LAND USE PLANNING and URBAN SALINITY

LOCAL GOVERNMENT
SALINITY INITIATIVE

Contents

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Introduction

Salinity in urban areas is increasingly recognised as an issue that can potentially cause significant economic, environmental and social costs in many areas of NSW. Urban salinity indicators are evident in many local government areas including small towns, regional centres and parts of metropolitan western Sydney.

Land use planning and thinking strategically can play an important role in minimising the economic, environmental and social impacts of the interactions between development and urban salinity. This booklet explains some of the opportunities and benefits of addressing urban salinity through the land use planning and development assessment process. Other booklets of the Local Government Salinity Initiative series outline urban salinity indicators, investigations, processes, impacts and costs of urban salinity.

Salt and water are entering the brickwork from the ground. Evaporation results in the formation of salt crystals. These exert pressure on the bricks so that grain by grain the brick crumbles.

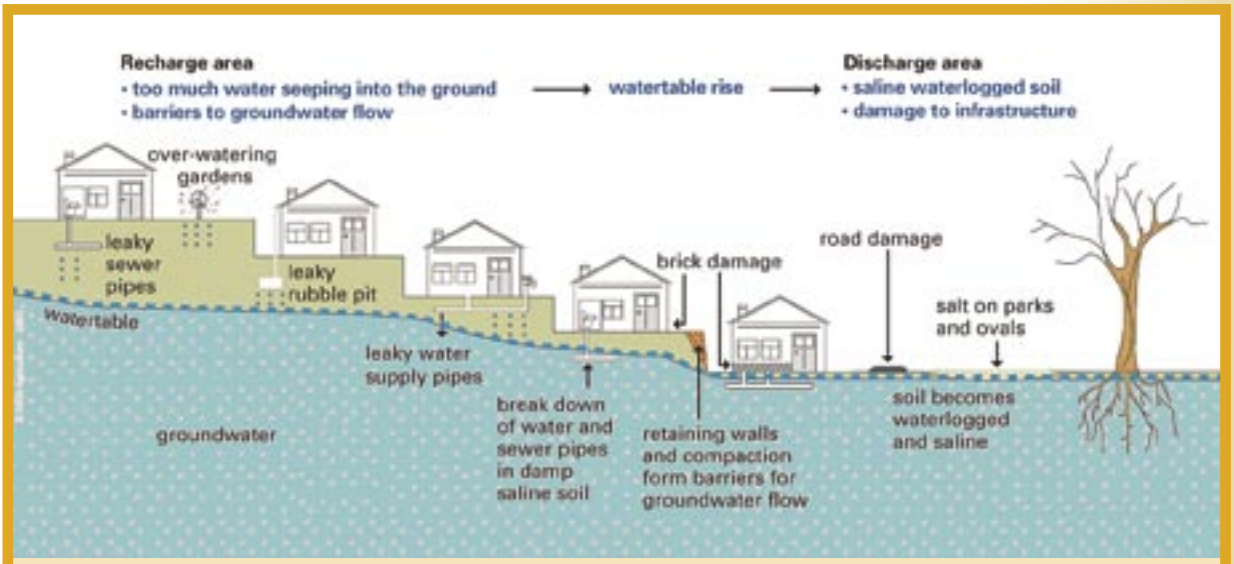
What is Urban Salinity and Where Does it Occur?

'Urban Salinity' is the term used to describe landscape processes and impacts associated with salts and water in, or as a result of, urban land uses. Urban salinity can impact on proposed or existing development. Development may also have an impact on landscape processes and therefore the expression of salinity.

Salinity is a dynamic process with the potential for the movement and accumulation of salts to change over time as a result of past, present or future land uses and management. The landscape may respond to these changes slowly or quickly. The location of the impact may be close to or distant from the cause, depending on the landscape characteristics.

Urban salinity predominantly occurs where the natural physical characteristics such as soils, geology and climate result in what is referred to as a salinity hazard, that is, the natural predisposition of the landscape to salinisation. Common impacts of salinity on urban development include:

- decreased life span of some bricks and concrete structures
- increased road failure
- waterlogging
- decreased water quality.



This diagram by NSW Department of Primary Industries illustrates many of the ways development may impact on landscape processes and how development may be impacted by salinity processes.

Vegetation has varying levels of tolerance to salt and water. In this case grass is turning yellow and dying. Plant death results in decreased soil health and increased erosion potential. Salt and water also affect the soil through changes to micro-organisms, nutrient cycling and structure.

Water affects the stability of the layers that support a road, while the concentration of salts through evaporative processes physically and chemically react with the construction materials.

Metal pipes, taps, tanks and fences rust quicker in a saline environment. Permeable cement also allows salty water to penetrate so that the reinforcing steel within the cement rusts. Over time the strength given to the cement by the reinforcing is diminished.

Unless undertaken in a salinity sensitive manner, residential, rural residential, commercial, industrial, recreational and other urban land uses may result in salinity issues in areas with even a low salinity hazard. This is because urban land uses can have a large impact on salinity processes. For example:

- exposure of saline subsoils through deep site cuts and earthworks
- changes to the water cycle through various components of potable water, stormwater and sewerage systems
- changes to surface and subsurface natural drainage patterns.

Typical slab on ground construction requires earthworks to establish a level site for the house. Retaining walls may affect natural groundwater flow. Terraced areas may be made of saline soils. The house slab prevents evaporation from the soil surface while increasing the opportunity for salty water to enter the structure.

Irrigation of sporting fields, golf course, parks and gardens may supply more water than the plants can effectively use. Excess water leaks past the root zone and enters the groundwater system. A soil profile wet from irrigation also has less storage capacity for rainfall .

This photo illustrates the extensive earthworks that are sometimes undertaken for urban development. This may expose saline or sodic subsoils, result in these soils being dumped in other locations and may also interfere with natural surface and subsurface drainage patterns.

Land Use Planning Tools

Urban salinity affects both urban development processes and natural resource management. Therefore a salinity management strategy may involve a potentially complex relationship between various laws, policies and plans. For example:

- trees planted to control groundwater levels and expression of salinity may be protected through provisions of the Environment Planning and Assessment Act 1979, the Native Vegetation Act 2003 or, where providing habitat for vulnerable or endangered species, through the Threatened Species Conservation Act 1995
- salty groundwater extracted to protect infrastructure may require an extraction license under the Water Management Act 2000 and must be disposed of in accordance with the Protection of the Environment Operations Act 1997. Disposal must also comply with the Local Government Act 1993, which prevents disposal of salt water into sewerage systems.

Various regional plans may also exist within or parallel to this legislative framework, for example, regional catchment action plans developed by catchment management authorities.

The links between land use planning tools and other activities and responsibilities of council may also need to be considered, for example:

- infrastructure programs
- education and awareness programs
- monitoring programs such as water quality and groundwater levels
- plans of management for community land, parks and reserves
- stormwater management plans
- wastewater management plans
- section 94 plans and contributions.

The challenge for land use planners is to ensure that at each stage of the planning and development process there are appropriate and consistent salinity measures that recognise local and regional variability in salinity processes and development practice.

Aesthetically pleasing, low maintenance waterwise landscaping in public areas help utilise groundwater and encourage waterwise gardens on private property.

Salinity indicator plants, salt crystals, groundwater seepage and poor soil structure are evident in this stormwater easement through an industrial area. Tree planting will help lessen the impacts of salinity processes while providing other benefits such as habitat.

Compaction during road and house construction may impact on the lateral flow of water. Salt crystals and salinity tolerant vegetation beside the road, as in this photo, may indicate this process.

Land Use Planning Decisions

There is a variety of resources available that can be referred to for information relevant to urban salinity, including dryland salinity hazard datasets, aerial photos and studies of dryland salinity outbreaks, soil data, soil landscape maps, groundwater monitoring and modelling, vegetation maps, water quality monitoring and land capability studies. These resources are described in the "Broad Scale Resources For Urban Salinity Assessment" booklet of this series. Much of the mapping has been undertaken at a broad scale (1:250 000) and therefore is not suitable for identifying salinity at individual sites. This type of information is better used as a strategic planning tool or to trigger other salinity planning responses such as site investigations.

Effective salinity planning responses need to be based on a range of information. This is because salinity expression changes with time and in response to varying land uses and management. Planning responses therefore need to consider how dynamic factors such as land cover and land use interact with more static factors such as geology and soil. To do this it helps to have a conceptual understanding of the salinity processes operating in the locality and also on the site.

Site-specific assessment and investigation may be required as part of the development assessment process, as well as included in strategic planning studies such as the Local Environmental Studies done for rezoning applications. The appropriate types of investigations for urban salinity and their interpretation and evaluation are presented in another Local Government Initiative booklet, " Site Investigations for Urban Salinity."

When considering salinity information in planning responses, planners need to ask the following questions.

1. What information relevant to urban salinity is available? What data gaps exist?
2. Has the information gathered been analysed and interpreted appropriately?
3. Is the information presented relevant to the site and the development proposed?
4. Is further site-specific assessment or investigation required?
5. Has the information been appropriately addressed in the planning responses? (eg Master plan, DCP, Design and construction requirements).
6. Have these responses been picked up in the other relevant development or land and water management plans for the site? (eg Storm Water Management Plan, Erosion and Sediment Control Plan, wastewater management proposals, infrastructure plans).

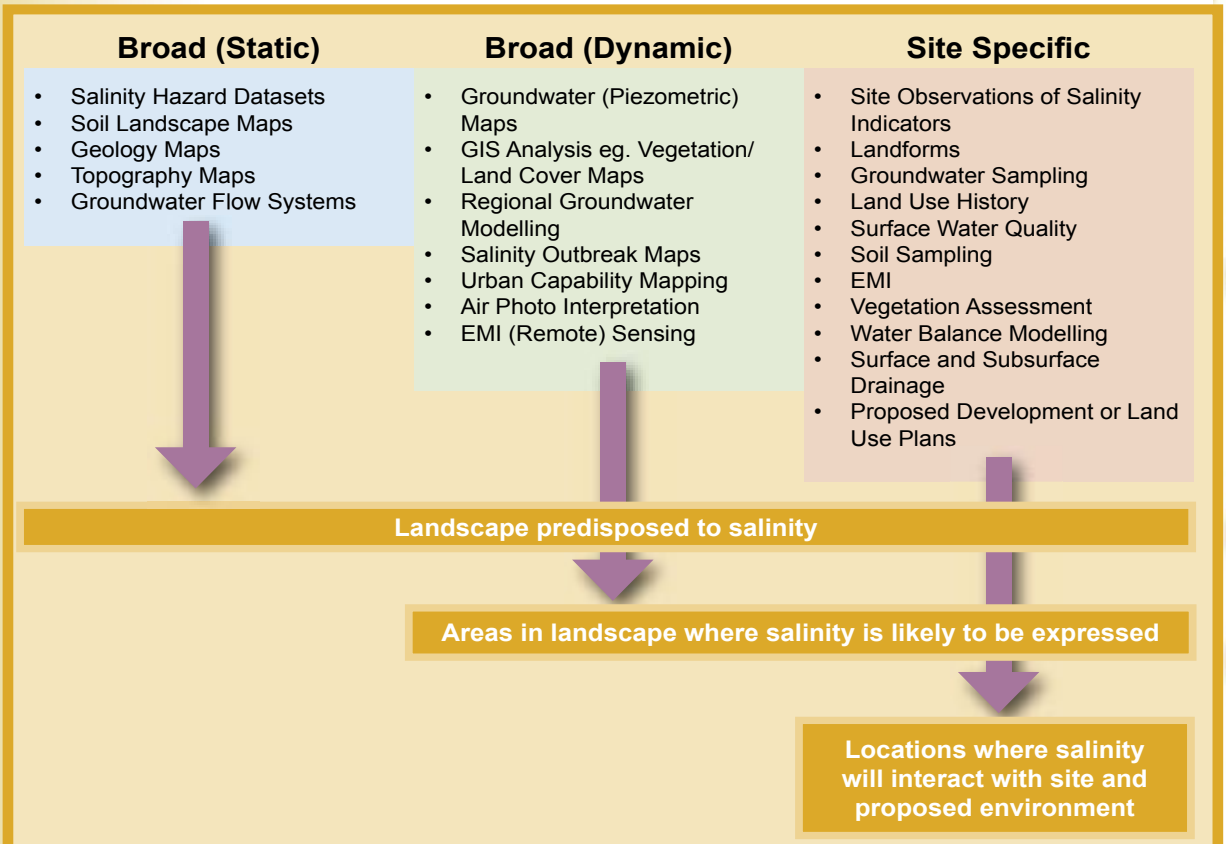


Figure: Salinity resources available for use in developing salinity planning response, and the level of information provided.

Key Considerations

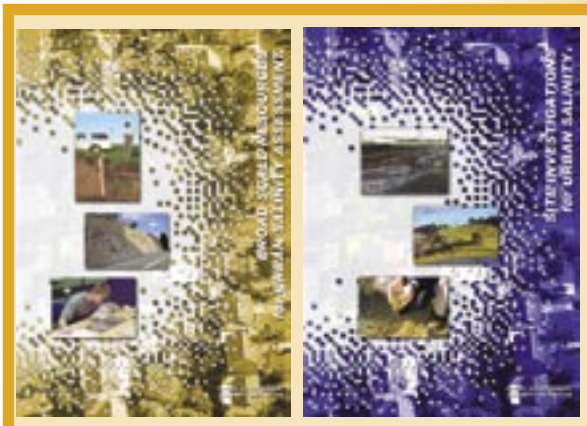
The consideration of salinity in land use planning responses needs to address both the effect of salinity on development, and the impact development will have on salinity.

In addition, planning responses need to address the offsite, long-term and cumulative impacts of the development. For example, the impact of discharging saline groundwater to adjacent land or waterways or the impact of loss of vegetation on the water balance.

Some of the key issues to consider in formulating planning responses to urban salinity are:

1. Salinity may cause substantial economic, social and environmental impacts, for example, damage to infrastructure and private dwellings and decrease in water quality over time.
2. Salinity impacts often develop slowly over long periods. Salinity is usually not static or related to distinct events.
3. It is difficult to predict with certainty the likely nature and location of salinity impacts over time because salinity processes are influenced by land use and land management.
4. Land use planning based responses need to be supported and supplemented by other appropriate measures, such as education and awareness programs. For example, the overwatering of gardens is influenced by block sizes, landscaping codes, the size of water supply systems, water pricing, water restrictions, education and awareness.
5. Information about salinity for urban areas is limited. Information regarding salinity hazards and outbreaks is only available in a broad or regional scale, which is not appropriate for development assessment. Such regional information is not intended for use with urban land use scenarios, which can dramatically change the natural processes and therefore the likely surface expression of salinity.
6. Salinity is one of a range of integrated land and water issues to be considered in planning, and is affected by and affects a range of these issues including soil erosion, vegetation management and water management. Salinity therefore should not be considered in isolation from other land and water issues, and planning responses need to link these issues together effectively.
7. The form and density of development have implications for the expression and management of urban salinity. There are relative benefits of high or low density developments and different styles of development that need to be considered and weighed up for each site and each community.
8. Urban salinity is closely related to ongoing urban water cycle management, which includes natural elements such as soils, drainage patterns and vegetation, and human elements such as stormwater, potable water and sewerage systems. Land use planning needs to address this relationship and recognise that the water cycle includes both above-ground and below-ground water processes.

The construction and maintenance of golf courses may affect urban salinity processes but may also be impacted by salinity processes. Suitable location and management of land uses can be undertaken when there is an awareness and understanding of local and regional salinity hazards and processes.



Local Government Salinity Initiative booklets have been sent to all councils in NSW. Further copies are available from the DIPNR Information Centre and the Department's website, www.dipnr.nsw.gov.au

This is an example of a waterwise home garden in Sydney. Rainfall is used effectively by plants suited to the local conditions and irrigation is not required. Mulch helps prevent evaporation while improving nutrient and organic matter levels in the soil.

Salinity indicators such as flaking paint, mortar, render and bricks may be evident on old and new houses. Some may be caused by other factors such as a leaking pipe.

Land Use Planning Phases

When addressing urban salinity in land use planning it is useful to differentiate between the three land use planning phases, namely the:

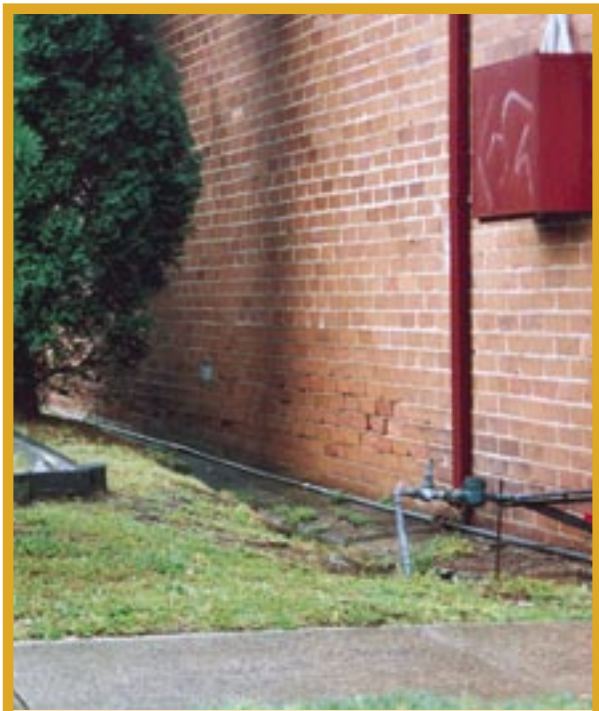
1. strategic or plan making phase
2. development or plan implementation phase
3. management or post construction phase.

The opportunities to address urban salinity are different at each of these phases, reflecting the differences in the scale of the area being considered, as well as the investment and approval decisions required.

The strategic and development phases (ie the first two phases) are the most important in determining the ongoing land use and the likely changes to landscape processes. However the management phase is also very important in determining what the long-term impacts of these changes will be.

It is important to think about salinity throughout the land use planning and development process, and at all relevant phases. Ignoring salinity at any one phase may limit the ability to successfully implement initial measures or to include other appropriate measures at later stages of development.

Salinity cannot be managed effectively by responses limited to any one stage; it requires an integrated approach throughout the life and the scope of land use planning and development for an area.



Water and salt are impacting on the mortar on this wall. Discharge of stormwater directly at the base of the wall is exacerbating the effects of local conditions.

Table 1: Planning stages and the consideration of urban salinity

Planning stage	Planning activity	Geographic scale	Salinity matters to consider
STRATEGIC PHASES (Plan making)	Preparing regional/local strategies (a framework for location of land use and infrastructure)	Regional/local	• Regional salinity processes and land characteristics identified to provide a context for land use decisions.
	Making local plans (provides the framework for development)	Local	• Identify possible limitations on different land uses due to salinity potential. • Identify information required for planning decisions. • Consider salinity when making broad location decisions, for example not placing 'leaky' land uses in recharge areas.
	Assessing subdivision of land (determining the final pattern of land use)	Street/subdivision	• Consider the impact of potential salinity on roads and infrastructure when deciding locations, eg not placing a road where it will impede groundwater movement. • Consider salinity in the pattern and density of land use, eg compare the benefits of a high density development with salt affected areas kept undisturbed to low density with greater opportunity for vegetation on individual blocks.
DEVELOPMENT ASSESSMENT PHASES (Plan implementation)	Assessing development (setting the form, density and character of development)	Lot	• Design development to recognise salinity conditions, the potential impacts on infrastructure and buildings, and off site environmental impacts eg use of salt resistant materials, or the design of a stormwater management system that minimises leakage to groundwater. • Consider measures to protect the development or mitigate environmental impacts, eg opportunities to use revegetation, restoration or groundwater management such as drainage to manage on and off site impacts
MANAGEMENT PHASE	Managing land (how land is used at a site scale)	Site/building	• Consider controls or policies to influence the types of management practices associated with development, such as vegetation removal, landscaping, irrigation, stormwater and wastewater management or drainage. • Options to address salinity at this stage are strongly influenced by earlier planning decisions.

Planning Principles, Aims and Objectives for Urban Salinity

Salinity is a relevant matter of consideration under Section 79C of the Environmental Planning and Assessment Act 1979. Under this section councils need to consider if the development is suitable for the proposed location and the likely impacts of development. However, plans with clear urban salinity objectives facilitate integration of salinity considerations into planning processes.

For example, objectives based on the following points can be incorporated in local environmental plans to integrate salinity management into strategic planning:

1. Minimise disturbance to natural hydrological systems as a result of development and appropriately manage land uses affecting land salinisation and/or those affected by salinity.
2. Regulate and provide guidelines for appropriate land uses and management practices on urban zoned land affected by and affecting salinity, eg groundwater recharge and discharge areas.
3. Ensure that land is used and developed in a manner that does not significantly increase water infiltration to groundwater systems and does not significantly increase salt loads in waterways, wetlands, drainage lines, or soils.

As well as more specific objectives where appropriate, such as:

1. Minimise damage to buildings and infrastructure in urban areas caused by salinity.
2. Ensure that the off-site impacts of any development on groundwater and salinity are recognised and assessed.
3. Recognise environmental values that are affected by salinity, and specify targets for these values, eg tree cover based on land class.
4. Retain or restore native vegetation on sites with high groundwater recharge potential, or where protecting salt affected land.

This undeveloped property in an industrial estate has salt crystals on the soil surface. These are only visible when rain, dew and other forms of moisture are insufficient for the salt to be dissolved.

In making a decision in an area with salinity potential it is important to address not only the impact that salinity may have on the development proposed, but also whether the proposed development is likely to contribute to local or regional salinity processes. This could include likely salinity impacts on the site itself or on other sites because of changes to the landscape processes and water balance.

Another important part of the development assessment process is considering the need for conditions of consent, which may require certain actions to be undertaken or certain standards achieved. These could include:

- Requirements for salt resistant building materials and techniques.
- Limitations to the types of wastewater treatment or re-use on-site due to the potential for these processes to bring additional salt onto the site.
- Limitations on the types of on-site stormwater management techniques in order to minimise the amounts of groundwater recharge occurring.
- Controls on the depth of cut and fill or areas of excavation allowed on the site to avoid disturbing areas of saline sub-soils.
- Requirements for vegetation retention or restoration.
- Requirements for remediation of salt affected areas or ongoing monitoring.

Salt and water have affected the paintwork and mortar on this property. Exposure class bricks and mortar are more resistant to the impacts of salinity.

Future Directions

Urban salinity is a complex issue that results from the interaction between natural processes and urban development processes. Considering salinity in urban land use planning and development assessment decisions needs to become normal practice in many parts of NSW.

Planners in local government and in state government agencies will need to:

1. Consider the need to incorporate suitable provisions in LEPs and other planning documents to allow salinity to be properly considered in decision-making.
2. Recognise the range of planning tools that exist and look at the opportunities to use these effectively to address urban salinity.
3. Access the range of information available about urban salinity to improve the way in which it is addressed in the planning process.

This salt scalded paddock is in an area earmarked for future urban expansion. Consideration of salinity at all stages of the land use planning process, as well as maintenance of established properties, will limit adverse impacts of salinity on development and of development on the salinity processes.