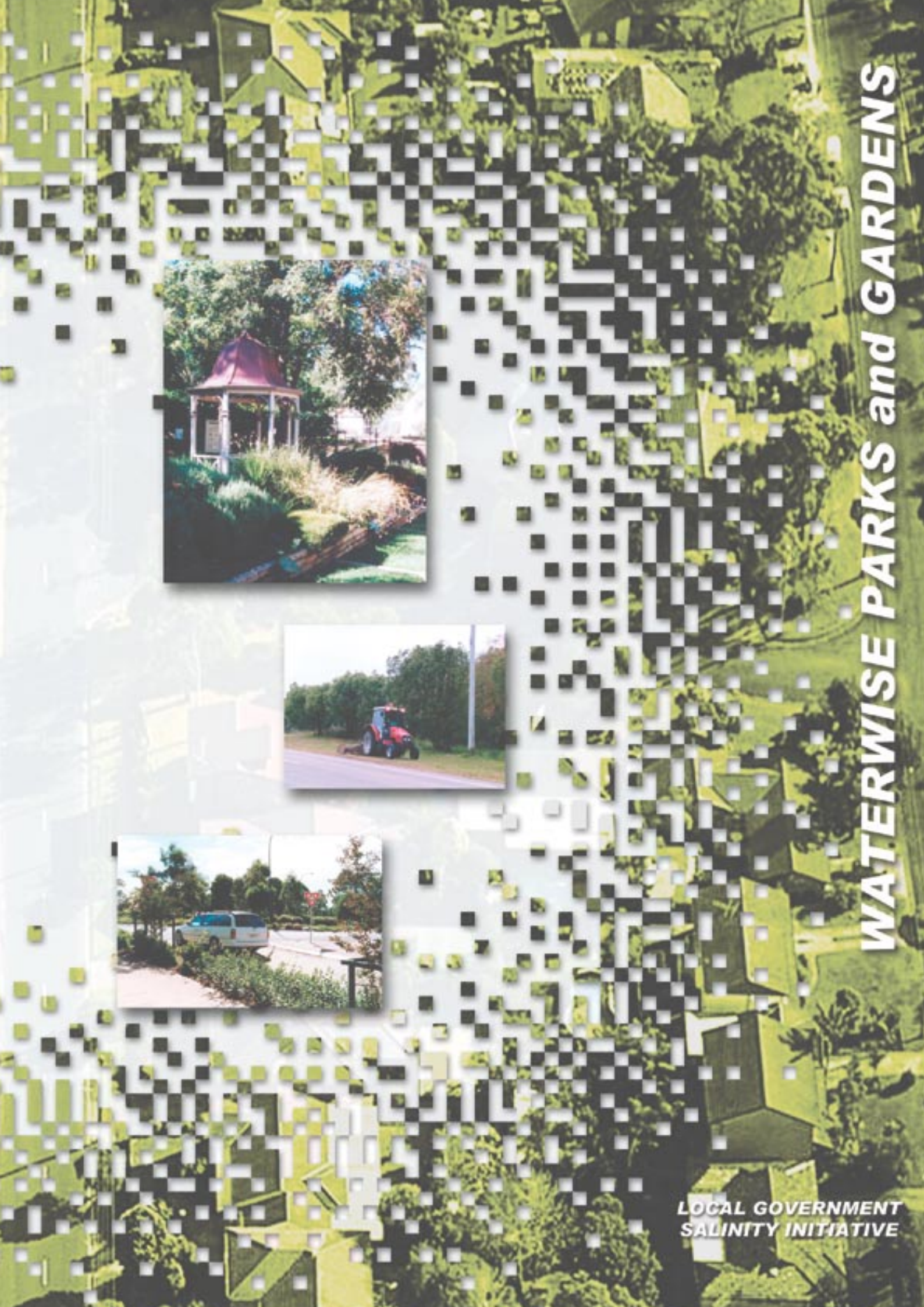

WATERWISE PARKS and GARDENS

LOCAL GOVERNMENT
SALINITY INITIATIVE

Contents

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Waterwise Parks and Gardens - Introduction

Salt is a natural part of the Australian landscape but human intervention can affect the movement and storage of salt in the environment. Urban salinity is a complex issue whereby the unnatural redistribution of salts in and above ground can have an adverse impact on our urban environment.

By understanding the processes of urban salinity, we can better manage resources and take preventative measures to limit the costs that result from salinity damage. One way of doing this is by creating sustainable, water-efficient landscapes.

This booklet is part of the Local Government Salinity Initiative (LGSI) series. It provides information on 'waterwise' practices that can be employed when public areas are created and maintained for recreation and aesthetic appeal.

Other LGSI booklets cover the appearance of salinity, site assessments for salinity, building in a saline environment, and roads and salinity.

Being 'waterwise' requires the incorporation of three principles in the design, implementation and maintenance of landscapes:

1. minimising the application of water;
2. incorporating vegetation that uses rainfall efficiently; and
3. reducing direct evaporation from the soil surface.

By adopting 'waterwise' practices we may decrease the incidence and severity of urban salinity and save local government millions of dollars.

Savings can be made through:

- reduced irrigation costs;
- reduced costs associated with maintaining salinity-affected green space;
- elimination of the costs associated with relocation of some recreation activities;
- reduced costs associated with the repair and maintenance of infrastructure affected by salinity;
- improved water quality; and
- improved biodiversity.

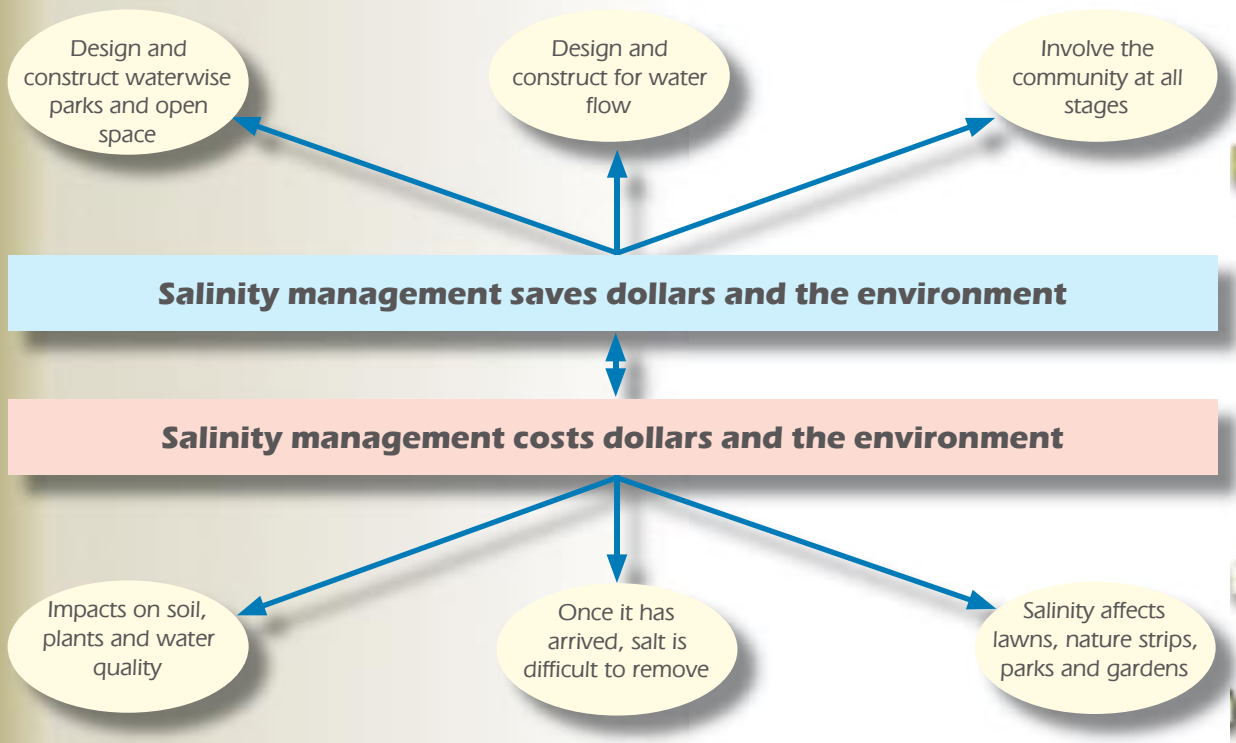
Public parks and gardens benefit from the adoption of 'waterwise' practices, as do roundabouts, nature strips and drainage areas which can be designed under the same principles. Local residents may also be inspired to adopt 'waterwise' practices after learning from these demonstration areas.

'Waterwise' roadside planting. Photo: DIPNR

Car park tree plantings provide shade and utilise soil moisture. Photo: DIPNR

Streetscape planting can include 'waterwise' strategies. Photo: DIPNR

Understanding the Costs and Benefits of Salinity Management



Salinity can adversely impact on parks and gardens and the environment. Effective salinity management can help avoid these costs but may take knowledge, time and dollars to implement.

Diagram courtesy of Tony Hepworth from Wagga Wagga City Council.

How are Parks and Gardens Affected by Salinity

The Impact of Salinity on Plants

Salinity is a complex process involving the movement and accumulation of salt and water in the landscape above and below the soil surface. The processes that cause land to become saline are highly variable and differ between locations, but whatever the circumstances there are three main effects on plants.

1. **Osmotic effects** - The accumulation of salt in the plant root zone affects the ability of plants to draw water out of the soil. When the concentration of salt in the soil is higher than the concentration of salt in the cells of the plant, the plant's ability to absorb water is greatly reduced, even when there is plenty of water in the soil. This leads to dehydration or wilting in plant leaves and stems.
2. **Toxic effects** - Plants need water to carry out metabolic processes like photosynthesis (food production). As plants absorb water, small quantities of salts dissolved in this water also enter the plant cells. This salt is concentrated in the plant cells and eventually becomes toxic.

   Different types of salt affect plants in different ways. They may affect structural components or inhibit plant processes. For example, an excess of bicarbonate will stunt plant roots while other salts cause the leaf tips of plants to turn yellow.

Salt toxicity in citrus. Photo: NSW Agriculture

3. **Waterlogging** - Areas affected by salinity are often also affected by waterlogging. Waterlogging occurs when the air pockets in the soil surrounding the plant root zone fill with water. This limits the amount of oxygen available to the plant. A lack of oxygen in the soil also inhibits the activity of micro-organisms and prevents normal plant function. This may cause symptoms such as stunting, discolouration of foliage, defoliation and wilting. These symptoms are very similar to those caused by excess salt.

Characteristics of Salt-tolerant Plants

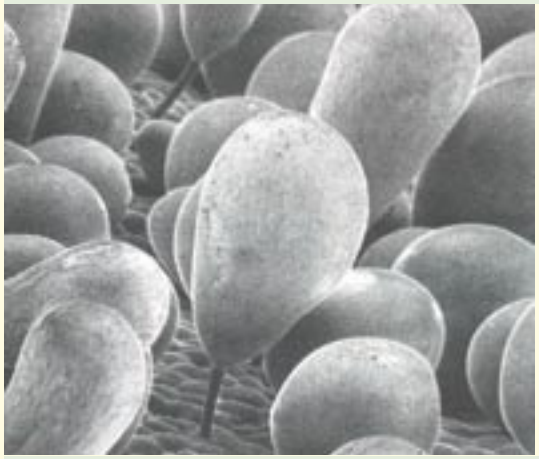
Halophytes are plants with the ability to cope with salt. The amount of salt they can tolerate varies. Halophytes occur naturally in mangroves and swamps, in areas affected by salt spray, along the seashore and in areas with salt-affected soils. Some halophytes grow only in salty habitats. Their salt tolerance is facilitated by physiological and biochemical adaptations which keep the protoplasm of living cells intact as salt levels increase. Other halophytes can cope with salty soils but do best in low-salt conditions. These plants avoid salt by means of structural and physiological adaptations that exclude or minimise salt accumulation in the essential organs of the plant.

Adaptations include:

- **Succulence** - Succulent plants have fleshy leaves that contain a high proportion of water. This water dilutes salt, keeping salt levels low within the plant.
- **Short life cycle** - Some plants have adapted to complete their life cycle before the salt level becomes toxic.
- **Root filtering** - Some plants, such as mangroves and some grasses, have a greater osmotic pull or ability to take up water from saline soils, and by this means salt is prevented from entering the roots of the plant.
- **Salt glands or pumps** - Salt glands direct salt to intercellular spaces, or pump it to organs that secrete salt through specialised cells at the leaf surface. For example, some saltbush have special glands that concentrate salt and pump it to expandable

bladders attached to their leaves by thin stalks. These bladders burst to release the salt when they are full.

(a) Saltbush



(b) Bladders that collect salt
Pictures: *Raven et al. (1992) Biology of Plants*

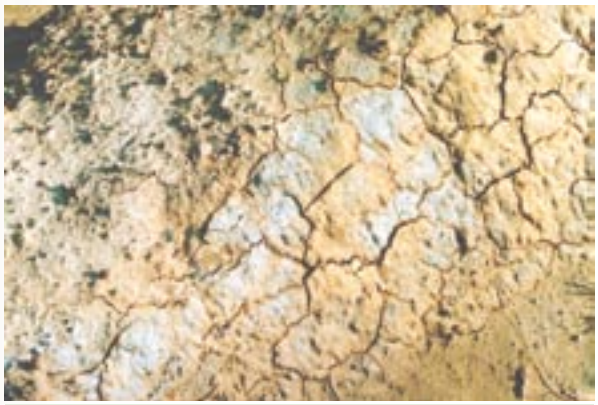
The Impact of Salinity on Soil

To fully appreciate the impact salinity can have on soils, it is important to realise that many natural processes are interrelated.

Salinity can change soil structure, chemistry and productivity. This can affect plant growth, which in turn alters soil structure, chemistry and nutrient levels. Soil properties and vegetation cover can influence the rate at which water infiltrates the soil as well as a plant's capacity to utilise the available soil water or cope with the stress of excess salt.

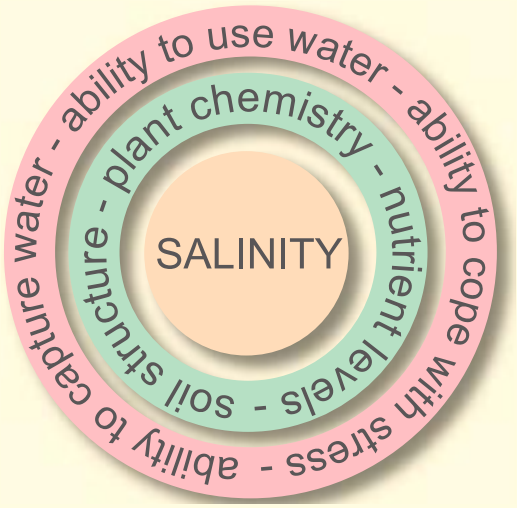
Salt causes chemical and physical changes in soil properties. For example:

- Healthy soils encourage vigorous plant growth and support a wide range of micro-organisms. This increases organic matter and improves soil structure. When soil becomes saline, plant and micro-organism numbers decline to the detriment of soil structure. Nutrient levels may also decline and waterlogging may occur.
- Surface soils high in sodium (sodic soils) disperse when saturated by rain, then dry to form crusts that inhibit air, water and root penetration.



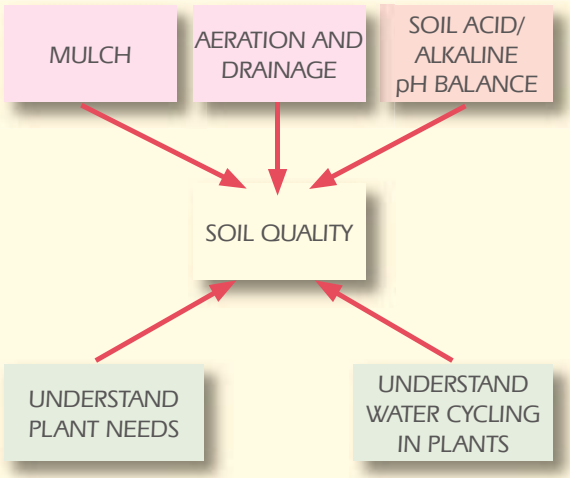
Soil crusting and salt accumulation at the soil surface. Photo: DIPNR

The Impacts of Salinity on Plants and Soils



Salinity influences soil properties which in turn impacts on plants. Diagram courtesy of Tony Hepworth from Wagga Wagga City Council.

The Importance of Soil Quality



Various factors influence soil quality. An understanding of soil quality is needed to understand plant needs and water use.

Diagram courtesy of Tony Hepworth from Wagga Wagga City Council

Signs of Salinity in Parks and Gardens

Some of the signs indicating that salinity is affecting plants and soil in parks, gardens, reserves, sports fields and other areas of green space in the urban environment are:

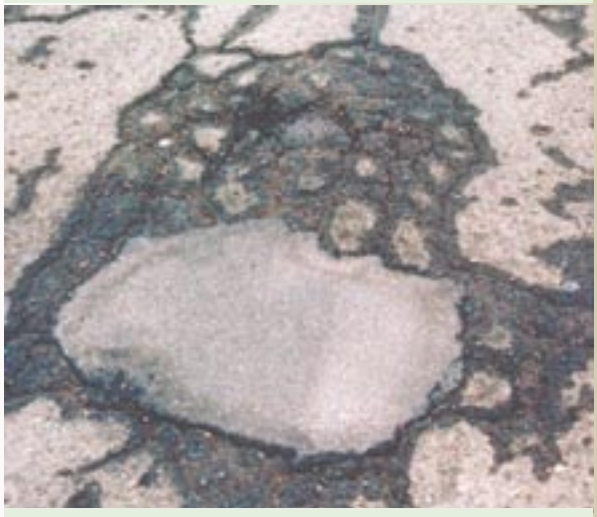
- salt crystals on the soil surface;
- vegetation changes as salt-sensitive plants die leaving only salt-tolerant plants;
- the death of vegetation as the salt content of the soil rises;
- the formation of uneven surfaces caused by the compaction of soil as it is continually being wet and dried;
- smelly areas of stagnant water that appear when waterlogging occurs;
- lawn mowers becoming bogged in wet patches that will not dry;
- slippery areas forming where there is constant water seepage onto concrete;
- salt crystals appearing on sprinklers;
- rusting of metal railings and fence posts;
- crumbling of bricks and mortar on toilet blocks and change rooms;
- premature breakdown of asphalt in parking areas;
- erosion due to loss of vegetation and changes in soil structure;
- increased runoff due to high water tables, decreased vegetation or changed soil properties;
- difficulties in establishing vegetation such as grass on sports fields;
- limited pedestrian access due to waterlogging;
- excavations that fill with groundwater; and
- ponds or waterways that become saline and appear clear.

Salt scald at sports ground. Photo: DIPNR

Eroded saline playing field.
Photo: DIPNR

Waterlogged area that has a purpose as a retention basin. Photo: DIPNR

Bricks and mortar affected by salt and water action.
Photo: DIPNR



Premature breakdown of asphalt. Photo: DIPNR

Runoff from site irrigation indicates that the area has been overwatered. Nutrients may be lost and soil structure affected. Photo: DIPNR

Dual Use Drainage and Open Space Areas

In the 1970s, councils in western Sydney introduced the concept of using open spaces for dual purposes: drainage and recreation. Dual use areas provide an economically viable option for incorporating drainage and open space in new release areas. However, because these sites are subject to wetting and drying, they often become prone to waterlogging and salt concentration as water accumulates and evaporates. Salinity therefore affects the water quality flowing from these areas as well as the maintenance and usage of the recreation facilities.

Design of such areas should therefore carefully consider:

- the influence of excavation on salt and water processes below the natural surface;
- the suitability of vegetation species for replanting;
- how to maintain a good vegetation cover; and
- how to avoid importing or concentrating further salts.

Scald in open space area. Photo: DIPNR

Waterlogged soil and bare patch in drainage/open space area. Photo: DIPNR

Open space/drainage area. Photo: DIPNR

Open space/drainage area. Photo: DIPNR

The Impact of Parks and Gardens on Salinity

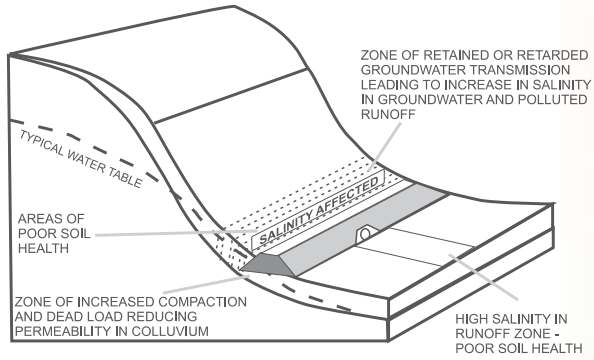
The establishment and maintenance of parks, gardens, sports fields, public amenities and other areas of public open space can also contribute to salinity problems in the urban landscape.

Site Location

Many impacts occur simply as a result of the location of the area chosen. For example, the area allocated as open space may not be considered suitable for construction due to slope, rocks and skyline dominance. These areas often have a significant impact on salinity processes when water seeps into the groundwater system. Alternatively, the open space area may have drainage problems, be close to a creek, or be an area with naturally salty soils. These are areas that are often easily affected by salinity and changes of land use.

Construction

The creation of green space areas often occurs only after the infrastructure has been established. The construction of roads, houses, buildings and much of the other infrastructure found in urban areas requires the use of heavy machinery that compacts soil. Although compaction is necessary to create stability for infrastructure, it removes the air spaces in the soil, making soil solid and less permeable. Compaction may thus exacerbate a salinity problem or transfer it to another location. Water is inhibited from entering compacted areas and this will increase runoff. Water may also build up in areas adjacent to or behind the compacted area if it is on a slope (see the following figure).



Road construction can lead to areas being affected by salinity. Source: *"Practical Measures Within Road Reserves to Avoid Development of Catchment Salinity Problems". Clifton and Porter, 2001*

Soil may also be removed or added to create level areas for sports fields. This can result in:

- excavation of areas that expose saline soils or saline groundwater;
- changes to surface and subsurface drainage patterns; and
- the incorporation of fill containing salt.

Other potential sources of salt include unwashed sands, bricks and pavers made with salty clays and concrete made with salty bore water or bore water used to suppress dust. Building materials stored on salty ground or exposed to salty winds or rain for extended periods may also pick up salts. Further information on this topic can be found in other booklets of the Local Government Salinity Initiative Series including, *Building in a Saline Environment* and *Roads and Salinity*.

On-going Maintenance

The on-going maintenance of green space can also result in salinity problems. For example:

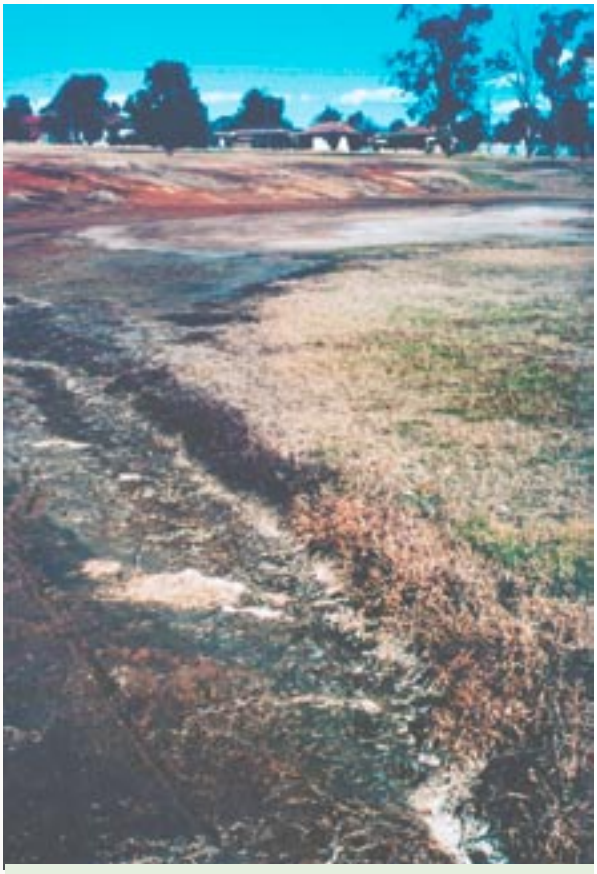
- over-irrigation of sport fields, lawns and planted gardens adds water to the soil profile. This water can accumulate causing waterlogging problems, or it can dissolve salts in the soil profile and bring them to the soil surface where they become concentrated and cause damage;
- dripping taps, leaky pipes and faulty irrigation fittings contribute excess water to the soil and groundwater system;
- irrigation applied while the sun's effect is strongest will encourage high rates of evaporation that can concentrate any salt in the irrigation water;
- recycled effluent used as irrigation water may contain a high concentration of salt;
- excessive amounts of fertilisers that contain salt contribute to salinity problems by adding salts to the soil;
- some fertilisers such as feedlot manure naturally contain high amounts of salt and will therefore contribute more salt than others;
- cutting lawns too short will increase evaporation directly from the soil surface and encourage salt accumulation in this area; and
- introduced plant species may have

different water and nutrient requirements, therefore altering natural patterns in the area.

Overwatered lawn with water flowing laterally down the slope. Photo: DIPNR

By scalping lawn, we encourage water to evaporate directly from the soil surface, resulting in the accumulation of salt. Photo: NSW Agriculture.

Soil exposed to the sun and wind may experience a higher rate of direct evaporation. Photo: DIPNR



Salt accumulation on a playing field. Photo: DIPNR

Management Options

In order to manage urban salinity we must first understand that it is a two-way process. Our activities may cause urban salinity problems and salinity issues may affect our urban areas. By being aware of how plants function and the interactions between water, salt and soils, we can learn how to create water-efficient green space areas that will minimise the problem of urban salinity.

Management options need to be exercised at various stages in the life of a development such as at the time of site selection and site preparation, and when undertaking maintenance.

Site Selection

There is usually little opportunity for the managers of open space to be involved in site selection. However, being involved as early in the process as possible helps insure that issues associated with the history of the site, future maintenance, and preparation for particular recreation types is incorporated as much as possible in the development.

For example, instead of having long, thin ribbons of grassed areas as drainage/ recreation corridors, it may be possible to negotiate wider areas with a range of recreation opportunities, vegetation types, access and views. It may be possible to enclose land for future recreation purposes to prevent damage by heavy machinery or earthworks to existing vegetation.

If boggy sites are selected, allowances for drainage and/or plans for the planting of trees to soak up the abundance of water should be incorporated in the design. Salt-scalded areas may be selected where budget, design and future use allows for remediation of the site to prevent further offsite and onsite impacts.

Awareness of salinity processes – how they affect open space and vice versa – will allow informed decisions to be made about the most appropriate use of and boundary for a site. Preparation and maintenance may also then be tailored to the characteristics of the site, the budget and the intended use of the site.

Codes and Regulations

Several Australian Standards (AS) relating to salinity focus on earthworks and landscaping. However, Australian Standards are only advisory unless called up by legislation, such as the Building Code of Australia, or specified in a job design document.

AS 3798, Guidelines for Earthworks, Commercial and Residential Development, recommends that:

- site investigations should include the identification of areas relating to groundwater
- material containing substances which can be dissolved or leached out be classified as unsuitable for use as fill
- the moisture content of fill not be increased with saline water without field or laboratory trials.

AS 4419, Soils for Landscaping and Garden Use, recommends:

- the use of appropriate labelling of low density and organic soils with an electrical conductivity of 2.5dS/m, or 1.2dS/m for soil blends and natural soils
- labelling with clear information about salinity and the types of plants that will tolerate high salinity
- expert advice be sought for the removal or dilution of salts as various factors such as the amount of salt present, depth and permeability of the soil need to be considered.

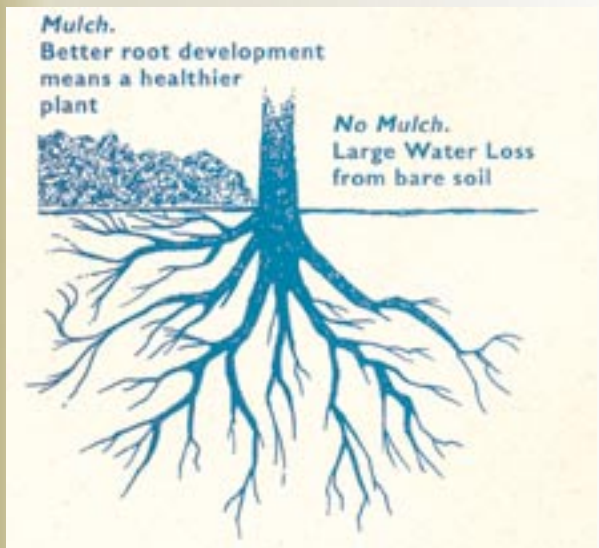
Site Preparation

Preparation of salinity-affected sites may include:

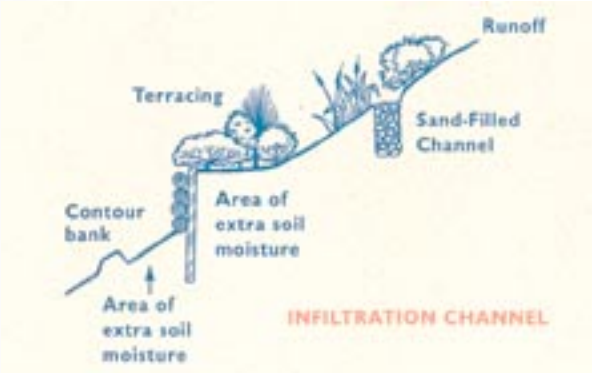
- adding gypsum ($CaSO_4$) to balance the high sodium levels in the soil;
- deep ripping of sodic soil crusts to allow water, air and root penetration;
- adding topsoil to replace soil that has been eroded due to saline conditions;
- raising beds and installing drainage lines to provide areas that are not permanently waterlogged;
- planting while the watertable is low or planting trees around boggy areas first may be options on some sites so that planting does not occur in wet soil;

- mulching to decrease evaporation and thus decrease the concentration of salt at the soil surface;
- mulching to decrease the need for irrigation while the plants are establishing;
- mulching to encourage micro-organisms and soil fauna such as worms that break down organic matter to release nutrients into the soil. Increased organic matter also improves the soil's water-holding capacity so that plants have a longer period in which to utilise soil moisture before it drains past the root zone into the groundwater system; and
- adding mulch, fertilisers and soil conditioners to improve the likelihood of vigorous plant growth. Vigorous plants are more likely to overcome salty or boggy conditions and to maximise use of available rainfall and thus decrease leakage to groundwater systems.

Natural mulch. Photo: DIPNR



Mulch prevents direct evaporation and promotes good plant growth. Brochure image: *How to use water wisely: in your garden (1994).* Prepared by ACT Electricity & Water, ACT Parks & Conservation Service and Public Works & Services.



Cross section of terraced garden area.

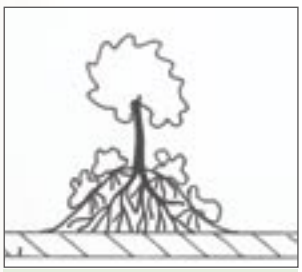
Brochure image: *How to use water wisely: in your garden (1994).* Prepared by ACT Electricity & Water, ACT Parks & Conservation Service and Public Works & Services.

When adding soil to reshape areas or create garden beds or sound barriers it is important to ensure that water flow, both lateral and vertical, is not inhibited. A mound that is too steep may shed water faster in lateral flow before the water can infiltrate the root zone.

Vertical water movement might be inhibited if soil with a different permeability is used for mounding or is placed over compacted soil. The new soil should be keyed into the existing surface rather than placed over compacted soil. This will help ensure that roots, nutrients, micro-organisms and water can move from the new soil into the former land surface.

All imported soils should be tested to ensure that high levels of salt are not imported into the site.

A lack of water and a restricted root zone may result in stunting and plant death.



Impermeable soil layer. Rootzone of plants restricted to mound.

Impermeable layer removed. Rootzone not restricted.

Mound planting. Photo: DIPNR

Established mound planting. Photo: DIPNR

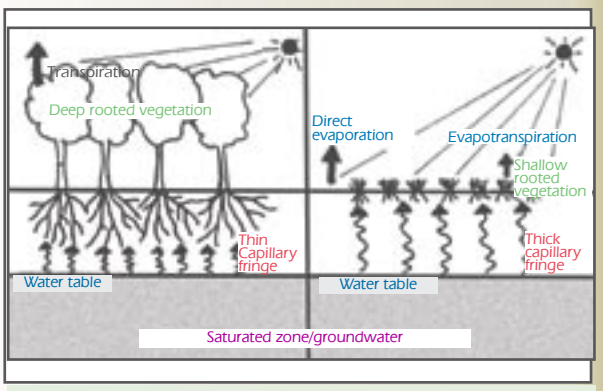
Site preparation should also consider the purpose of the area, as follows:

- What activities are to be conducted in the area?
- Will there be much pedestrian traffic?
- Are there in-ground cables, drainage or sewer lines that could be affected by vigorous root systems?
- Are there overhead powerlines?
- Is the area for entertainment and leisure or does it have a specific function such as a roundabout?

The design of the area and the plants chosen should reflect:

- the site's use;
- climate, aspect and soil properties; and
- the site's potential role in salinity processes and management.

For example, if an area of open space is to be used for aesthetic reasons and to help reduce a rising watertable and does not require extensive turfing as is the case with sports fields, then deep-rooted perennial trees, shrubs and grasses may be appropriate with no watering system employed.



Increase in capillary rise. Deep-rooted vegetation vs shallow-rooted vegetation

Plant Selection

Some areas will require salt-tolerant plants while others will require plants that can also tolerate very wet conditions. Most areas will require 'waterwise' plants.

'Waterwise' plants are those that, once established, do not need constant watering. These plants can make use of rainfall and require little or no further irrigation for their survival. They use most of the available water from rain and this helps reduce leakage to the groundwater system, thus preventing boggy, waterlogged conditions nearby.

Grouping plants according to their water requirements is also important for good water management when getting plants established. If plants are not grouped like this, some plants may not receive enough water and others will be over-watered.

'Waterwise' plants are generally quite hardy and can withstand periods of very little infrequent rainfall. There is a diverse range of plants that can be considered 'waterwise'. Since each region in NSW varies climatically, there is a range of 'waterwise' plants for each area.

Nurseries and garden groups should be able to provide information on 'waterwise' and salt-tolerant plants suitable for the local area.

Alternatively, note which species survive well in the area and plant those.

It is always best to use native plants that come from the local area. These are best suited to the local soils and climate and have the added benefit of providing food, shelter and habitat for local native birds and other wildlife.

Characteristics of 'Waterwise' Plants

Plants have developed a variety of mechanisms to prevent high rates of water loss during dry periods. These can either be physical features of the plant or other adaptations, including:

- long tap roots that enable plants to access water deep in the soil profile;
- water-storing organs that allow storage of excess water for drier periods;
- fleshy leaves which have a high water-holding capacity;
- embedded stomata for minimizing evaporation;
- low stomata numbers for limiting evaporation;
- vertically hanging leaves for avoiding direct sunlight and minimizing evaporation;
- narrow leaves for minimizing stomata through which water is lost;
- hairy leaves for reflecting the sun and maintaining a cooler leaf temperature to minimise evaporation;
- shiny or grey leaves to reflect the sun and minimise evaporation;
- the ability to slow metabolic processes and in some cases to become dormant when temperatures rise;
- production of a large quantity of seed to ensure the survival of the next generation even if the parent plant does not survive the drought;
- self mulching to reduce the temperature of the root zone and minimise water loss from this area; and
- a high oil content that ensures plants need less water.

Lamb's ears are hairy and light in colour, therefore reflecting the sun and minimising evaporation. Photo: DIPNR

The long thin leaves of grass minimise the surface area from which water can be lost. Photo: DIPNR

As a succulent plant, Pigface can store water in its fleshy leaves. Photo: DIPNR

Lawn

Australians have inherited the tradition of keeping a lawn. Historically, a lawn was a status symbol. If you could grow lawn, it meant that you didn't have to grow your own potatoes as you could afford to buy them. Today, a lush green lawn is still valued in public and private green space.

Lawns require a lot of maintenance, time and water. Approximately 80% of all water used in the home garden is used on lawns. Yet many lawn areas get minimal use and could be planted out to groundcovers, shrubs and, in some cases, trees. If this is not possible, there are techniques to ensure that lawns are not exacerbating salinity problems. For example:

- adjust lawn mowers to their maximum (rather than minimum) height to allow grass to grow longer. As a consequence, roots will penetrate deeper into the soil to access water and lawns will require less regular irrigation. An added benefit is that the soil is more protected from the sun so that evaporation, and thus concentration of salts at the soil surface, is limited;
- use a more water-efficient turf. Turf suppliers recommend a number of Buffalo varieties as being very water-efficient, drought-tolerant and suitable for planting in coastal areas exposed to salt winds. Couch is often observed growing around the edges of salt scalds and is therefore likely to be salt tolerant; and
- install an efficient irrigation system. A timed irrigation system connected to water sensors will ensure that water is applied in an accurate manner and overwatering is prevented. Water sensors will detect soil moisture and turn off the irrigation system once soil moisture reaches the required level. Irrigation systems will remain off during periods of rainfall. Irrigation frequency and duration may also be reduced during winter. The level of moisture required will depend on plant needs, soil type and climate, so the irrigation program must be calibrated for the specific site conditions.

Grassed nature strip in an urban area. Irrigation applied to nature strips may overflow into stormwater systems and contribute to groundwater recharge. Photo: DIPNR

Typical urban area with a high proportion of lawn. Photo: DIPNR

Reduced lawn area in a 'waterwise' garden. 'Waterwise' areas minimise mowing, reduce the risk of salinity and increase bird life. Photo: DIPNR

Maintenance

Once urban green space is established, routine maintenance will ensure that it does not become degraded and prone to salinity or adversely affect urban salinity processes. Education of maintenance staff and vigilant monitoring are key elements in ensuring salinity-aware management is maintained.

Routine maintenance carried out by council.
Photo: DIPNR

Urban areas are generally planted with shallow-rooted plants that are largely ornamental in purpose. They have only a comparatively small capacity to transpire water and cannot access water deep in the soil profile. They are often not locally native species suited to the climate, and therefore require watering. Careful watering is required to prevent irrigation water running past the root zone of plants and adding to groundwater sources, including shallow perched water tables.

Aspects of good irrigation practice include:

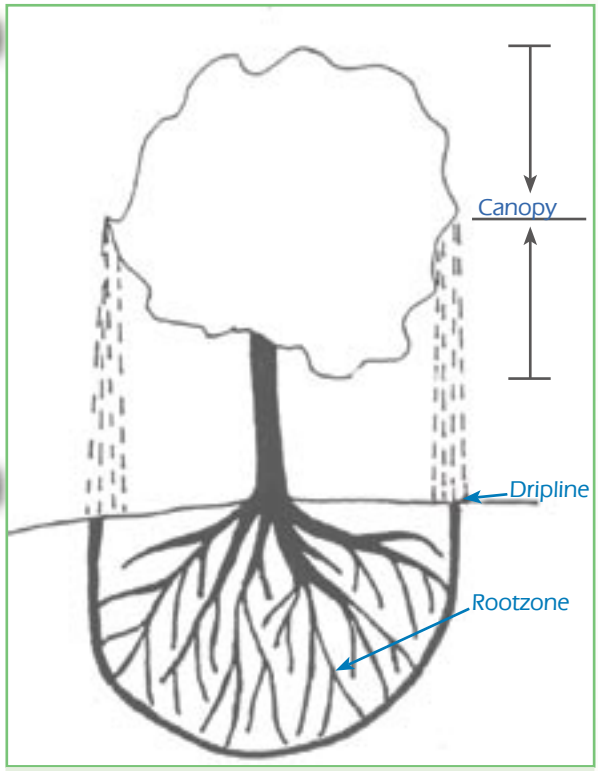
- installation of drip irrigation systems that allow water to penetrate the plant root zone for slow absorption by the plant. This will prevent salt accumulation caused by excess evaporation and reduce the likelihood that excess water will flow to other areas; and
- cyclic watering in areas with low soil permeability. Several irrigation cycles applied at a low flow rate will allow soil to absorb water over a longer period of time;
- maintenance of all irrigation equipment and hoses to prevent leaks adding water to the groundwater system;
- adding organic matter to the soil to increase the soil's water-holding capacity. Plant roots will then have more time to access water prior to it draining past the root zone;
- using tap timers, moisture sensors and computer-controlled irrigation equipment to help match plant water needs with evaporation, rainfall and irrigation rates;
- planting trees to provide shade and protection for other plants, thus reducing evaporation rates and irrigation needs;

Brochure image: *How to use water wisely: in your garden (1994)*. Prepared by ACT Electricity & Water, ACT Parks & Conservation Service and Public Works & Services.

Drip irrigation systems provide effective irrigation and minimise water lost to evaporation
Photo: DIPNR

Sprinkler irrigation.
Photo: DIPNR

- irrigation scheduling to suit plant water requirements at a flow rate that suits the plant's ability to take up water. For example, a plant's stomata will be closed during the hottest part of the day in order to conserve water. Water applied at this time will not be accessed as readily due to plant functions being carried out at a slower rate. During winter, plant transpiration and growth rates are also reduced and so they have a lower water requirement during this period;
- encouraging deep root growth by deep, occasional watering rather than the 'little and often' approach. 'Deep' means that the whole root zone of the plant, and not just part of it, has received sufficient water. This does not mean that the area should be waterlogged as this would promote disease and stress plants. It also does not mean that water should be allowed to add to groundwater sources and encourage salinity problems. Deep sporadic watering allows plants to adjust to soil moisture availability. It encourages deep root growth and hardens plants off, preparing them for a dry spell. In the long term it reduces irrigation dependency;



Irrigation should be applied to the dripline for maximum interception by plants

- decreasing irrigation prior to anticipated higher rainfall months. This allows the soil profile to dry out, making space for absorption of rain and helping to prevent flooding and water leaking into the groundwater system;
- consideration of the salt content of irrigation water. All water contains some salts. Irrigation over a number of years with moderate levels of salt in the water leads to a build-up of salt in the soil profile. Effluent from industry and domestic waste water systems can also contain significant quantities of salt;
- matching the rate of irrigation to the soil's ability to absorb water prevents water from running off the surface. Sand, for example, can absorb water at a faster rate than clay. Clays take longer to absorb water as their particles are more tightly held together and this slows down the movement of water into the soil profile; and
- matching the depth of watering to root zone depth. Small plants and some groundcovers have roots only in the top 10-20cm of the soil. Irrigating these will take a shorter period of time than if water is required to penetrate to a depth of 60cm or more.

Apart from good irrigation practice, there are other salinity-wise maintenance considerations, which include:

- regular replacement of mulch to prevent high rates of evaporation and therefore high concentration of salt in the top soil;
- setting mowing height and frequency in order to maintain leaf blade area of lawns, thereby encouraging root growth and decreasing evaporation from the soil surface;
- minimal use of fertiliser so extra salts are not added to the soil;
- water quality monitoring to ensure the regular water supply is not becoming increasingly salty;
- monitoring of salinity indicators and planning of remedial actions; and
- review of maintenance schedules and plant selections when more is known about the salinity processes on the site and within the town's catchment.

What Local Government Can Do

It has become the role of local government to plan and look after much of the urban green space we have today. This not only includes parks but also playing fields, planted areas along roadsides, within roundabouts, in reserves and around heritage buildings. With such a vast area to look after, there are many considerations. For instance, plants selected often have to be durable and self reliant, aesthetically pleasing, functional and significant to the town in some way.

Maintenance being carried out by council.
Photo: DIPNR

Some councils have incorporated 'waterwise' practices into their planning and maintenance regime. For example, Wagga Wagga, Mudgee and Cowra councils have been involved in 'waterwise' demonstration gardens. This provides private gardeners with the opportunity to learn about salinity-wise practices and plants suited to their region.

Other possibilities for action by councils include:

- the development of 'waterwise' and salt-tolerant plant species lists for urban planting in their area;
- the provision of a council nursery or support for local nurseries that promote 'waterwise' and salt-tolerant species; and
- requiring certain plant species to be incorporated in landscape plans for development applications.

The 'waterwise' demonstration garden at Cowra.
Photo: DIPNR

'Waterwise' demonstration garden in the Botanic Gardens, Wagga Wagga.
Photo: DIPNR

Many councils are also planting in roundabouts and nature strips. Not only aesthetically pleasing, plants used in these areas help absorb water infiltration from excess garden watering as well as runoff from hard surfaces such as paving and roads. An added benefit is that occupational health and safety issues associated with mowing beside roadways are avoided. These benefits need to be balanced against individual site issues such as:

- vehicle and pedestrian access to properties;
- line of site for turning traffic; and
- kerbside garbage collection services.

'Waterwise' roundabouts. Safe, low maintenance and aesthetically pleasing. Photo: DIPNR

An assortment of plants can be used such as in this roundabout. Photo: DIPNR

Standard bare roundabout.
Photo: DIPNR

'Waterwise' roundabout. Photo: DIPNR

As local governments control both planning and development functions for their specific area, they have the ability to control land use and therefore the environmental impact of development on those locations. Local governments, via the *Environmental Planning and Assessment Act (1979)*, can do this by considering the type and location of developments they approve. Many facets of development can affect salt and water flow patterns in the landscape, and development can in turn be affected by salinity.

The Department of Infrastructure, Planning and Natural Resources (DIPNR) is currently working with local government to develop a series of planning guidelines that deal with urban salinity. These will be covered in another booklet of the Local Government Salinity Initiative series.

Local government has a number of tools that provide opportunities for promoting appropriate vegetation management. These include:

- local environmental plans that determine land use within an area. For example, an LEP could identify areas of existing native vegetation on hilltops and in drainage corridors that are set aside for recreational or environmental protection purposes;
- development control plans that establish landscaping requirements and tree cover requirements, or determine the size of allotments, buildings and house set backs, etc. For example, in Wagga Wagga, DCP11 sets tree cover percentages based on land capability for new rural residential development. If this tree cover is not present at the time of development, steps are put in place for revegetation using specified tree and shrub species at a rate of one tree per four shrubs;
- development approval conditions allow development to take place provided certain conditions are met. These could include a requirement for the submission and approval of a landscaping plan with 'waterwise' gardening design criteria;
- plans of management for community land are required under the *Local Government Act (1993)* for all council-owned and managed land, including public reserves and parks. These plans could include short- and long-term goals to increase perennial vegetation cover, remediate salt-affected areas, mulch garden beds and upgrade watering systems to minimise waste water and leakage into groundwater systems;
- council management plans are the annual organisational plans for a council's activities. They identify the priority activities, budget, fees and charges of the council. The plan should take into

account the affect of salinity on council activities and assets as well as how the council is managing salinity.

Matters that could be considered include:

- water usage charges (where appropriate);
- expenditure on reserves or landscape maintenance (eg watering and lawn mowing);
- programs to improve irrigation efficiencies;
- the planting of water efficient landscaping; and
- the provision of a salinity education program.

- council policies and practices are often less formal measures that influence salinity management. These include how a council enforces a Tree Preservation Order, or supports vegetation and salinity management committees, landcare or bush regeneration groups and whether the council has a tree nursery and sells to the public, encourages mulching and composting, manages road corridors or integrates natural resource management into everyday decision-making. These all influence salinity processes as well as public responsiveness to good salinity management practices.

Community involvement. Photo: Courtesy of Wagga Wagga City Council

Local government policies and investment on public land should ultimately reflect community expectations. However, community education may be required to increase awareness and understanding of salinity in order to gain acceptance and support in some salinity management decisions and actions. For example, the community may assist in planting or managing areas vegetated to control groundwater levels once there is an understanding that excess water infiltration can exacerbate salinity and in turn increase the repair and maintenance costs for roads, buildings and other infrastructure.

As well as public land, large proportions of our urban areas are occupied and managed by private landholders. The majority of water used around the home is utilised in outdoor activities such as watering lawns and gardens.

Private property can contribute significant amounts of both water and fertilisers to groundwater systems. Again, education may change people's attitudes and behaviour, resulting in better management of salinity on private land.

There are still many large, privately owned areas of lush green lawn that are over-watered and under utilised. With an aging population, shortage of space in some of our towns and cities, water scarcity issues, and policies to encourage a decrease in garden waste disposal at tips, urban salinity awareness is just another reason to rethink the Aussie icon of a large green lawn.

Area of revegetation. Photo: DIPNR

Salinity and Related Problems

Money issues and choices are interrelated. Over-watering large lawn areas can exacerbate salinity and create lots of grass clippings. With an ageing population these areas are often not used regularly, are difficult to maintain, and costly to water. Less water is available for the environment and less space available for trees and shrubs. Biodiversity is impacted by these issues but also by increased salinity.

Vegetation planted by the road in a new subdivision. Photo: DIPNR

There is a great deal of educational material available on the subject of being 'waterwise'. Material has been developed to suit everyone from primary school children to adults. Much of the material consists of pamphlets containing practical 'waterwise' hints. These are a relatively cheap way of reaching a large audience, for example, by inclusion with rate notices or other council mail outs.

There are also various websites that contain information on how to plan a 'waterwise' garden and how to save both water and money around the home, farm or at work.

Other references include books that focus on using water in a sustainable way and minimising water consumption, and there are horticultural courses and books that offer detailed information on soils, plants, landscape and irrigation design and maintenance.

Community playground in Wagga Wagga. Perennial vegetation was planted to utilise rainfall and mop up the groundwater in an effort to reduce salinity problems in the area. Photo: DIPNR

Resources

Pamphlets

Sydney Water has information and several brochures on water conservation available at www.sydneywater.com.au. Click on 'water conservation and recycling', then 'waterwise resources', then 'publications'.

A series of fact sheets is available from South East Water at, www.southeastwater.com.au/news_publications_fact_sheets.asp?area=news

The Australian Plant Society has a publication titled *How to Establish Australian Plants the Waterwise Way* available at www.austplants-nsw.org.au.

The Environmental Protection Agency (Qld) sells the following brochures for $22.00 per 100 copies:

- *Be Waterwise at Home*
- *Helpful Hints for Waterwise Gardeners*
- *How to Identify Water Efficient Plants at a Glance*
- *Waterwise Watering and Irrigation Systems*
- *Save Water and Money with Your Existing Lawn*
- *Successful Pot Plants Using Less Water*
- *You can have Beautiful Flowers and Still Conserve Water*
- *Water Efficient Shrubs*
- *Seven Secrets to Saving Money on Your Water Bill.*

Order from the Environmental Protection Agency Sustainability Publications and Products Catalogue 2003, or call 1800 679 778.

Wyong Shire Council has a brochure titled *Whizzy Wally's Water Tips!*. This provides information on conserving water around the home and is available from Wyong Shire Council on telephone (02) 4350 5244.

Wagga Wagga City Council has a brochure *Be Water Wise For Our Community*, available free from Wagga Wagga City Council on telephone (02) 69269100. It also produces a *Halt the Salt* pamphlet, and its brochure titled *Waterwise and Salt Tolerant Plants for the Wagga Wagga Area* is available as a pdf file at www.wagga.nsw.gov.au/home-garden/pdf/waterwise_salt_tolerant.pdf

Mid-Coast Water has the pamphlet *Helpful Hints for Waterwise Gardeners: seven secrets to help your garden thrive, while using less water!*, available at www.midcoastwater.com.au/seven%20secrets%20gardening.pdf

Two brochures can be downloaded from Hunter Water's website at, www.hunterwater.com.au/wwbooklet.asp.

NSW Agriculture has a *Be Waterwise it's worth it!* pamphlet, available free on telephone (02) 6391 3621. This covers tips on being 'waterwise' on the farm and in the garden. More information can be gained from its website www.agric.nsw.gov.au/waterwise

The Gardening Australia program has created two fact sheets providing information on 'waterwise' gardening and plants that are 'waterwise'. These are available at

www.abc.net.au/gardening/stories/s53879.htm

and

www.abc.net.au/gardening/stories/s811210.htm

'Waterwise' material for primary school children is available at www.watercorporation.com.au

Websites

There are many other sites that contain information on 'waterwise' gardening. Some of these include:

www.savewater.com.au

www.waterwise.nsw.gov.au

www.plantsinternational.com.au/info/waterw.php

www.thisplace.com.au

www.dipnr.nsw.gov.au.

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