Drainage

Why install drains?

Salinity in Tasmania is generally due to the upward movement of water in the soil, bringing salts in the soil and groundwater into the root zone, or to the soil surface. In all cases, salinity is only moved in the soil by water, so management practices that affect water movement will affect salinity.

Water moves quickly through saturated soil materials. As the soil dries, water is removed from the larger pores and movement is restricted to the smaller pores and movement is slowed. So, if the surplus water can be removed, for example by drainage, there is opportunity to reduce the movement of salt to the root zone and the soil surface. But the water and the salt it contains needs to be released somewhere; we need to be sure the water and the salt is not going to create problems elsewhere.

Surplus water can be removed from the surface with surface drains, from the subsoils with open and underground drains, and from the groundwater by pumping. These options are discussed in this Technote.

Drainage of one type or another will help with salinity management in nearly every situation. The best type of drainage varies depending particularly on the use of the land, and the nature of the soil materials.

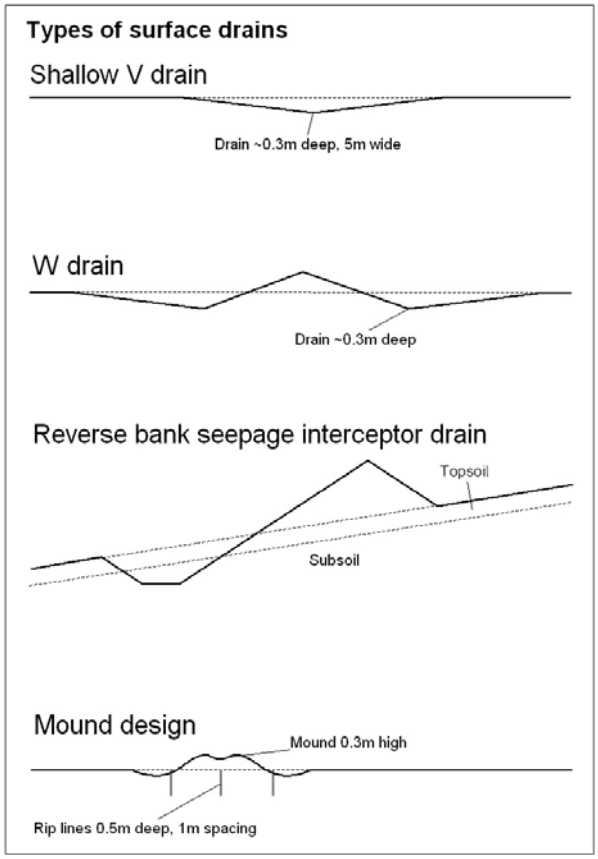
Managing surface water

Ponding of surface water mostly occurs on flat land when the infiltration of water into the soil is restricted by soil layers with low permeability. Surface drains are designed simply to remove surface water by linking depressions to natural drainage lines.

If the surface water is flowing onto the area from elsewhere, then interception and diversion drains will help. This includes deeper drains that intercept the movement of water in the subsoil layers. If the surface water is simply from rain or irrigation ponding where it falls, then simple surface drains will help get this water off the area. Raised beds and mounding will similarly help to remove the surface water.

In all cases the drains must not be too steep, or erosion will occur. This is even more likely in saline areas, where vegetative cover is generally less than in non-saline areas, and soil organic matter levels are low. Alternatively, make sure that shallow surface drains are well grassed (difficult in salty sites).

Several drain designs are illustrated below.



Shallow V drains are easily installed with a road grader or spinner drainer. Make sure the soil is graded well away from the drain, or water will not be able to flow into the drain. If possible, provide topsoil over the base and batters to help pasture establish.

The W drain profile places all the soil in the middle, so that water flow into the drain is not impeded.

Reverse bank seepage interceptor drains are particularly designed for moderate slopes. The spoil is all placed on the high side, and acts as a contour bank to catch surface water. This reduces erosion of the upslope batter. The drain needs to be deep enough to intercept seepage flows moving through the topsoil on top of a clayey subsoil.

Mounding has a number of advantages for trees and shrubs. It provides a volume of topsoil with improved drainage, and the furrow help to remove surface water. In saline areas, salt is leached out of the mound, providing a lower salinity environment for plants to establish. The recommended procedure is to spray for weeds in late spring, deep rip and mound in early autumn, and spray for weeds again. Plant in late winter or early spring.

Deeper surface drains (to say 0.6-1m) are sometimes installed to drain groundwater, particularly when water is "perched" above a heavy clay subsoil. However, the costs of excavation are high, and the excavation creates a large amount of spoil.

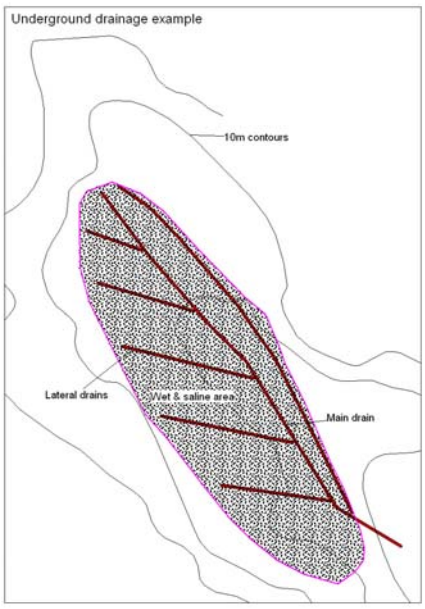
Underground drains

Buried pipe drains can be installed to intercept and remove groundwater and lower the watertable over a wider area. Various types of piping are laid in trenches or pulled into rip-lines, with gravel backfill around and above the pipe.

Generally underground drains are limited to cropping paddocks, as the costs are considerable and only likely to be recovered where the land can produce relatively high returns.

Drains can be laid in a grid to lower the water table over a discrete area, but more commonly buried drains are fed to "wet" areas of cropping paddocks where groundwater rises to the surface. Feeder drains in a herringbone pattern are generally added to the main drain to increase the area that will be drained.

An example of this strategic drainage is shown below.



Wet areas are commonly smaller in size and serviced by a single underground pipe. While drainage of these small areas might seem uneconomic, it allows the entire paddock to be cultivated earlier than otherwise.

Underground drains should be installed when the soil is at a suitable moisture content for cultivation (not too wet or too dry). This reduces the risks of soil sealing, compaction or ditch walls falling in.

Mole drains are sometimes pulled over buried pipe drains. However, moles will only retain their shape in stable (non-dispersive) subsoil clays. In saline soils the subsoil clays are often dispersive (fall apart and almost dissolve in water), so it is essential to check if the subsoil clay is dispersive before installing mole drains. In Tasmania, mole drains are generally not recommended in saline situations.

Remember to locate the pipes on a map for later maintenance.

Groundwater pumping

In Mainland states groundwater pumping is used to lower groundwater levels. However, it is effective only when the underlying soil and sediments have high permeability. This is unusual in Tasmania, so the technique is unlikely to be useful here.

Disposal of saline drainage flows

The disposal of drainage water is an issue that must be considered. The diversion of saline water downstream may raise the salinity levels of water for downstream users and the environment. For example, this is likely if the drainage flows enter an irrigation dam a short distance downstream.

The impact will depend on a number of factors, including the overall salinity of catchment flows, and the level of dilution in the receiving waters. In many circumstances, the drainage flows will occur when the general surface water flows are greatest, so there will be good dilution. However, flows of subsurface water, for example from underground drains, will continue when surface flows are slowed, and this could add highly saline water to streams. Generally groundwater has a higher salinity than surface waters, so be particularly vigilant where groundwater is being drained.

The possibility of increasing the salinity of water for downstream users and the environment must be considered and highly saline water which could impact on others must be managed on the property.

Further reading. Bastick, C. and Cotching, W. 1996. Drainage Information Package. Published by DPIF.

Author; D. Armstrong, AK Consulting, reviewed by project team.

This Technote is one of a series produced as part to the Best Practice Salinity Management Project.
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