EYRE PENINSULA
NATURAL RESOURCE MANAGEMENT

Drainage of saline land on Eyre Peninsula

Information you need to know

Introduction

One of the methods of controlling secondary salinity is the construction of drains in groundwater discharge areas. Drains can be used to control shallow surface and sub-surface water flows to aid water removal and in some cases to lower watertables.

Across the lower, eastern, and central districts of Eyre Peninsula drainage of saline land has been successfully carried out in numbers of different areas.

Drain construction however is not a stand alone cure, nor is it appropriate in many cases. The following Fact Sheet has been designed to give some technical guidelines for the construction of drains as well as provide a broad checklist for those considering drains as a control measure for salinity.

Why should drainage be considered?

Drainage of saline ground can help remove saline water away from a site thus reducing soil salinity levels. In many cases where drains have been well constructed reduction of waterlogging allows plant cover re-establishment on previously scalded ground.

Where should drainage be considered?

Drainage should only be considered where saline water can be safely removed from a site without creating off site problems. The site must have adequate fall for drainage and have soils and rock strata that are conducive to construction and function. High costs can be incurred where soils are not suited or solid rock bars are encountered.

Salt scald near Wanilla on lower Eyre Peninsula. Such areas can be rehabilitated through the use of drains in combination with vegetation re-establishment and appropriate fencing. Not all sites are suited to drains, and landholders should consult agency staff for assistance with site assessment in the first instance.

Surface drains can be constructed in heavier soils however for sub-surface drainage lighter sub-soils are required to ensure adequate through flow. Drainage should **not** be considered where acid sulphate soil conditions exist (see p. 4 for details).

What things must be taken into account before drainage work is carried out? (a checklist)

- Before any work is considered landholders need to consult with agency staff as to the suitability of the proposed drainage work. The Regional Salinity Officer (Eyre Peninsula Natural Resource Management Group), PIRSA, and DWR staff can all help landowners to assess options.
- All drainage **must gain approval before commencement of any works**. Advice on procedure needs to be sought from the Department of Water Resources (see contact details p. 4). A number of Legislative Acts relate to drainage, with significant penalties applicable for breaches.
- Assessment of field and surface conditions needs to be carried out in the wet. Consider whether the waterlogging conditions are typically found each year or whether the present conditions are unusual. Investigate and plan for drainage in the wet **but** install in the dry.

A large surface drain developed as part of the Cummins Wanilla drainage project 1999. (Note that the sides have been battered to a 3:1 slope) Slope battering reduces erosive conditions which could cause slumping of the sides. The steepness of the batter depends upon the soil type, generally the more potentially erosive the soil the more gently graded the profile. The long sinuous curve in the drain reduces potential erosion of the drain in high rainfall events. Such curves should always be included in drain design to mimic natural stream flow patterns.

- Sites must be assessed to determine whether enough fall for the proposed drains exists? Government agency staff or contractors will need to take levels to determine this accurately.
- A detailed field survey will need to be undertaken to establish soil types and preferred drainage routes. The use of aerial photographs with clear overlays is helpful. Confirm in the field the location of all permanent features as well as under and above ground services (allow up to two weeks to gain services information from SA Water, AGL, and Telstra). Note the presence of any surface inflows from outside the site.
- Off site effects must be considered. This is critical as all saline water must be discharged in a manner that does not create further problems elsewhere. Off site areas include:

  – receiving water bodies
  – neighbouring properties
  – downstream users
  – water dependant ecosystems

What type of Drain?

Drains fall into two basic categories, surface or sub-surface. Surface drains are designed to stop the ponding of water and to provide an outlet for run-off from saline areas. Sub-surface drains (which on EP are normally deep open drains), are designed to lower water-tables enough to allow reclamation of land. **It must be noted that deep drainage has limited application on Eyre Peninsula.**

How should drains be constructed?

Drains are significant engineering structures and as such require careful planning. The following information is to be taken as a general guide only. Specific on site design will need to be carried out to determine accurately the following design factors.

Siting of the drain in the scalded area

The drain should be located within the lowest lying area of the scald. This may not always be in one location only and so a drain may need to connect lower areas together. Levels will need to be taken to ensure correct placement of the drain.

Drain shape (plan view)

Drains should be constructed to include gentle longitudinal curves so as to mimic natural stream flow. Drains that are straight or have sharp turns will inevitably erode along the sides and possibly cause bank collapse with subsequent impairment of stream flow. The length and shape of curves will depend upon soil types and natural topography that the drain bisects.

Drain profile (cross sectional view)

Drain width and profile is dependant upon expected stream flow and the erosivity of soils. The following table (p 3) provides a general guide, however site inspection will be required to determine soil types accurately. Some sodic clay soils on Eyre Peninsula for example are highly erodable, and need to be battered at a slope similar to a sandy soil.

Bank stabilisation

Where unstable soils are present (eg. very fine sand), establish grass on the banks as soon as possible. Severe cases may require lining with stone or protective matting.

An aerial view of a section of the Cummins Wanilla drainage project showing the graded longitudinal curve. For the implementation of successful drains a detailed site plan must be drawn up which shows curve details which can then be pegged out prior to excavation.

Treatment of spoil

Where possible spoil from drains should be removed or graded so as to enhance the aesthetics of the drain. Grading the material can assist in revegetation (with grasses or native vegetation), as spoil material often consists of poorly structured clays which are not readily vegetated.

If spoil is stored near the drain, gaps must be left at short intervals to allow free surface drainage off the land. This can also be done by alternating the sides on which the spoil is dumped.

Batter slopes of open drains according to soil texture and drain depth (from Bastick, C.H and Cothching, W.E 1996 *Drainage Information Package*. Dept of Primary Industries and Fisheries with assistance from the GRDC. Tasmania Australia).

Soil	Channel less than 1.3 m deep	Channel greater than 1.3 m deep
Heavy clay	0.5 : 1.0	1.0 : 1.0
Clay or silt loam	1.0 : 1.0	1.5 : 1.0
Sandy loam	1.5 : 1.0	2.0 : 1.0
Sand	2.0 : 1.0	3.0 : 1.0)

Grade control structures

In any channel construction or drainage works there is always a possibility for erosion with the risk relative to the soil type, flow rates, and particularly stream geometry. Natural channels tend to meander as this dissipates stream energy as the stream moves through the landscape. Whenever a straight channel is constructed it will invariably erode, downwards first then laterally as the water seeks to establish equilibrium with the landscape. To overcome this tendency to erode it may be necessary to construct grade control structures which allow the dissipation of the water's energy at specific points along the channel. These structures can be constructed out of a wide variety of materials ranging from railway sleepers, to sedge plants, to rock or concrete. The most important aspect in the construction of grade control structures is in their design and placement – always seek advice.

Revegetation of surrounding ground

Good ground cover is a key to salinity control and treatment as it reduces the evaporation of water which in turn reduces the concentration of salts at the soil surface. Once good cover can be established, further positive effects can be realised as increased plant transpiration (the ability of plants to draw up water from soil and release it to the atmosphere) will further assist in using up excess water.

Plant establishment can be carried out by the sowing of salt tolerant grasses such as Pucinellia, and by the planting of appropriate tree and shrub species by direct seeding, or by tube stock.

Natural regeneration of native vegetation that has been degraded or has died can also occur on land that has been drained, providing a seed source is still available. The lowering of the watertable through drainage and the subsequent leaching of salts by rainfall will once again create a favourable

Grade control structure being installed as part of the Cummins Wanilla Drainage Scheme. Such structures help slow water flow where mean fall is too great. A fall of no more than 0.7: 100 is desirable.

seed bed for native species that formerly existed on the site. The revegetation program you undertake will ultimately be dependant on the management regime that is implemented after drain construction.

Where NOT to site drains – more on acid sulphate soils

In some areas where rising water-tables have caused waterlogging and soil salinity, a new issue is arising, that of acid sulphate soils. These soils develop in saline scalded discharge areas where the underlying rocks or sedi-ments contain sulfide minerals.

What they look like

Affected soils are characterised by the following properties:

- mushy, black appearance with strong sulfidic smell (rotten egg gas). These are formed under very wet conditions.
- an acidic topsoil with reddish yellow coloured iron rich deposits, often with a shiny oil like surface. These are formed under slightly drier conditions.

What are the key problems associated with acid sulphate soils?

If affected waterlogged acid sulphate soils are disturbed and soil is exposed (such as through excavation of a drain), sulfuric acid forms and soil pH can drop below 4. In addition to this the mobilisation and re-precipitation of iron oxides in soil micropores cause them to become blocked causing failure of soil structure and the cementing of soil surfaces upon drying. This can cause further waterlogging and local spread of salinity upslope.

Associated problems include the release of such toxic substances as cadmium, lead and arsenic.

Clearly very thorough site assessment must be carried out to avoid potentially severe downstream problems.

If you have Acid-Sulphidic soils DO NOT CONSTRUCT A DRAIN!

Who can I contact to get more information?

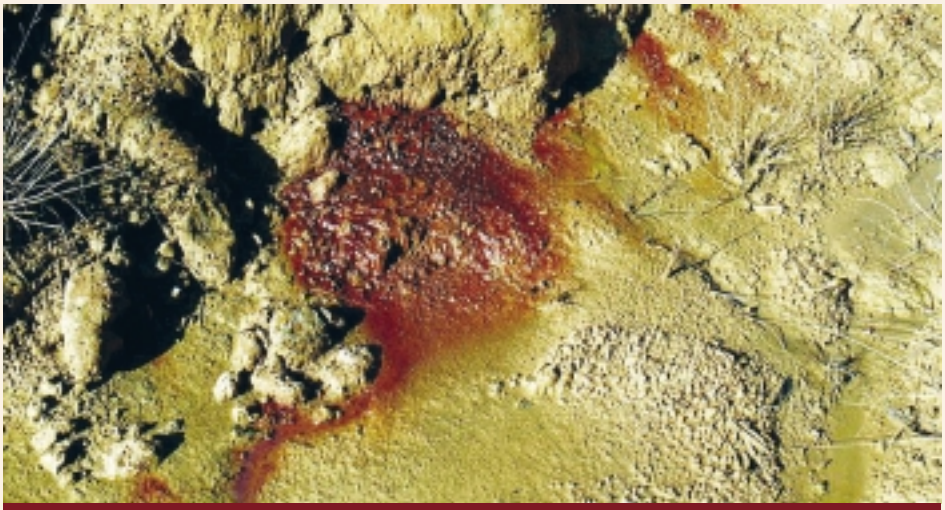
As noted in the check list the first step in considering the option of drainage is to contact agency staff. The simplest path to go down is to contact the Regional Salinity Officer – details are given below:

Regional Salinity Officer – Rod Dowie
Office 5 Adelaide Place
Pt Lincoln SA 5606
phone: 8688 3412
fax: 8688 3407
mobile: 0427 001 099
e-mail
dowie.rod@saugov.sa.gov.au

What is the process to gain approval for drain construction?

To seek approval for drain construction contact the Catchment Management Officer at the Department of Water Resources and relevant procedures will be outlined.

Catchment Management Officer – Mark Sindicic
48 Liverpool Street
Port Lincoln SA 5606
Phone: 8683 0027



Acid sulphidic soils at the Toolillie Gully showing the distinctive shiny oil like surface. Where these soil conditions exist drains must not be constructed. The main emphasis at such sites will be establishing vegetative cover on scalded ground. Reverse interceptor banks may have an application up slope of acid sulphate soils to help reduce sub-surface water flow to the area.

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