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## Managing Wet Soils: Planning Farm Drainage

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Waterlogged pastures can be a common occurrence in wet years on many dairy farms in southern Victoria. There are a number of options available to reduce the severity of the problem. However, many can be costly so planning is crucial to decide on the most cost effective system to use.

This note suggests some of the decisions and planning needed to prepare a farm drainage strategy.

### Introduction

Waterlogging can be a problem over winter and early spring in the high rainfall zones of Victoria. This waterlogging period can range from several weeks to a couple of months in average rainfall years but can last several months in wetter than average years.

Waterlogging occurs when rainfall exceeds the ability of some soils to drain surplus water away. It is often perceived that waterlogging is a surface water problem that surface drains will overcome. However, in many situations waterlogging is due to the soil profile (soil below the ground surface) being saturated and some type of subsurface drainage may be necessary to overcome this problem. Unfortunately, some soils and areas, due to their location, cannot be economically or feasibly drained by any means.

Waterlogging reduces the strength of the soil making it vulnerable to pugging, which leads to pasture damage resulting in lost production and repair costs. Soil structure can be severely affected on some soil types. Unfavourable anaerobic conditions occur in waterlogged subsoils that leads to a build up toxic hydrogen sulphide and reduced iron and manganese. It can also cause reductions in potassium, chloride and magnesium in plants.

Weeds and pastures that are more suited to waterlogged situations take over and summer production is decreased due to reduced rooting depth of surviving pastures. Another costly outcome of waterlogging is that fodder conservation is delayed by several weeks resulting in poor quality fodder, less dense pastures and even more weed growth.

### Planning a drainage system

The aim of farm drainage is to improve the soil environment to provide favourable growing conditions in the root zone for high producing pastures and crops. To be successful many factors need to be considered when assessing which drainage system to use, its design and its implementation.

There are some key questions to ask that will help you plan farm drainage:

#### 1. What is causing the waterlogging problem?

Is the waterlogging due to surface or subsurface water or both? Is this water flowing from upslope area from the ground surface or subsurface or both? Installing a subsurface drainage system is very expensive, so excess surface water must firstly be drained with a surface drainage system.

#### 2. What is the frequency of waterlogging?

The frequency and duration of waterlogging will influence the type and cost of the drainage system. Does waterlogging happen every year, or only in a small area or short periods each/most years, or does it only occur in very wet years? The answer will dictate the priority and expense needed in designing and implementation of the necessary system.

#### 3. Is there a sufficient outfall available?

This is a most important factor to consider. If water cannot be drained by gravity to an outfall then it must be delivered to a sump and then pumped to a main drain, adding substantially to the cost and maintenance to the system.

In some areas where the land is relatively flat, there are insufficient main drains either through paddocks or on roadsides to take away excess water quickly.

A further complication is that often these drains are not deep enough, which limits the ability of the farmer to drain land on his own property. If this is the problem then a possible solution may be that a group of landholders may agree to install a drainage scheme. This may enable a sufficiently deep and large main drain system to be installed to everyone's satisfaction and needs at a shared cost. Agreement must ensure

proper maintenance to the entire drained area and outfalls and that no harm is done to the environment.

However, on many farms there is sufficient fall to have adequate outlets so that internal drainage systems can function properly.

#### 4. What are the likely benefits of draining this area?

Consider how productive this area will become once drained. If the soil type is poor, even if drained improved pastures may not grow to their potential. However, maybe just draining a small area may allow faster or easier access to other sections of the farm. Would draining a spring line or preventing uphill water from gaining access to the lower areas increase productivity in the protected areas?

#### 5. Which areas should be drained first?

Should the paddock on the flat which floods (it may potentially be the best paddock), or the ones higher in the landscape that are known to allow water to run off easily be drained? If the higher paddocks are drained first then smaller main drainage pipes (or drains) will give initial cost savings. Draining the paddocks closest to main drain or a creek outlet generally requires having to put in larger mains so that when the scheme is extended upslope, the existing pipes (or drains) can cope with additional drainage water.

#### 6. What type of drainage system is required?

There are two basic types of drainage systems: surface and subsurface drains.

##### Surface drains

This is the first thing that should be looked at in any drainage scheme. Surplus water running over farmland will keep it saturated for longer, reducing pasture growth and increasing problems such as pugging and tractor mobility. An area should only have to deal with the rainfall falling on it, not also the rain that fell on the areas further upslope.

Therefore, adequate surface drains need to be installed along fence lines, laneways, depressions etc, so that surface water can be controlled more effectively. Care must be taken to ensure that potential problems such as scouring and erosion are not created by concentrating flows. In some cases surface drains will need fencing off so they can be protected from stock and tractor damage. See Agriculture Note AG 0946: *Managing wet soils: surface drainage*.

##### Subsurface drains

Once the extent of the contribution of surface water and its potential for drainage is determined, the next step is to determine which subsurface drainage system is best suited. The basic subsurface systems are subsurface pipes, mole drains or variations or compilations of the two systems. The types of systems to install are covered in detail in Agriculture Note AG0947: *Managing wet soils: types of subsurface drainage systems*.

The drainage system should, ideally, remove excess soil water to a depth of about 30 cm within 24 hours of the rainfall event. Ideally a drainage expert should be used to help design any drainage system involving pipes. The final design of the drainage system greatly influences both efficiency and final cost of an installation.

To do this requires knowing land gradients, soil types, soil profiles, clay content and types, permeability of the soil to be drained, cost and amount of backfill required for some systems, accessibility to drainage contractors, etc.

Also necessary is the typical annual rainfall amounts and likely rainfall events (mm), area to be drained, location and depth of outfall(s) and pipe diameters and lengths, etc.

#### 7. Do I need assistance to develop a plan?

An experienced drainage contractor can be most helpful in helping to develop a plan of works (the drainage plan). If large areas need draining then, ideally, the plan should cover 3 to 5 years of works. Joint discussions will produce possible layouts and the best sequence for carrying out works.

Plan ahead. Don't expect the drainage contractor to sort out for you a properly designed system in the middle of summer. Get in touch with the contractor when there is a problem (winter) so they can inspect the problem in situ and discuss the options with you more thoroughly. This will give you plenty of time to organise finance and set priorities, and fit into the contractor's work schedule.

#### Other actions needed as part of a drainage plan

Other changes may also be needed to support the drainage plan. They will all have associated costs which need to be included in the budget. These changes could be:

- Altering paddock layouts to allow more efficient mole drainage installation.
- Re-laying water supply lines and altering trough locations to fit in with drain placements. As mole drains are likely to be redone about every five years, it is best to make sure the other pipes are located to minimize potential damage and save time and money.
- Fencing drains off to protect outlets and minimise erosion, while allowing sufficient space for maintenance.
- Bigger bridges or culverts on main drains to allow for the increased rate of water removal.

Other capital investment into farm infrastructure may also be needed to capture the benefits of drainage. For example if drainage improves pasture growth, then more cows might be needed to harvest this extra growth. It is unlikely to be profitable to drain paddocks and not increase cow numbers even if supplementary feeding is reduced. So additional questions are:

- Can more cows be milked comfortably in the shed?
- Will more labour be needed?

- Is a bigger milk vat needed?
- Do the laneways need to be widened?
- Will the ability to harvest silage at the right time make it more attractive to invest in silage gear?

Even after putting a physical drainage system in place farmers (especially those with clay soils) will need to consider loafing-pads or feedpads to keep cows off drained paddocks during and immediately after rain events. This will protect the soil from pugging damage and compaction, which will reduce the effectiveness of the drainage system.

Loafing-pads and feedpads are described in Agriculture Note AG0955: *Managing wet soils: feedpads and stand-off areas*.

### What are the non-drainage options?

If prolonged wet periods are not common simply adopting an on-off grazing strategy to reduce pasture damage caused by pugging and compaction is a relatively cheap option. See Agriculture Note AG0980 *Managing wet soils: On-off grazing*.

Obviously the more severe the waterlogging (i.e. longer period, more frequent and/or larger areas), the better the stand-off facilities have to be to cope with animals being off pasture for longer periods. This may require building a feedpad or loafing-pad.

If these are used on a regular basis then attention to effluent management is vital to utilise nutrients the cows would normally have put on the paddocks for you. Effluent management is also necessary to keep the effluent on the farm and out of waterways. The effluent system may need to be enlarged or redesigned.

Extra machinery such as feed out carts may be needed as well. See Agriculture Note AG0955: *Managing wet soils: feedpads and stand-off areas*.

Other strategies to reduce pasture damage such as grazing several shifts in a day, standing on laneways or cow yards, and having separate day/night paddocks are covered in Agriculture Note AG0943: *Managing wet soils: grazing techniques*.

### The Water Act

The Water Act (1989) provides guidance for the management of waterways and swamps. Before considering draining a wet area you should contact your local Catchment Management Authority for advice, as a permit may be required.

### Further References

See other Agriculture Notes, especially:

AG0946: *Managing wet soils: surface drainage*

AG0947: *Managing wet soils: Types of subsurface drainage systems*

AG0948: *Managing wet soils: subsurface pipe drainage*

AG0949: *Managing wet soils: mole drainage*

AG1355: *Managing wet soils: determining which subsurface drainage system to use*

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