cannot be avoided in a discharge area, appropriate engineering precautions must be implemented in order to overcome the wet conditions. Officers from the Building and Engineering Sections of the Responsible Authority should be consulted.

Example:
Before any building and works associated with the *use and/or development* start, detailed construction plans must be prepared to the satisfaction of the Responsible Authority demonstrating appropriate engineering solutions to overcome saline wet conditions. All building and works constructed or carried out must be in accordance with those plans.

Construction of dams, water storages, or settling ponds in high recharge areas.
If the construction of dams, water storages and settling ponds cannot be avoided in a discharge area, appropriate engineering precautions must be implemented in order to overcome possible leakage problems and subsequent recharge. Officers from the Building and Engineering Sections of the Responsible Authority should be consulted.

Example:
Before any works associated with the development start, detailed construction plans must be prepared to the satisfaction of the Responsible Authority demonstrating that the *dam, water storage, settling pond* will be sealed to the highest standard possible with a clay or synthetic lining. All works carried out must be in accordance with those plans.

Septic tanks in high recharge areas.
If effluent disposal from septic tanks cannot be avoided in a high recharge area, planting trees and deep-rooted perennial pasture species around effluent disposal lines can help to minimise the recharge. Be aware that planting should take place at least five metres from the lines because the roots can damage the lines themselves.

Example:
Deep-rooted perennial pasture species or trees must be planted and maintained to the satisfaction of the Responsible Authority at a distance of 5 m around all septic tank effluent disposal lines in a high recharge area as identified by the Site Capability Report.

Septic tanks in discharge areas.
Effluent disposal from septic tanks is not possible in a discharge area. If a septic tank system cannot be avoided in a discharge area, pump-out systems must be installed to dispose of the effluent off-site.

Example:
Pump-out systems and off-site disposal must be installed and managed to satisfaction of the Responsible Authority for all septic tank effluent disposal in discharge areas as identified by the Site Capability Report.

Monitoring.
If high risk activities as listed in Tables 3 and 4 do proceed in high recharge or discharge areas, annual monitoring of watertables and surface water salinity in watercourses and drainage lines, should be required as a condition of the permit.

Example 1:
Before the use or development starts, a bore must be installed to the satisfaction of the Responsible Authority at *(specify location)* for monitoring the height of the watertable. A reading of the height of the watertable must be taken annually in Winter or Spring and forwarded to the Responsible Authority for recording and monitoring change.

Example 2:
Before the use or development starts, a base reading of surface water salinity must be taken at *(specify site)*. A reading of the surface water salinity must be taken annually in Summer and forwarded to the Responsible Authority for recording and monitoring change.

General conditions.
The following conditions will help to ensure that what is specified on the planning permit and endorsed plans is actually carried out.

Landscaping completion and maintenance
Landscaping works as shown on the endorsed plans must be completed within *(specify number)* months from *(insert date)* to the satisfaction of the responsible authority and then maintained to the satisfaction of the responsible authority (Department of Planning and Development, 1994).

Landscaping before commencement of use
Before the use allowed by this permit starts, landscaping works as shown on the endorsed plans must be completed to the satisfaction of the responsible authority and then maintained to the satisfaction of the responsible authority (Department of Planning and Development, 1994).

Layout not altered
The layout of the *use/ and or development* as shown on the plans must not be altered without the written consent of the responsible authority (Department of Planning and Development, 1994).

Plans required
Before the *use and/ or development* starts, plans to the satisfaction of the responsible authority must be submitted to and approved by the responsible authority. When approved, the plans will be endorsed and will then form part of the permit. The plans must be drawn to scale with dimensions and three copies must be provided. The plans must show:

(a) Planting requirements (*to be specified*) (Department of Planning and Development, 1994).

Section 173 of the Planning and Environment Act, 1987.

Section 173 enables the responsible authority to enter an agreement with the landholder to specify ongoing management requirements that pertain to the use and development of the land. The responsible authority can enter an agreement with the land holder on its own or in conjunction with another party such as a referral authority. Agreements should be worded with legal advice, since the outcome not only binds the owner, but gives the ability to bind future owners as well, through the placement of a memorandum on the land title. Further information on Section 173 Agreements is available from the Department of Planning and Development.

Example:

The applicant must enter into an agreement under Section 173 of the Act with the responsible authority *and/or (name of authority e.g. Department of Conservation and Natural Resources)* to provide for the following:

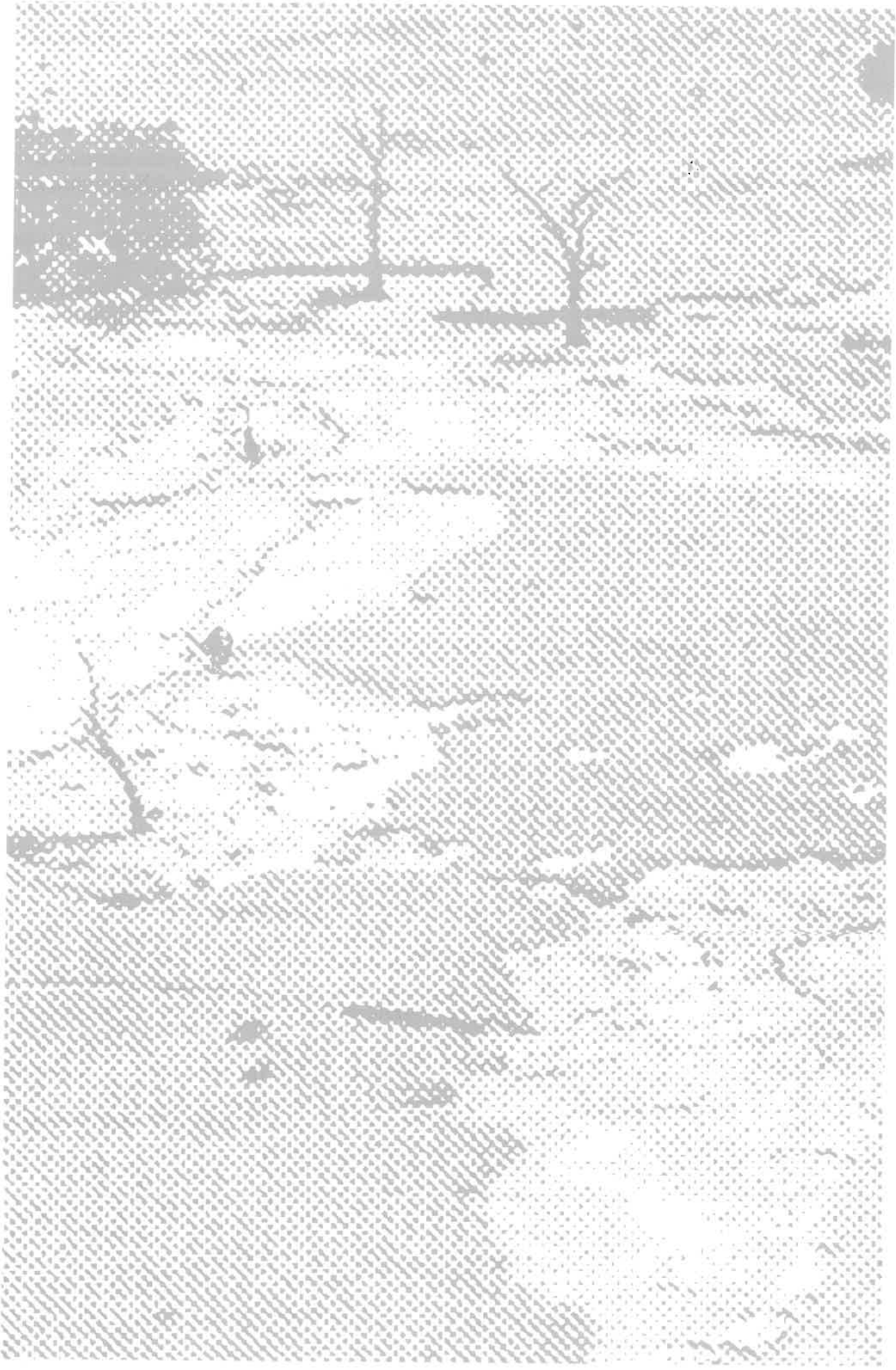
- *Establishment and maintenance works and/ or a monetary contribution for the services or works (to be specified i.e. fencing of remnant vegetation, planting in high recharge or discharge areas, provision and planting of buffer zones around waterways and drainage lines etc.)*

Land Management Plans and Works Programs

Clause 7-4.3 of the State Section of the Planning Scheme supports the submission of Land Management Plans and Works Programs to accompany applications for the clearance of native vegetation. Land Management Plans and Works Programs explain the current applications in the context of long-term plans for the sustainable management of the subject land. The plans can prepared by an individual landholder, a group of landholders, a statutory authority, or government departments, for a single property, a group of properties, a catchment, or a planning area. "Planning Guide for Native Vegetation Retention" prepared by the Department of Conservation and Natural Resources (1994) details the requirements for the submission of Land Management Plans and Works Programs. Land Management Plans and Works Programs are also encouraged under this model planning provision. Further information on Land Management Plans and Works Programs is available from the Department of Conservation and Natural Resources.

Covenants

Areas of native vegetation in high recharge areas and discharge areas can be protected by a conservation covenant which is registered on the land title. This covenant binds current and future owners of the land. The consevation covenant can be entered into by an individual landowner, a group of landowners, a responsible authority, or a statutory agency aspiring to protect a habitat that extends over one or more properties. The Trust for Nature (Victoria) is an independent body that has regional representatives around Victoria that can discuss, assist with the preparation of, and enter into Conservation Covenants with individuals (Department of Conservation and Natural Resources, 1994). For more information on Conservation Covenants, contact the Trust for Nature (Victoria).



Useful References and Sources of Information

General Salinity Information

Allan, M.J. *"An Assessment of Secondary Dryland Salinity in Victoria. Technical Report No. 14"*. Centre for Land Protection Research, Department of Conservation and Natural Resources, Victoria, February, 1994.

Avoca Dryland Community Working Group. *"Avoca Catchment Salinity Management Plan"*. Victoria, October, 1993.

Campaspe Community Working Group. *"Campaspe Catchment Salinity Management Plan"*. Victoria, December, 1992.

Chaffey, B. *"Dryland Salinity – Early Indicators and Control Measures. Principles of Sustainable Agriculture"*. Department of Food and Agriculture, Department of Conservation and Environment; National Soil Conservation Program, Victoria, September 1992.

Charman, P . Murphy, B.W. (Editors). *"Soils - Their Properties and Management. A Soil Conservation Handbook For New South Wales"*. Sydney University Press, Melbourne, 1993.

Hooper, J. *"Saltpak 1 – Saltland in Victoria."* Distance Learning Centre, Victorian College of Agriculture and Horticulture, Victoria, 1991.

Department of Conservation and Natural Resources, Department of Agriculture, Rural Water Corporation. *"Avoca–Loddon Campaspe Regional Landcare Plan"*. Landcare Victoria, Victoria June 1993.

Loddon Community Working Group. *"Loddon Catchment Salinity Management Plan"*. Victoria, December, November 1992.

Regional Landcare Plan.

Sites of Significance and Environmental Information

Allan, M., Bryant, E., Robley, A. *"Environmental Assessment of the Avoca Catchment"*. Department of Conservation and Natural Resources, Bendigo, 1993.

Robley, A. *"Environmental Assessment of the Campaspe Dryland Salinity Management Planning Area"*. Department of Conservation and Natural Resources, Bendigo, 1992.

Robley, A. *"Environmental Assessment of the Loddon Dryland Salinity Management Planning Area"*. Department of Conservation and Natural Resources, Bendigo, 1992.

Land Capability and Geotechnical Information

Avoca Dryland Community Working Group. *"Avoca Catchment Salinity Management Plan"*. Victoria, October, 1993.

Campaspe Community Working Group. *"Campaspe Catchment Salinity Management Plan"*. Victoria, December, 1992.

Culley, C. *"Salinity Recharge Mapping Kit – A guide to assessing the recharge capability of soils on sedimentary country in Central Victoria"*. Department of Conservation and Natural Resources, National Soil Conservation Program, Maryborough, Victoria, 1994.

Day, C., Kevin, P. *"Explanatory Guide to High Potential Recharge Maps. Technical Report No. 11"*. Centre for Land Protection Research, Department of Conservation and Natural Resources, Victoria, February, 1994.

Hooper, J. *"Saltpak 1 – Saltland in Victoria."* Distance Learning Centre, Victorian College of Agriculture and Horticulture, Victoria, 1991.

Kevin, P. "*Groundwater and Salinity Processes in the Uplands of the Campaspe River Catchment. Technical Report No. 6*". Centre for Land Protection Research, Department of Conservation and Natural Resources, Victoria, February, 1993.

Kevin, P. "*Groundwater and Salinity Processes in the Uplands of the Loddon River Catchment. Technical Report No. 5*". Centre for Land Protection Research, Department of Conservation and Natural Resources, Victoria, February, 1993.

Loddon Community Working Group. "*Loddon Catchment Salinity Management Plan*". Victoria, December, November 1992.

Vegetation Information

Costermans, L. "*Native Trees and Shrubs of South–Eastern Australia*". Rigby, Adelaide, 1983.

Matters and Bonzon. "*Spotting Soil Salting – A Victorian Field Guide to Salt Indicator Plants*". Department of Conservation and Environment, 1989.

Ross, J.H. "*A Census of the Vascular Plants of Victoria*". Department of Conservation Forest and Lands, Victoria, 1990.

Carr, G.W. and Jugovic, J.V. "*Weeds of Native Vegetation in Victoria*". Land Protection Division, Department of Conservation and Environment, 1989.

Maps and aerial photographs

Information Victoria
Topographic maps are available for most of Victoria at 1:100,000 and 1:25,000.
Aerial photographs available in a variety of scales in black and white and colour.

Wetlands, watercourses, and drainage lines can be identified from the topographic maps and aerial photographs.

Areas of proclaimed water catchments can be determined from maps available from local government or the Area offices of the Department of Conservation and Natural Resources.

Planning Information

Department of Agriculture and Department of Conservation and Environment. "*A review of Rural Land Use in Victoria*". Government Printers, Victoria February 1991.

Department of Conservation and Natural Resources. "*Planning Guide for Native Vegetation Retention*". State Government of Victoria, Melbourne, 1994.

Department of Planning and Development. "*A Guide to Planning Permit Conditions*". State Government of Victoria, Melbourne, 1994.

Department for Planning and Environment. "*State Environment Protection Policy – Waters of Victoria*". Government Printer, Melbourne, 1988.

Forge, W. "*Conservation Covenants– An Introduction*". Victorian Conservation Trust, Victoria, Melbourne, 1990.

John Bennett & Associates. "*Study for a Salinity and Catchment Planning Package*". Mid–Goulburn Catchment Coordinating Group, Victoria, February 1992.

Perrott Projects Steering Committee. "*Committee Recommendations and Project Team Reports*". Department of Panning and Development, Victoria, 1993.

Trevor Budge & Associates. "*Local Section Amendment – Bet Bet Planning Scheme*". Shire of Bet Bet, Victoria, 1994.

Trevor Budge & Associates. "*Local Section Amendment – Korong Planning Scheme*". Shire of Korong, Victoria, 1994.

Wilson Sayer Core Pty Ltd. "*Guidelines for the preparation of Environmental Management Plans for Strathfieldsaye Rural Areas*". City of Greater Bendigo, June 1994.

Appendix 1

Water Balance Report

We can account for all the water on any given piece of land in a Water Balance. The components of a Water Balance are as follows:

Inputs	Rainfall Irrigation Miscellaneous inputs e.g. seepage from dams or water channels
Water use	Evaporation from the soil surface Evaporation from surface flows including watercourses Water taken up by plants and transpired
Lateral Movement	Surface flows Runoff Soil moisture
Recharge	Deep percolation of water into the groundwater system

When the groundwater system is in equilibrium, the inputs are balanced by evaporation from the soils surface and surface flows, transpiration, and the seepage of groundwater into watercourses. Rising watertables and salinity are an indication that the system is out of balance, and that the proportion of inputs that percolates into the groundwater system is too high. The key objective for salinity control is to use the rainfall and irrigation inputs before they reach the groundwater system, particularly in high recharge areas.

Applicants need to demonstrate that the proposed development will not create a high level of recharge in an area that by its physical characteristics makes it prone to high recharge. It follows that the riskiest developments in a high recharge area are those which involve irrigation of water or effluent for agricultural purposes or sportsgrounds. To demonstrate that such a development will not contribute to the salinity problems, applicants are required to account for all the water in the different components of the of the system on a month by month basis over the period of an 'average year'.

This is a complex exercise which is the reason why it has not been made a general requirement of all developments proposed in high recharge and discharge areas. It is also difficult to determine what accounts for an average year since rainfall is unpredictable, and the amounts of water applied for irrigation purposes are linked to rainfall events. However, the general principle of only applying as much water as required by the plants for healthy growth is a sound one. Calculating the Water Balance will help applicants to fine tune their proposal for irrigation.

It is suggested that calculations are undertaken on a monthly basis so that compensation may be made for higher evaporation and transpiration rates in summer, higher intensity of rainfall and lower evaporation and transpiration rates in winter, and higher plant water use from higher growth rates in spring. It is advisable that the calculations are undertaken by an irrigation consultant.

In order to calculate Water Balance, the following information is required:

Inputs	Average monthly rainfall figures Number of days of rainfall per month i.e. rainfall distribution affects irrigation application rates Irrigation application rates by month Method of irrigation and management practices that may affect application rates
Water use	Amount of water required per month by type of plants (crop, pasture, trees, or grass) Transpiration rates by month Evaporation rates by month
Lateral Movement	Runoff rates by month Soil type and water–holding capacity Depth of soil to impermeable layer
Recharge	Percolation rates

Simply expressed, the formula for calculating the resulting recharge is:

Amount of Recharge = Inputs – (Evaporation + Transpiration + Runoff + Water-holding capacity)

Where:
Inputs = (Monthly amount of rainfall x Area) + (Monthly amount of irrigation water applied x Area)

Monthly amount of irrigation water applied = F (Soil type, plant type, method of irrigation)

Evaporation = (Amount of evaporation from soil x Time x Area) + (Amount of evaporation from surface water x Time x Area)

Transpiration = Amount of water transpired from plants x Time x Area

Runoff = Amount of runoff x Time x Area = F (Soil type, Rainfall distribution)

Water-holding capacity = F (Soil type x Rainfall distribution) x Soil depth

Roughly, estimates of recharge usually account for 5 to 10% of annual rainfall inputs, evapotranspiration accounts for 90%, and runoff for 5%. If the irrigation development contributes a level of recharge that is equivalent to less than 10% of the annual rainfall, it can be said that the impact of the of the development has created a situation that is no worse than if no development was to take place. If the development contributes a recharge figure that accounts for greater than 10% of the annual rainfall, the development is creating an adverse impact.