CORANGAMITE CMA SALINITY ACTION PLAN

Identification and management of salinity

Australian Government

Victoria
The Place To Be

CORANGAMITE CMA
HEALTHY CATCHMENTS - HEALTHY WATERWAYS

Produced for the Corangamite Catchment Management Authority by the Victorian Department of Primary Industries

Cover Photo:
An example of a salinity discharge site.
Photo by Peter Dahlhaus.

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Contents

What is salinity?

Salinity usually refers to a significant concentration of mineral salts in soil or water as a result of hydrological processes. Salinity accumulates through ***salinisation***, which is the process by which land or water becomes affected by salt.

- Land salinisation occurs through the accumulation of salts in the root zone and on the soil surface, usually by the evaporation of saline groundwater from shallow watertables.

- Water salinisation occurs through an increase in the concentration of salt in the water, usually by the removal of fresh water through evaporation, harvesting or diversion.

In some landscapes, the processes that cause salinity have been present for many hundreds or thousands of years, resulting in the formation of salt lakes and salt pans that are considered ***primary salinity*** sites.

In other landscapes, salinity processes have been induced as a result of changed land use or water use, resulting in the emergence of ***secondary salinity***.

The distinction between primary and secondary salinity is important. Primary salinity sites may include semi-permanent or permanent saline wetlands, many of which are highly valued ecosystems or environmental assets.

By contrast, secondary salinity is rarely regarded as an asset and is generally seen as a threatening process.

Both primary and secondary salinity can be a threat to a variety of assets. Salinity can restrict the growth of plants in agricultural production, parks and gardens; it can destroy building foundations, sewer pipes and road materials; and salinity can corrode water pipes and telecommunication cables. The quality of urban water supplies can be degraded by salinity and remediation requires expensive treatment. Environmental and recreational values of waterways, lakes and native vegetation can also be lost through salinisation.

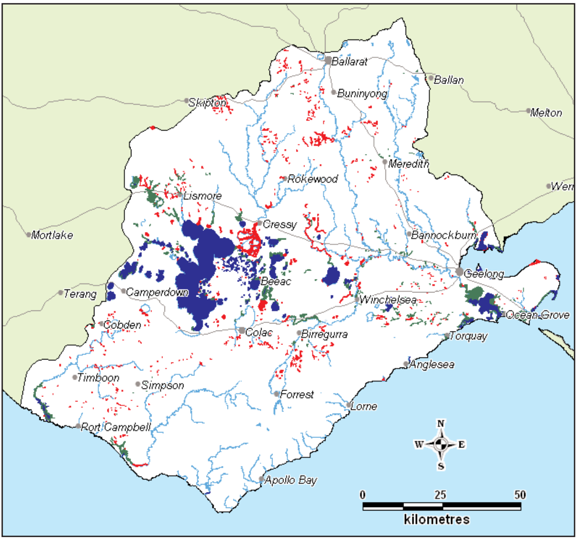


Fig 1: Mapped salinity in the Corangamite region.

The origins of salinity in the Corangamite region

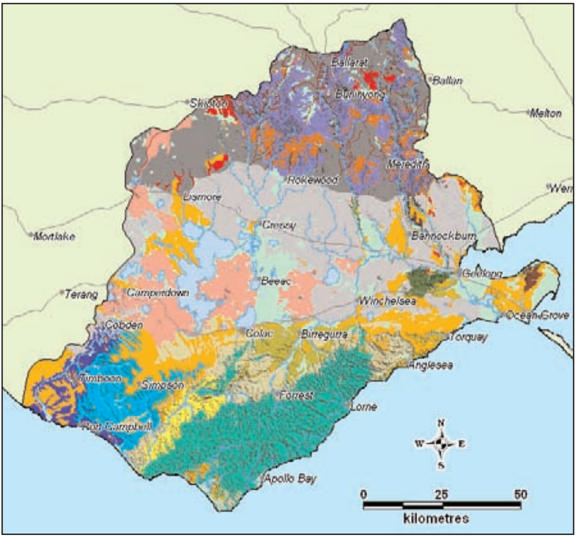
To a large extent, the salinity processes in the Corangamite region are related to groundwater processes. There are believed to be 17 groundwater systems in the region and these fall into three categories:-

- **Local:** groundwater flows over distances of less than 5 kilometres within the confines of surface water sub-catchments

- **Intermediate:** groundwater flows over distances of 5 to 30 kilometres and may occur across sub-catchment boundaries

- **Regional systems:** flow occurs over distances exceeding 50 kilometres at the scale of river basins.

Groundwater is present in all the landscapes and moves slowly through the various geological materials under the influence of gravity. Rainwater soaks into the ground and the portion that is not evaporated from the soil or used by plants continues down to recharge the groundwater store. Groundwater moves slowly from the higher elevations to the lower parts of the landscape where it discharges onto the ground surface as a seep or spring, or into the base of a stream, lake or wetland. The path from recharge to discharge may be a few metres or tens of kilometres, and the travel time may be days, months, years, decades, centuries or millennia. A small quantity of salt is present in the initial rainwater and more is accumulated as the groundwater travels along the torturous path through the soils and rocks. At the location where the groundwater discharges from the system, the water is evaporated or used by plants, but the salt is left behind.



Groundwater flow systems

Local systems

- Quaternary sediments
- Scoria cones and stony rises
- Highlands gravel caps
- Heytesbury marl
- Gerangamete marls
- Otway Group - Barrabool Hills
- Granitic rocks
- Older volcanics
- Otway Group - Otway Ranges

Intermediate systems

- Pliocene sands
- Wiridjil Gravels
- Palaeozoic sedimentary rocks
- Central Highlands volcanics

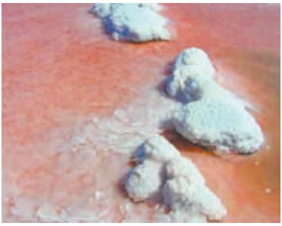
Regional systems

- Volcanic plains basalt
- Deep Leads
- Port Campbell Limestone
- Dilwyn Formation

Fig 2: Groundwater flow systems of the Corangamite CMA Region.

How is salinity recognised?

In wetlands and waterways, salinity can be sometimes be recognised by the salt crystals that are left behind when the water evaporates. However, in most cases the salinity is not as obvious and may be more difficult to spot with the untrained eye. For example, the salinity in West Basin, a small crater lake near Pirron Yallock, is three times saltier than the sea, but there is no obvious salt to be seen.



Salt crystals formed on the bed of Lake Weering are an obvious sign of salinity.

A fringe of salt can be seen along the banks of the Cundare channel.

Although not obvious, West Basin is three times saltier than the sea.

Salt water in a tributary to Naringhil Creek is about half as salty as seawater.

Fig 3: Examples of water salinity in the Corangamite region.

Because water salinity is not always apparent, the most common method to confirm salinity in water bodies (lakes, wetlands, waterways, reservoirs, farm dams) is to measure the salinity using a meter, or where appropriate, by taste.

Soil and land salinity. By comparison, the most common way to recognise soil and land salinity is by looking at the plants and condition of the soil. Some plant species, termed halophytes, have adapted to saline soils. These species are often seen at the coast and include succulents such as Beaded Glassworts and herbs such as Sea Celery. In agricultural land where secondary salinity has developed, the most common vegetation indicator species are Buck's-horn Plantain, Water Buttons and Sea Barley Grass.

S1 salinity at Pittong. Spiny Rush and some deterioration of pasture is evident.

S2 salinity at Inverleigh. Salt tolerant plants abundant and the land cannont be cropped.

S3 salinity at Mt Mercer. Salt tolerant plants dominate and bare ground is evident.

S4 salinity at Werneth. Only a few very salt tolerant plants survive in the saline soil.

Fig 4: Examples of land salinity in the Corangamite region.

Land salting

Land salting, is the most obvious manifestation of salinity in the Corangamite region. There is an estimated 17,250 ha of land salting, occurring at 1,500 locations in the landscape. The most recent estimate suggests that just over half the mapped salinity is primary in origin. If the integrity of this natural salting is intact, these areas need to be viewed as environmental assets.

Primary and secondary salinity occur on both private and public land. Much of the land salting is associated with the foreshores of the extensive lake and wetland complexes throughout the region. The latest estimates of land salting in the Corangamite region by type and ownership are:

Type of salinity	Saline sites (number)	Public ownership (hectares)	Private ownership (hectares)	Total salinity (hectares)
Primary	422	2241	6942	9183
Secondary	1075	1062	7022	8084
Total	1497	3303	13964	17267

Table 1: Number and area of land salting by ownership and type

Saline wetlands

In terms of area, saline wetlands are the most extensive expression of salinity the Corangamite region. Approximately 72% of the salinity in the region occurs as semi-permanent or permanently saline wetlands. Most wetlands receive a considerable volume of groundwater discharge, such that they vary in their salinity range from brackish to hyper-saline.

The location of saline wetlands in relation to the primary and secondary land salting is illustrated here.

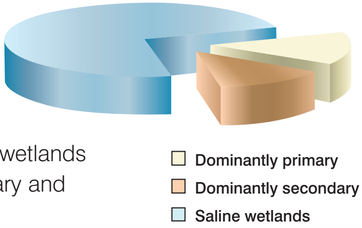


Fig 5: Proportion of the salinity types.

Salinity hazards and risks

Identifying the salinity risks (or hazard assessment) requires an analysis of what can happen, where in the landscape it's likely, and when it could occur. As an example, in undertaking any works that change the landscape or land-use it is recognised that there are two possible salinity risks:

- the potential impact of salinity on the works or development being undertaken at a site,
- the potential impact of the works or development at the site on salinity elsewhere in the catchment.

Thus, there are potentially five situations that need to be considered:

1) Areas currently affected by secondary salinity. If works are being undertaken in a saline area the salinity might affect the success of the job. For example, a road constructed through a saline site will need to be designed to resist attack by shallow, salty groundwater.
2) Areas of primary salinity regarded as an asset. Works undertaken in an area where salinity is the asset (a saline wetland for example) will need to ensure that the processes causing the salinity are not affected.
3) Areas not currently affected by salinity, but with a likelihood of experiencing secondary saline groundwater discharge within a given time-frame. The success of works in areas with shallow saline water tables might not be very long if the water tables rise and bring salt to the surface.
4) Areas where inappropriate land-use or development may adversely impact on primary salinity assets. Works near a saline wetland or ecosystem that depends on shallow saline groundwater need to ensure that they don't affect the salinity processes keeping the environment healthy.
5) Areas where development or inappropriate land-use may ultimately initiate or exacerbate secondary salinity elsewhere in the landscape. As an example, irrigation of sporting grounds, parks and gardens situated on a local groundwater system may ultimately create salinity in low-lying areas in the catchment in a few decades.

The impact of salinity to the Corangamite region

Salinity threatens the economic, environmental and social assets of the Corangamite region.

Economic threats:

- urban water – costs are borne by households and industries. For example, the current salinity of 700 EC (after treatment) at the Lal Lal Reservoir costs urban water users approximately $8.1M per year. By 2010 it is expected that the EC will reach the upper limit of Australian Drinking Water Guidelines water users would be facing a cost of approximately $9.2M per year, a difference of $1.1 million.
- agricultural productivity - more than 8,000 ha are affected by secondary salting, mostly on private land primarily used for grazing and broad acre cropping, where salinity is reducing potential yields by as much as 90%.
- infrastructure such as buildings, roads, railways lines and utilities including telephone, electricity and gas are currently threatened by salinity-
    - land - the City of Colac is currently confronted with proposed development of peri-urban areas on the southern fringe of the city being subdivided for urban housing. This area has existing land salting and rising watertable.
    - Roads - 61 km of sealed and unsealed roads are currently salt affected
    - telephone, electricity and gas conduits currently adopt preventive salinity measures to protect their assets, but this comes at an increased cost.

Environmental threats:

- surface waters in wetlands, lakes, rivers and streams - the Barwon River, Lake Corangamite and Moorabool River basins
- 6,400 ha of very high and high conservation significance vegetation intersect with mapped salinity. In some cases, the presence of salinity may be critical to the stability of these vegetation areas, such as halophytic herblands, but in other locations, secondary salting is likely to threaten salt sensitive vegetation classes.

Although salinity has not been directly linked to the social assets in the Corangamite region, it would be fair to assume that there is a connection. Population and land use change will be influenced by salinity through poor water quality for urban use, degradation of the recreational values attached to waterways and wetlands and degraded vistas with increasing land salting. Lower productivity from agriculture and possible re-location of industry because of high salinity in water has the potential to reduce employment and economic activity.

Determining the risk

To determine the salinity risk, both the **likelihood** of salinity impacting on an asset and the **consequence** of that impact on the asset need to be estimated. These can be assessed separately or combined. The alternatives are described in the Manual. The following example combines likelihood and probability.

The risk is then described as a function of the likelihood and the consequence. Once defined, these are assessed via a matrix:

Likelihood	Risk Consequence			
	Major	Major	Moderate	Minor
Probable	Very high	Very high	High	Moderate
Possible	High	High	Moderate	Low
Improbable	Moderate	Moderate	Low	Very Low

Table 2: Example matrix for determining the level of risk (based on HB 346:2004).

Alternatively, the level of risk can be calculated as a probabilistic equation. This is detailed in the Manual.

Further information

Contact your Supervisor who will have access to more detailed information on salinity from the Corangamite Catchment Management Authority.

Additional information also available on the CCMA Soil Health website at **www.ccma.vic.gov.au/soilhealth**

Acknowledgement: Much of this information has been sourced from other documents and full reference is given in the accompanying training manual.

The Corangamite Soil Health Strategy and associated background reports contain a great deal of information on salinity. This can be accessed at **www.ccma.vic.gov.au/soilhealth**

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For further information on Soil Health in the Corangamite region:
www.ccma.vic.gov.au/soilhealth

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