Natural Resources and Environment

AGRICULTURE
RESOURCES
CONSERVATION
LAND MANAGEMENT



# Land Classing

## *kit for farmers*

AGRICULTURE VICTORIA

A business of the Department of Natural Resources and Environment

State Government of Victoria

# CONTENTS

# INTRODUCTION

## WHAT IS LAND CLASSING?

Land classing is a fundamental step in developing a Whole Farm Plan. By identifying areas with similar land and soil types you are better able to make informed decisions on what land use is best suited to a certain area. Land classing determines land and soil with similar agricultural potential and similar management requirements.

### The benefits of land classing

The land classing process also helps you to decrease your financial and environmental risks by:

- Using the land within its capability so as to minimise land and water degradation.
- Identifying areas where the intensity of cropping or grazing may be inappropriate.
- Identifying areas that are under utilised.
- Matching inputs (e.g. fertilisers and chemicals) with outputs (level of production).
- Developing a farm layout that will facilitate your day to day management as well as management through climatic extremes (droughts and wet periods).

As part of a Whole Farm Planning or Property Management Planning program, land classing can assist you to be more strategic with your management decision making.

For example, a management system that includes a common whole of farm superphosphate program, does not take into account that some areas may need more superphosphate to optimise profitability, and some may need less. Such a blanket approach to management increases the financial risk of farming. Environmental risks are also increased. Excess nutrients not being used for production are potentially being lost to ground or surface waters. Land classing in the Whole Farm Planning process allows you to identify areas that require different management.

Land classing involves identifying constraints that will affect production or result in land degradation. Some of these are inherent limitations, that is, they cannot be easily changed, therefore they dictate how the land can be managed. By giving your land limitations, the strengths of your land can be assessed, enabling you to objectively assess your farming operation.

## LAND CLASSING KIT FOR FARMERS

This booklet is designed for you, the farmer. It allows you to identify the limitations of your land and soil in a systematic and rational way. You will utilise your knowledge of the farm, assisted by a few simple rules and tools.

To identify the different land classes requires you to work through a number of ordered steps. The flow diagram (Figure 1) provides you with a summary of the land classing process. A more detailed description on how to work through each step is provided in this booklet.

When you have worked your way through these steps, you will have a plan of your property. The plan will be divided into areas with similar land and soil characteristics, and a list of any limitations associated with the land units. You will have identified whether or not you have non-agricultural areas, arable or non-arable areas using an eight class rating system.

The limitations of your land are important. If you can overcome these limitations by management then you may be able to improve the potential economic output of the land.

The limitations will always be there. Through better management you may improve the drainage of grazing land and then be able to crop the land. However it will always revert back to grazing land if you discontinue the higher level of management i.e. the improved drainage.

## SUMMARY OF THE STEPS INVOLVED IN LAND CLASSING

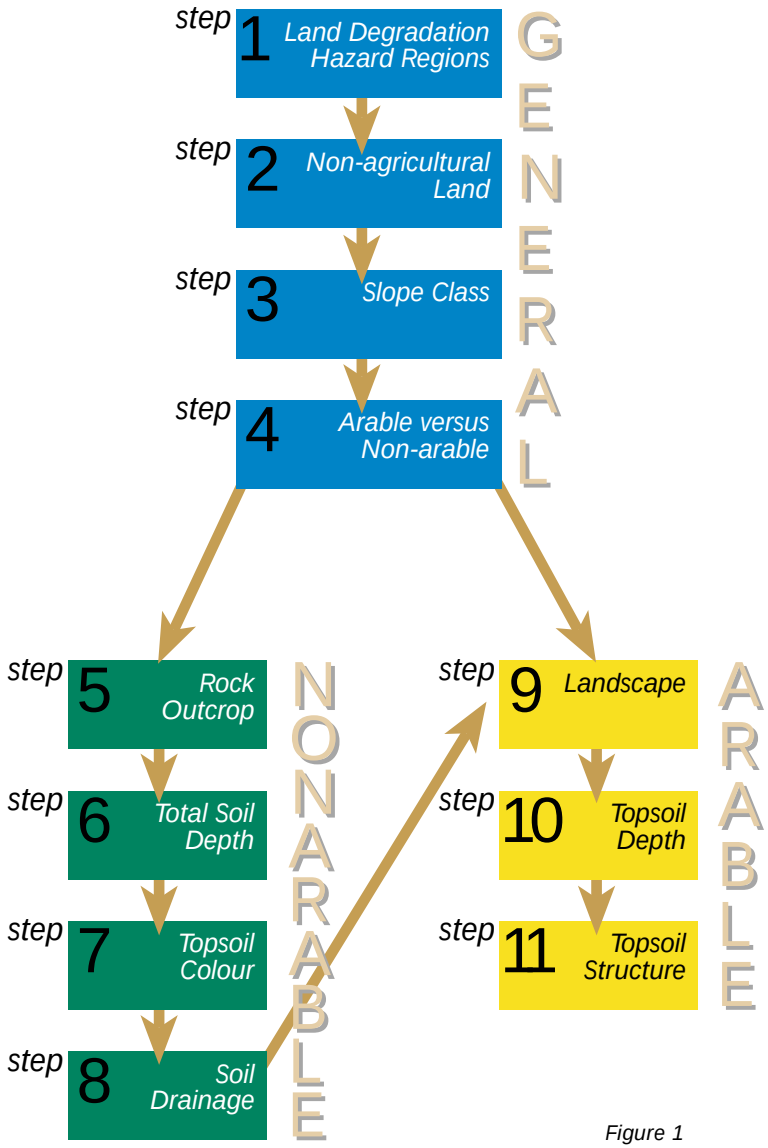



*Figure 1*

## LAND CLASSING PRINCIPLES

The main aim of land classing is to ensure that your land and soil is not being used beyond it's capability.

This is achieved by looking at three fundamental aspects of the land:

- the land degradation hazard,
- the landscape features, and
- soil properties.

### Land degradation hazard

Assessing the land degradation hazard of an area requires combining the climate (rainfall and temperature) which determines the length of growing season, the landform (such as hills or mountains), the geology and the common soil types.

Some areas that have low rainfall and high temperatures generally have a short growing season. If this is combined with certain landforms, geology and soil types, this area would have a high land degradation hazard. This leads to gentler slopes (e.g. 10%) in low rainfall areas having a higher degradation hazard than an area that has a higher rainfall and longer growing season.

### Landscape

The lie of the land (topography) influences a number of factors, including the flow of water (surface and groundwater), depth of soil, and management difficulties with respect to the access of machinery. Land degradation, particularly soil erosion and mass movement (land slips), is strongly dependent upon slope in addition to the climate.

### Soil

Soil characteristics (in conjunction with landscape and climate factors) primarily dictate how productive an area is, and the types of crops and pastures that can be grown. Some soils are more prone to degradation (such as erosion), which can be compounded by climate and landscape factors.

When land classing, the depth of soil, drainage of the soil, and topsoil properties are important aspects to consider as they impact on productivity and also potential degradation.

## WHAT DO I DO WITH THE LAND CLASSES?

At the completion of the land classing exercises, you will have your property divided into different land classes. The completed map will allow you to make some informed decisions on the future management of your farm. How you manage your farm in light of the identified land classes will become clearer when you use them within the Whole Farm Planning framework.

An overlay with your property boundaries outlined will be useful as it will show you which paddocks fit into a similar land class and which paddocks have different land use potential.

Some of the land management options you can consider are outlined below.

1. When you overlay your existing paddock boundaries over your plan with the land classes identified, you may find that in some cases the different land classes will not coincide with your paddock boundaries. That is, you may have two or more land classes in the same paddock. If this is the case, you can manage this in two ways.

In the longer term, you could look at re-fencing your land so that the fence runs along the boundary of the different land classes. In some cases this will not prove practical if the areas are small, but if it can be done, you will find the paddocks not only easier to manage, but they may also show a higher return as they will be used within their capability.

In the short term, it may not be feasible to re-fence. You should treat both paddocks as the most limiting land class.

2. In some instances, you may choose to overcome the limitation by directly managing the problem, thereby improving the land class. For example, if you have a deep topsoil on a level plain but you also have poorly structured topsoil, the area will be classed as a Land Class 3 due to the poor structure of the topsoil. If you choose to directly manage the structural limitation by applying gypsum, and find that you have improved the topsoil structure, the area would become more productive (similar to a Land Class 2). You may find you have more land use options due to your improved level of management.

It must be noted that if you do stop any management to overcome the limitation (e.g. not reapplying gypsum), the land immediately falls back to the original land class. This approach cannot be used if the limitation is due to inherent characteristics of the land that cannot be altered. This includes slope, soil depth, rock outcrop and gravel content.

## MATERIALS FOR GETTING STARTED

You will need:
Plan of your property
Permanent markers (red, black, blue and green)
2 overlay sheets (e.g. acetate sheets)
Adhesive tape
Shovel or auger
Ruler
Tape measure
Water bottle
Clinometer (see back cover)
Cotton or string and a weight
Pen and paper

*An aerial photograph of property*

*Plan of your property*

You will require a map or aerial photograph of your property at an appropriate scale. These are available from
Qasco VicImage, Clarendon Street, Southbank, Victoria 3006
Telephone: (03) 9682 3330 Fax: (03) 9682 3335

The appropriate scale depends on the size of your property.

| Property Size | Recommended scale of aerial photograph |
|---|---|
| Less than 50 ha | 1:1 000 (1cm = 10 m) |
| 50 - 100 ha | 1:2 000 (1 cm = 20 m) |
| 100 - 200 ha | 1:4 000 (1 cm = 40 m) |
| 200 - 1 000 ha | 1:5 000 (1 cm = 50 m) |
| > 1 000 ha | 1:10 000 (1 cm =100 m) |

Land classing is easier when you take the plan to the paddocks. You should laminate your plan to protect it.

*Permanent markers*

You will need 4 thin permanent markers that can write on plastic. Thin permanent markers can be found at good business supply shops or some newsagents. The four colours used in this booklet are commonly available in a pack of four permanent markers.

The land classing steps are easier to follow when they are colour coded. We recommend

Black for property boundary, slope classes and landscape boundaries.
Red for land class boundaries and land class labels.
Blue for arable versus non-arable outlines on overlay 1, and the topsoil depth exercise.
Green for existing property boundary on an overlay.

*Overlay Sheets*

You will require two overlay sheets that cover the whole of the plan. Acetate sheets available from good newsagents are ideal.

*Adhesive tape*

You will need adhesive tape to attach your overlays to the plan.

*Shovel*

For some of the soil assessments you may need to dig a shallow hole. You will require a shovel or an auger.

*Ruler*

A ruler will help you establish the depth of topsoil in the cropping steps.

*Tape measure*

A tape measure will be useful in the total soil depth and topsoil depth steps.

*Water bottle*

A small spray bottle of water is required for the topsoil colour step.

*Clinometer*

You are required to assess the slope classes on you property. To assist you with this there is a ‘clinometer’ on the back cover of this booklet.

*Cotton or string*

A length of cotton or string needs to be attached to the clinometer.

*Weight*

You will need to use a weight to weigh the string down on the clinometer.

‘Blu Tack’ is ideal, as it will stick to paper making it easier to read your slope class.

*Pen and paper*

This will be useful for any additional notes you want to make.

## HOW DO I USE THIS BOOKLET?

In order to make this booklet easier to use the three major sections are colour coded. The colour coding makes it easier for you to know which steps you need to do and which ones you may be able to skip (refer to Figure 1).

This booklet consists of three main sections:

- Gathering general property information
- Determining the non-arable land classes
- Determining the arable land classes

*Gathering general property information (Steps 1-4)*

In this section you will gather some background information that you will require in the following steps. You will also establish areas that are non-agricultural (Land Class 8), or have steep slopes (Land Class 7).

Step 4 will direct you to the non-arable or arable section, whichever applies to your property. Everyone is required to work through this section.

*Determining non-arable land classes (Steps 5-8)*

In this section you will establish the appropriate land class (Land Class 5 to 7) for areas that are non-arable.

You do not need to work through this section for any areas in Step 4 that you establish as clearly arable land.

*Determining arable land classes (Steps 9-11)*

In this section you will establish the appropriate land class (Land Class 1 to 4) for arable land.

You only need to work through this section once you have worked through the non-arable section and found that you have arable land or you have been directed here from Step 4.

*Appendices*

Appendices A and B provide a guide to the land classing process and what the codes mean. You may need to refer to these throughout the land classing process.

## WHAT DO THE LAND CLASSES MEAN?

The classes you will establish relate to the number of land use options available based on the potential productive capacity of the land and the susceptibility for land degradation.

Land Class 1 has the widest range of potential options available whilst Land Class 8 has the least range of potential land use options. It is important to note that land use options will also be affected by climatic factors such as rainfall, temperature and frost. These factors are not considered as part of the land classing process.

Throughout the land classing process you should refer to the land class definitions in order to familiarise yourself with the different land classes. At the end of the land classing process you will be able to identify your property using some or all of the land classes outlined as follows.

## ARABLE LAND - Land with many potential land use options

*Land Class 1:*

Land suited to a wide range of uses especially horticulture and cropping. Very high levels of production possible with standard management levels. Land degradation is possible if the land is poorly managed therefore conservation land management practices are recommended.

*Land Class 2:*

Land suited to a wide range of land uses including horticulture, cropping, grazing and farm forestry. Low risk of land degradation but still requiring high levels of management for production and protection of the land.

*Land Class 3:*

Land suited to a wide range of land uses including less intensive horticulture, cropping, grazing and farm forestry. Moderate risk of land degradation requiring very high levels of management such as conservation tillage and maintenance of a vegetative cover on the soil surface.

*Land Class 4:*

Semi-arable land. Land suitable for a range of land uses including occasional cropping, grazing and farm forestry. High risk of land degradation requiring the highest level of management for arable land such as conservation tillage, maintenance of a vegetative cover on the soil surface, and surface water control.

## NON-ARABLE LAND - Land with fewer land use options

*Land Class 5:*

Land suitable for less intensive agriculture such as high density grazing or farm forestry and cultivation associated with pasture development.

*Land Class 6:*

Land suitable for grazing or farm forestry. Low capability to resist land disturbance such as cultivation due to physical features of the land and erosion risk. Good management required to preserve vegetative cover.

*Land Class 7:*

Land suitable for low density grazing or low intensity farm forestry. Very low capability of supporting a diverse range of agriculture. Good management required to preserve vegetation cover.

## NON-AGRICULTURAL LAND

*Land Class 8:*

Land incapable of sustaining agricultural production but may be suitable for activities such as low intensity farm forestry, revegetation or wildlife shelters.

Not all farms will have all these land classes. Some farms may have only two or three land classes.

# GATHERING GENERAL INFORMATION ABOUT YOUR PROPERTY

step 1

## ESTABLISHING YOUR LAND DEGRADATION HAZARD REGION

*Conducted in the home*

You will not identify any land classes in this step

You will need:
Property plan with boundary marked out in black permanent marker
Permanent marker (any colour)

Land use and the potential for land degradation is largely determined by climate, geology and land types.

Land Degradation Hazard Regions (LDHR) combine areas with similar climate, geology, soil and land types that are likely to have the same land degradation hazard. For example, the Wimmera LDHR is an area of lower rainfall and has a short growing season. In combination with erodible soils, the Wimmera LDHR is susceptible to water erosion on much gentler slopes than the Eastern Mountains and Hills LDHR that is a higher rainfall area with a longer growing season.

Map 1 on the following pages, shows the Land Degradation Hazard Regions of Victoria.

Step 1: Land Degradation Hazard Region

Locate where your property is on Map 1. If you are located near a boundary between the units, refer to the definitions of the areas and establish which one best suits your area.

Write on your plan (outside the property boundary) the land degradation hazard region. You can use any colour.

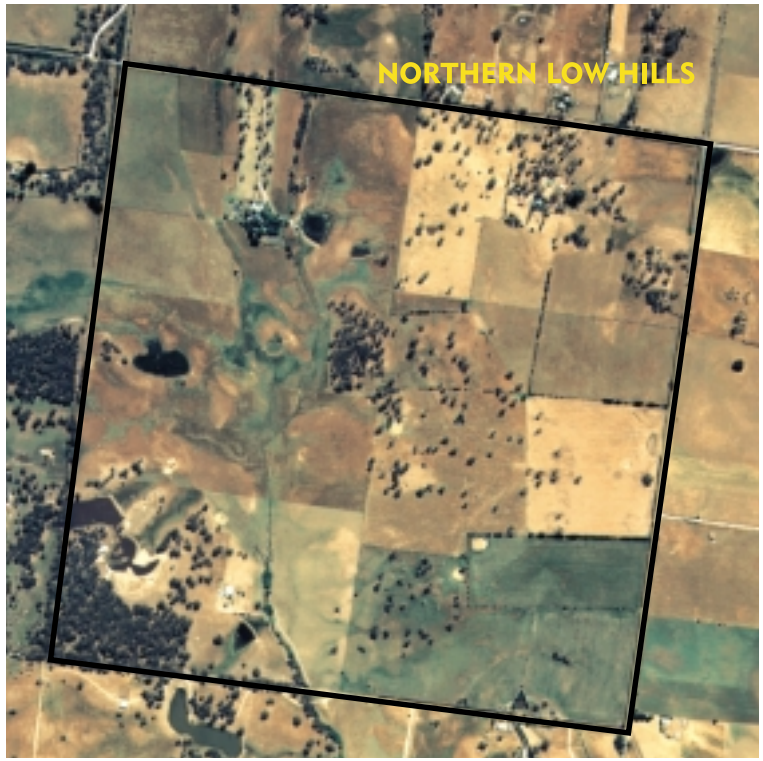



*Figure 2 Step 1: Labelling the Land Degradation Hazard Region. Note the property boundary has been marked out in black on the property plan.*

# MAP 1
# LAND DEGRADATION HAZARD REGIONS

### *North Western Sands LDHR*

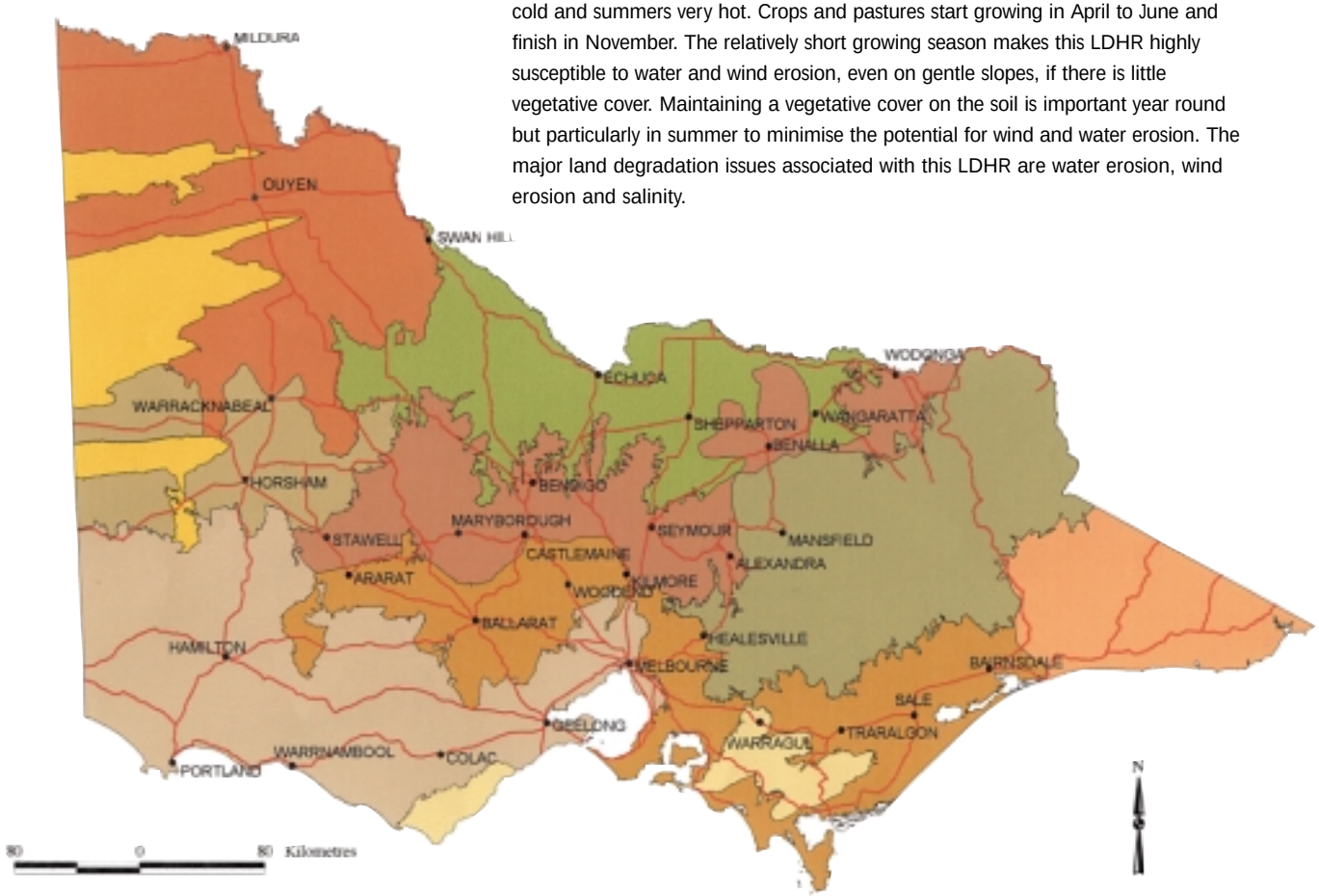
This region consists of the sand dune country in and around the Big and Little Desert national parks. The main land uses are cropping, grazing and horticulture. Annual rainfall is generally 300-450 mm, and the winters are cold and the summers very hot. The growing season for crops commences in May or June and finishes in October. Due to the dry climate, very short growing season and sandy soils this LDHR is highly susceptible to land degradation, even on very gentle slopes. Therefore the maintenance of a vegetative cover of the soil is essential year round. The major land degradation issue associated with this LDHR is wind erosion.

### *Southern Hills LDHR*

This region incorporates the steep terrain of the Strzelecki and Otway ranges. Annual rainfall is high (700-1 400 mm), and the winters are cold and the summers are warm. The growing season for crops and pastures can be year round. The deep soils combined with the steep slopes and high rainfall constitute a landslip hazard, which requires the strategic planting of trees. The climate, steep terrain and erodible soil type also constitutes a water erosion hazard and requires the maintenance of vegetative cover of the soil year round. The major land degradation issues associated with this LDHR are water erosion and mass movement (landslips).

### *Northern Low Hills LDHR*

This region is located in northern Victoria and includes the low hills on the northern slopes of the Great Dividing Range. It is generally a grazing area with occasional cropping and horticulture. Annual rainfall is generally less than 600 mm, winters are cold and summers very hot. Crops and pastures start growing in April to June and finish in November. The relatively short growing season makes this LDHR highly susceptible to water and wind erosion, even on gentle slopes, if there is little vegetative cover. Maintaining a vegetative cover on the soil is important year round but particularly in summer to minimise the potential for wind and water erosion. The major land degradation issues associated with this LDHR are water erosion, wind erosion and salinity.



- Northern Low Hills
- Northern Riverine Plains
- Southern Hills
- Southern Plains and Hills
- South Western Plains and Low Hills
- East Gippsland
- Eastern Mountains and Hills
- Wimmera Clay Plains
- Mallee
- North Western Sands

*Use this legend as a guide for the Land Degradation Hazard Regions Map on the previous page*

### *Mallee LDHR*

This region incorporates the plains and rises of the Mallee region in the north-west of the state. The Mallee is a cropping, grazing and horticultural area. Annual rainfall is generally 300-450 mm, and the winters are cold and the summers very hot. The growing season for crops commences in May or June and finishes in October. Due to the dry climate, very short growing season, and sandy soils, this LDHR is highly susceptible to land degradation, even on very gentle slopes. Therefore the maintenance of a vegetative cover of the soil is essential year round. The major land degradation issues associated with this LDHR are wind erosion, water erosion and salinity.

### *Wimmera Plains LDHR*

This region incorporates the clay plains as well as the sandy rises of the Wimmera region in the west of the State. The Wimmera is a cropping and grazing area. Annual rainfall is generally 450-650 mm, and the winters are cold and the summers very hot. The growing season for crops and pastures commences in April to June and finishes in November. The clay plains are susceptible to soil structure decline. The maintenance of vegetative cover of the soil is important year round but particularly in summer to minimise the potential for wind and water erosion. The major land degradation issues associated with this LDHR are soil structure decline, water erosion, wind erosion and salinity.

### *South Western Plains and Low Hills LDHR*

This region incorporates the extensive basalt plains of western Victoria and the low hills associated with the plain, the dissected Dundas Tablelands and the mountainous Grampians. Main land use is grazing, with increasing areas under farm forestry. Annual rainfall is generally 600-800 mm. The winters are cold and the summers are warm to hot. Crops and pastures start growing from April to June and finish in December or January. The high rainfall, hilly terrain and soil types constitute a water erosion hazard and the sandy topsoils, particularly in the far western areas, are susceptible to wind erosion. The whole of this LDHR requires the maintenance of vegetative cover of the soil year round. The major land degradation issues associated with this LDHR are water erosion, salinity, wind erosion (far western areas) and land slips (Dundas Tablelands).

### Northern Riverine Plains LDHR

This region incorporates the plains in the north of the state. It is mainly a cropping, grazing and horticultural area. The annual rainfall is generally less than 600 mm, with cold winters and very hot summers. The growing season for dryland crops and pastures commences in April to June and finishes in November. The major land degradation issues associated with this LDHR are soil structure decline, water erosion and salinity.

### Southern Plains and Hills LDHR

This region incorporates undulating and hilly areas on and south of the Great Dividing Range and the northern foothills in the north-east. Main land use is grazing, with increasing areas under farm forestry. Annual rainfall is generally 600-1 000 mm. The winters are cold and summers are warm to hot. Soils range from deep red well drained soils to yellow imperfectly drained soils. The growing season commences in April to June and finishes in December or January. The high rainfall, hilly terrain and erodible soil types constitute a water erosion hazard and require the maintenance of vegetative cover of the soil year round. The major land degradation issues associated with this LDHR are water erosion, salinity, wind erosion and land slips.

### Eastern Mountains and Hills LDHR

This region incorporates the steep mountains and tablelands of the Great Dividing Range in the east of the State. Annual rainfall is generally greater than 1 000 mm and winters are very cold and summers cool to warm. Peak rainfall intensities can occur over the summer months and constitute a water erosion hazard on steep bare slopes. The maintenance of vegetative cover of the soil is important year round. The major land degradation issues associated with this LDHR are water erosion and land slips.

### East Gippsland LDHR

This region incorporates the plains and hills of East Gippsland where the climate is often variable with extreme rainfall events occurring during the summer months. It is generally a grazing and horticultural area. Annual rainfall is generally 700-1 000 mm, and the winters are mild and the summers warm to hot. Extreme rainfall events, hilly terrain and soil types all constitute a water erosion hazard requiring the maintenance of vegetative cover of the soil year round. The major land degradation issues associated with this LDHR are water erosion, salinity and wind erosion.

step 2

# IDENTIFYING NON-AGRICULTURAL LAND

*Conducted in the paddock or home*

In this step you will identify Land Class 8.

Land Class 8: Land incapable of sustaining agricultural production but may be suitable for activities such as low intensity farm forestry, revegetation or wildlife shelters.

You will need:
Property plan
Red permanent marker

This stage of land classing involves identifying areas not suited to agriculture. Features that prevent agriculture occurring are inherent physical or environmental characteristics of the land that cannot be altered.

## Permanent streams

Streams should be managed to preserve your section, and to avoid contributing to problems such as siltation and pollution down stream. The areas adjacent to a permanent stream should be treated as non-agricultural land, as poor management around the stream will have major consequences on a catchment-wide basis. The land should be classified as non-agricultural and should include a 15 metre buffer strip on either side of the stream to prevent erosion of the stream bank and pollution of the water supply. Ideally permanent stream buffer strips should be fenced off and revegetated.

## Permanent natural water bodies

Permanent natural water bodies do not include farm dams but include lakes and wetlands. The same environmental concerns that occur with permanent streams should be considered for permanent natural water bodies including a buffer strip (15 metres wide) around the waterbody. Stock should not be allowed to enter the waterbody as this would not only cause bank erosion and damage revegetation, it will also affect the quality of the water.

### Degraded land

Active land degradation that makes agricultural activities impossible, such as eroded gullies and salt scalds, should be fenced off and ameliorated.

### Native Vegetation

Native vegetation is an asset to your farm and the environment and should be preserved. Large areas of native vegetation should not be constantly used for agriculture. These areas should be fenced off to allow for regeneration, and used as wildlife areas or corridors. With care they could however, be used as emergency grazing land in very dry seasons.

### Very steep land

Very steep land will be identified and marked out in Step 3: Determining Your Slope Class

On the plan, mark out the boundary of the non-agricultural land and label with the appropriate land class code the following areas using a red marker:
Permanent streams (15 metre buffer strip) - 8PS
Permanent waterbodies (15 metre buffer strip) - 8PW
Degraded land - 8DL
Native Vegetation - 8NV

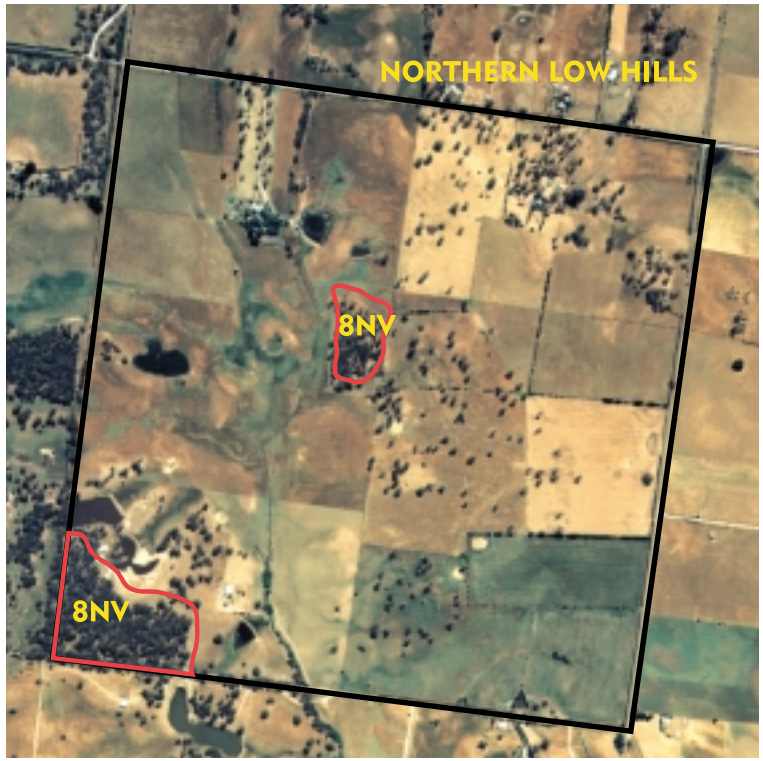



*Figure 3 Step 2: Marking out the non-agricultural land on the property plan.*

step 3

## DETERMINING YOUR SLOPE CLASSES

*Conducted in the paddock*

In this step you will identify Land Classes 7 and 8

Land Class 7: Land suitable for low density grazing or low intensity farm forestry. Very low capability of supporting a diverse range of agriculture. Good management required to preserve vegetation cover.

Land Class 8: Land incapable of sustaining agricultural production. May be suitable for activities such as low intensity farm forestry, revegetation or wildlife shelters.

You will need:
Clinometer (at back of booklet)
Red permanent marker
Overlay sheet
Black permanent marker
Property plan

When allocating different land classes to your property, consider the limitations of slope for machinery and also erosion risk. Severity of erosion risk is linked to the slope gradient, geology type, soil type and climate. Refer to the Land Degradation Hazard Regions you identified in Step 1.

The slope becomes limiting for agriculture when:

- it is steep or very steep,
- there is a high land degradation hazard, or
- there are limitations for machinery.

Moderate and gentle slopes become limiting when they are combined with shallow soils. You will mark the moderate slopes on an overlay.

Step 3: Slope Classing

1. Use your clinometer to establish the slope classes.

2. If the slope is generally consistent throughout the property, test one or two slopes then mark the whole area as the one slope class.

3. Refer to Table 1 for the slope ranges and slope class definition relevant to your Land Degradation Hazard Region.

You will need to refer to the overlay in the steps following.

On the plan, mark out the boundary of any steep (7S) or very steep (8VS) slopes and label with the appropriate land class code using a red marker:

If you have moderate slopes attach one of the overlay sheets over your plan with the adhesive tape. Mark out your property boundary so that you can orientate the overlay correctly if it comes away. Label this 'Overlay 1'.

On the overlay mark out the moderate slope boundary and label '*mod*' using the black marker and continue. If you have gentle slopes leave these blank and continue.

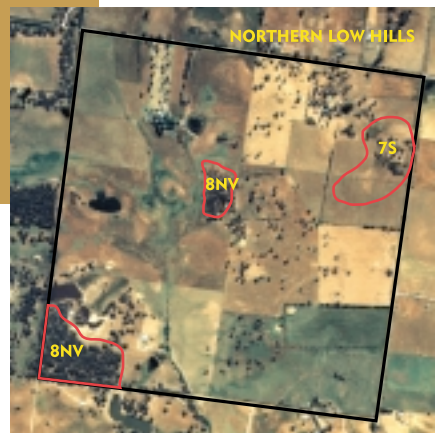



*Figure 4 Step 3: Marking out and labelling the steep slopes on the plan.*

*Table 1 Slope ranges and land class codes for each Land Degradation Hazard Region.*

| LAND DEGRADATION HAZARD REGION | Very steep slope 8VS on Plan | Steep slope 7S on Plan | Moderate slope Mod on overlay (continue) | Gentle slope (continue) |
|---|---|---|---|---|
| Southern Plains and Hills<br>South Western Plains and Low Hills<br>Eastern Mountains and Hills<br>East Gippsland | >40%<br>(⩾22°) | 30-40%<br>(≈ 17°-22°) | 20-30%<br>(≈ 11°-17°) | <20%<br>(⩽11°) |
| Northern Low Hills<br>Northern Riverine Plains<br>Southern Hills | >40%<br>(⩾22°) | 30-40%<br>(≈ 17°-22°) | 10-30%<br>(≈ 6°-17°) | <10%<br>(⩽6°) |
| Wimmera Plains | >30%<br>(⩾17°) | 15-30%<br>(≈ 11°-17°) | 8-15%<br>(≈ 5°-11°) | <8%<br>(⩽5°) |
| Mallee<br>North Western Sands | >30%<br>(⩾17°) | 15-30%<br>(≈ 9°-17°) | 5-15%<br>(≈ 3°-9°) | <5%<br>(⩽3°) |

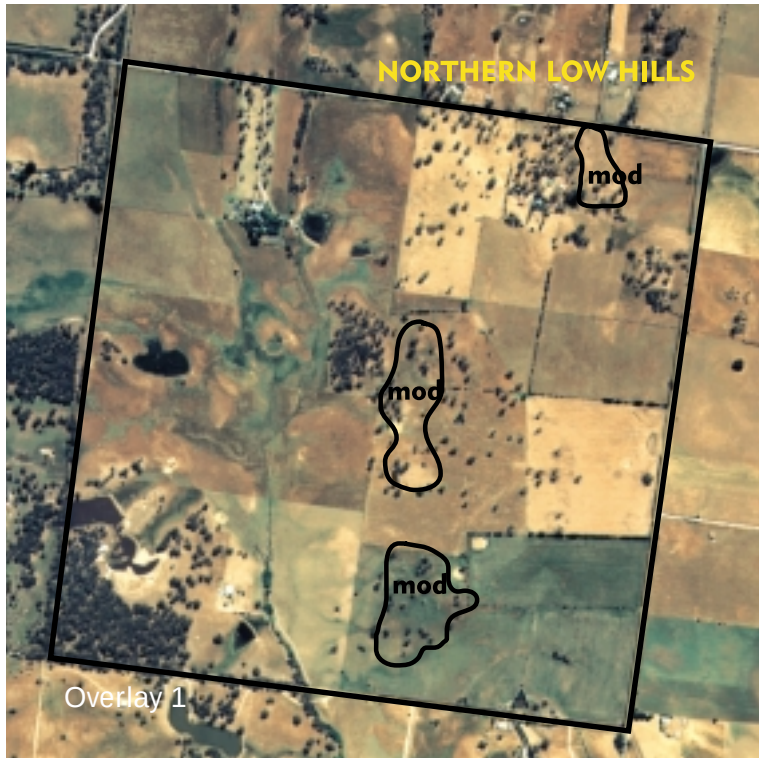



*Figure 5 Marking out and labelling the moderate slopes on Overlay 1.*

step 4

## DO I HAVE ARABLE OR NON-ARABLE LAND?

*Conducted in the home*

You will not identify any land classes in this step.

You will need:
Property plan
Overlay
Blue permanent marker

Land classing looks at whether your land and soil is arable or non-arable, or if it is unsuitable for agriculture. Arable land is suitable for cropping on a regular basis whereas non-arable land is not capable of supporting cropping due to land and soil constraints. You have already established if you have areas on your property that are unsuited to agriculture.

This booklet has separate non-arable and arable sections. In order to make it easier to follow, the non-arable section is in green, and the arable section in yellow.

This step provides you with a quick way of working out which part of land classing you will concentrate on: non-arable, arable or both.

If you can work through Step 4 and establish that some or all of your property is suitable for cropping (therefore is arable land), then you do not have to work through the non-arable section for these areas.

If you are unsure whether your land is arable, (you may be using it for grazing but feel there is some potential for cropping), you should work through the non-arable section and see whether you can continue through to the arable section.

Table 2 lists limitations of the land and soil that will prevent cropping, making the land non-arable. The definitions in the table are very broad, as the limitations are usually obvious. You should rely on your existing knowledge of your property to work out whether you do or don't have these limitations. If you are not sure whether these limitations are severe enough to prevent cropping, work through the non-arable section anyway. When you work through the non-arable exercises you will look in more detail at each of these limitations.

*Table 2 Limitations that prevent cropping (non-arable land).*

| Limitations that prevent cropping (non-arable land) | Definition |
|---|---|
| Steep slopes | Too steep for cropping machinery. Some moderate slopes may be too steep for cropping machinery if the length of slope is short. |
| Shallow soils | Where you think the soil is too shallow for cropping. |
| Rocky | Any rock outcrop that is limiting to machinery. |
| Surface stone | When surface stone is limiting to machinery. |
| Drainage problems | Areas that get very wet and restrict vehicle traffic. |

## Step 4: Arable versus Non-Arable

As the definitions in the table are very broad, this step is designed to identify the areas that are obviously non-arable or obviously arable. This will help you determine which section of the booklet to use. Mark the non-arable and arable areas on an overlay.

1. Attach an overlay on your plan. Label this 'Overlay 2'.
2. Work through Table 2 above.
3. If you have one or more of the limitations in Table 2, roughly draw a blue boundary around the area on the overlay. Move onto step 5 for those areas.
4. Move onto step 9 for the areas that do not have any of the limitations in the table.

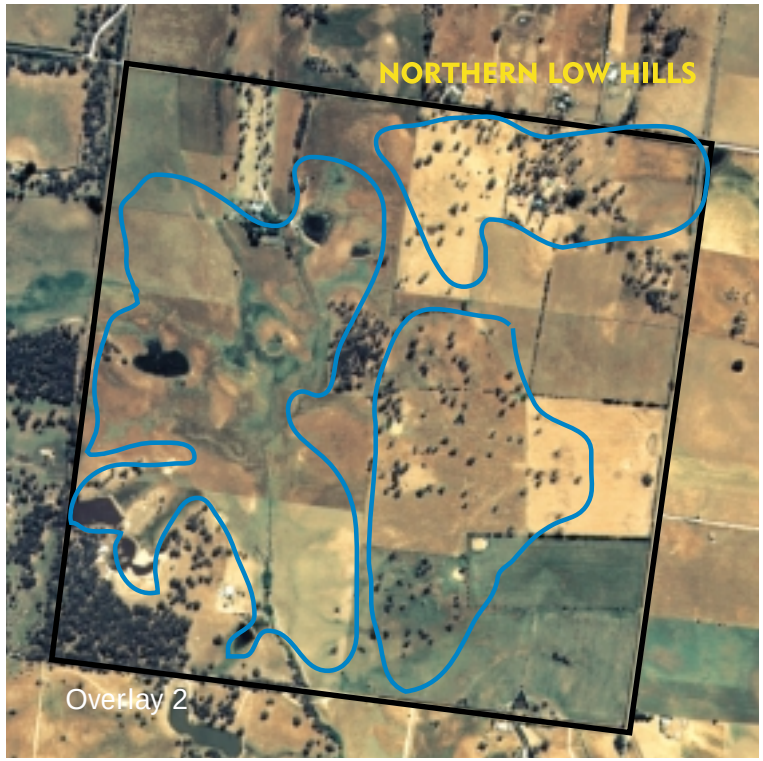



*Figure 6 Step 4: Broadly marking out the non-arable land on Overlay 2.*

## DETERMINING THE NON-ARABLE LAND CLASSES

*You only need to conduct Steps 5 to 8 in the areas you established as being non-arable in Step 4.*

step 5

### DETERMINING THE PERCENTAGE OF ROCK OUTCROP AND SURFACE STONE

*Conducted in the paddock or home*

In this step you will identify Land Classes 6 and 7:

Land Class 6: Land suitable for grazing or farm forestry. Low capability to resist land disturbance such as cultivation due to physical features of the land and erosion risk. Good management required to preserve vegetative cover.

Land Class 7: Land suitable for low density grazing or low intensity farm forestry. Very low capability of supporting a diverse range of agriculture. Good management required to preserve vegetation cover.

You will need:
Property plan
Overlay 2
Red permanent marker

Refer to the areas you outlined on Overlay 2 as being non-arable. For this exercise rock is defined as greater than 20 cm in diameter and surface stone is defined as less than 20 cm in diameter.

Large amounts of surface rock and stone can occur on any slope. Surface rock outcropping is more common with certain types of geologies, mainly basalt, granite and sedimentary rock.

The amount of rock outcrop is the limiting factor. Greater than 50% rock outcrop makes agriculture difficult for anything but low density grazing or low intensity farm forestry (Land Class 7).

*Figure 7 Less than 20% rock outcrop is not a major impediment to agriculture.*

*Figure 8 Between 20% and 50% rock outcrop is limiting for agriculture due to access problems with machinery (Land Class 6).*

*Figure 9 High amounts of stone (greater than 40%) at or near the surface of the soil is not only an impediment to machinery, it also limits the water and nutrient holding capacity of the soil.*

On the plan, mark out the boundary and label with the appropriate land class code the following areas using the red marker:

Greater than 70% rock outcrop (rocky) - 7R
20-50% rock outcrop (partially rocky) - 6PR
Greater than 40% surface stone - 6St
Less than 40% surface stone - continue
Less than 20% rock outcrop - continue
No rock outcrop - continue
No surface stone - continue

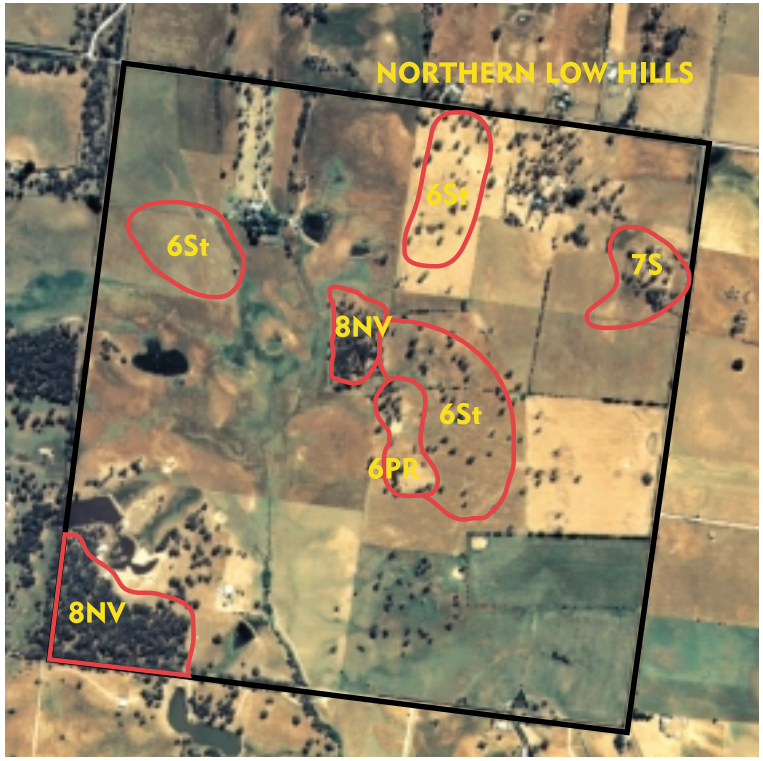



*Figure 10 Step 5: Marking out and labelling areas of high rock outcrop or surface stone on the plan.*

step 6

# DETERMINING TOTAL SOIL DEPTH

*Conducted in the paddock*

In this step you will identify Land Class 6:

Land Class 6: Land suitable for grazing or farm forestry. Low capability to resist land disturbance such as cultivation due to physical features of the land and erosion risk. Good management required to preserve vegetative cover.

You will need:
Property plan
Overlay 2
Overlay 1
Red permanent marker

Refer to the non-arable areas you outlined on Overlay 2.

In this step you will class the moderate and gentle slopes using total soil depth as a factor. For this exercise the moderate and gentle slopes are treated separately.

*Moderate slopes (labelled 'mod' on Overlay 1)*

On moderate slopes, soils less than one metre deep are non-arable due to a high water erosion risk associated with cropping.

It is important that any other type of land use on the moderate slopes be managed to maintain a vegetative cover year round to protect the soil from erosion.

*Figure 11 Moderate slopes with deep soil are arable.*

*Gentle slopes (areas left blank on Overlay 1)*

Plants prefer deep soils giving them a large volume of soil for roots to access water and nutrients. On gentle slopes where the water erosion hazard is not as high as on moderate slopes, soil depth is associated with plant water stress. Therefore, the soil depth that becomes limiting is less than 60 cm.

*Figure 12 The poor pasture growth on the gentle slope in the foreground is an indication that the soils are shallow and unsuitable for cropping. The soils are deeper on the slopes in the background and cropping can occur.*

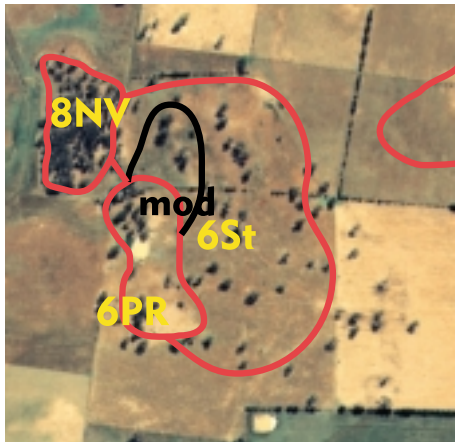



*Figure 13 Overlay 1 shows that rock outcrop and surface stone override the moderate slope in the centre of the plan.*

Step 6: Soil Depth

Assess the depth of soil by either digging a hole, or use existing knowledge, e.g. post holes, dams, road side cuttings close by (make sure they are in the same position in the landscape that you are assessing).

1. Refer to the slope classes you outlined on Overlay 1. Some of the slope classes may already be labelled with rock outcrop or surface stone being the limitation.

2. Refer to the appropriate slope class:

Moderate slope

On the plan, mark out the boundary and label with the appropriate land class code the following areas using the red marker:
Moderate slopes with soils less one metre deep (shallow soil) - 6mSS
Moderate slopes with soils deeper than one metre (deep soil)
- Continue

Gentle slope

On the plan, mark out the boundary and label with the appropriate land class code the following areas using the red marker:
Gentle slopes with soils less than 60 cm (2 feet) deep (shallow soil)
- 5gSS
Gentle slopes with soils deeper than 60 cm (2 feet) deep (deep soil)
- Continue

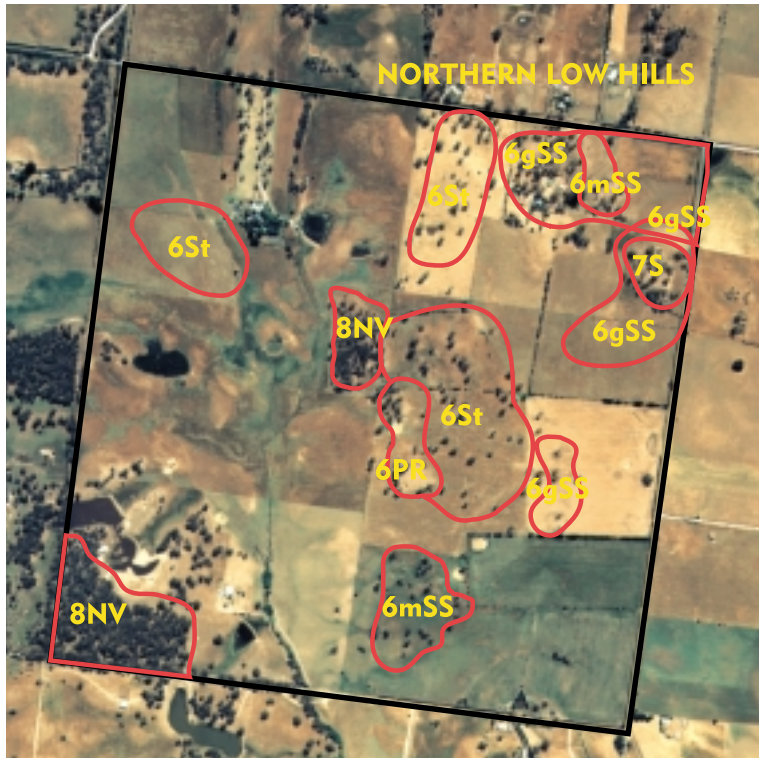



*Figure 14 Step 6: Labelling and marking out the shallow soils on the plan.*

step 7

# IDENTIFYING THE TOPSOIL COLOUR

*Conducted in the paddock*

In this step you will identify Land Class 5:

Land Class 5: Land suitable for less intensive agriculture such as high density grazing or farm forestry and cultivation associated with pasture development.

You will need:
Property plan
Overlay 2
Red permanent marker
Water bottle

Refer to the areas you outlined on Overlay 2 as being non-arable.

For the purpose of this exercise the definition of the topsoil is the top 10 cm of soil.

The topsoil is the principal soil zone for water and nutrient uptake by plants. The colour of the topsoil can give an indication of the nutrient status. A pale or grey coloured surface soil often indicates that the topsoil has little organic matter, is low in nutrients, and has a low water holding capacity.

A red, brown or black topsoil, on the other hand, often indicates more fertile conditions, and therefore is favoured for agriculture.

Step 7: Topsoil colour

- The colour of the topsoil should be assessed when it is wet.
- Using the water bottle, lightly wet the topsoil (but do not saturate).
- Using the colour swatches in the diagram below, work out, using the dominant colour, whether the topsoil will be classed as pale.

On the plan, mark out the boundary and label with the appropriate land class code the following areas using the red marker:
Pale topsoil - 5TP
Red, brown or black topsoil - Continue

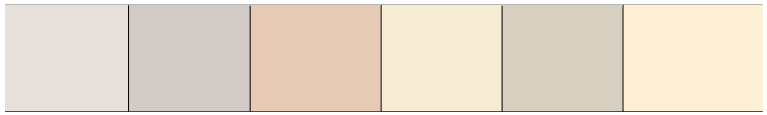


*Diagram 1 Pale soils. If any of these colours approximate the topsoil colour, then the topsoil is considered pale.*

*Figure 15 Pale topsoil; although the very surface of the soil is dark, the dominant colour in the top 10 cm is pale.*

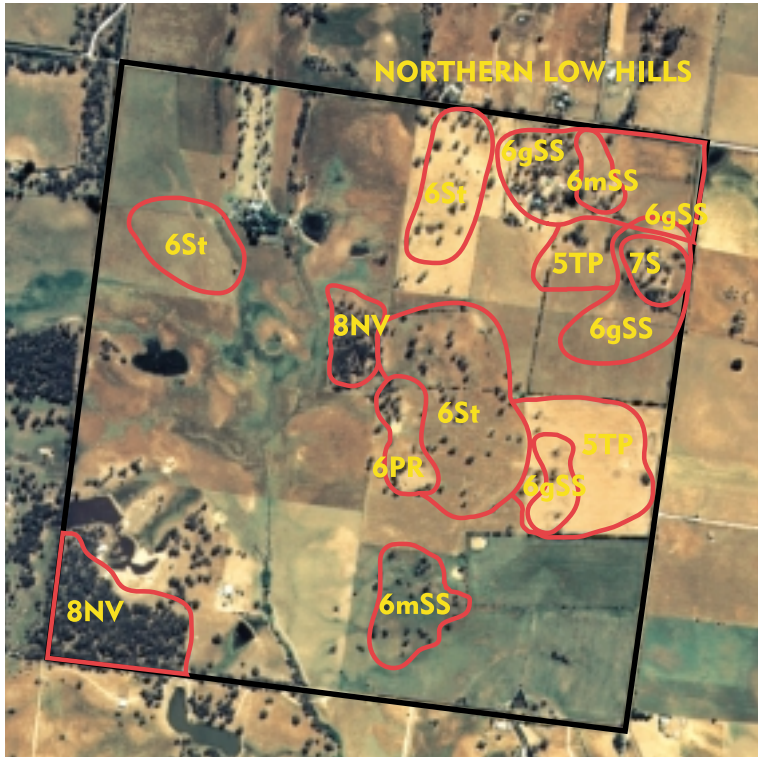



*Figure 16 Step 7: Marking out areas of pale topsoil on the plan.*

step 8

## ASSESSING SOIL DRAINAGE

*Conducted in the paddock or home*

In this step you will identify Land Classes 5 and 6:

Land Class 5: Land suitable for less intensive agriculture such as high density grazing or farm forestry and cultivation associated with pasture development.

Land Class 6: Land suitable for grazing or farm forestry. Low capability to resist land disturbance such as cultivation due to physical features of the land and erosion risk. Good management required to preserve vegetative cover.

You will need:
Property plan
Overlay 2
Red permanent marker

Refer to the areas you outlined on Overlay 2 as being non-arable.

Poor drainage that allows the soil to remain saturated for long periods can kill or stunt the growth of many agricultural plants.

Large areas that experience seasonal water ponding, (defined as areas that experience surface ponding at least twice in five years i.e. swamps), are less productive than the surrounding areas.

Conversely, excessive drainage is also a limitation due to an insufficient amount of water available for plant growth. Soils that drain very quickly are more limiting for agriculture if they are located in a low rainfall area, such as the North Western Sands or Mallee Land Degradation Hazard Region (LDHR).

*Poorly drained soils*

Characteristics that are commonly attributed to poorly drained soils are:

- Presence of rushes
- Difficulty driving on the area during winter and spring
- Hardsetting grey clay soils

*Figure 17 The presence of rushes in the foreground indicates poorly drained soils.*

*Excessively drained soils*

Characteristics that are commonly attributed to excessively drained soils are:

- High sand content
- High gravel content
- Located in the North Western Sands LDHR and the Mallee LDHR

*Figure 18 High sand content in the North Western Sands LDHR would be classed as Land Class 5.*

*Surface ponding*

- Surface water evident at least twice in five years

*Figure 19 Surface ponding*

1. Refer to the previous definitions
2. On the plan, mark out the boundary and label with the appropriate label code the following areas using the red marker:
Poorly drained soils - 5PD
Excessively drained soils - 5ED
Surface ponding - 6SP
Other areas - continue
Note: The areas marked out as poorly drained and surface ponding should be large areas of land rather than drainage lines. It is necessary to take note of the drainage lines as they will become important in Step 9: Establishing Landscape Types.


*Figure 20 Step 8: Marking out soil drainage on the plan.*

# DETERMINING THE ARABLE LAND CLASSES

*At this stage you have either come directly here from Step 4, or you have worked through the non-arable exercises (Steps 5-8) and found that you do have arable land.*

step 9

## ESTABLISHING LANDSCAPE TYPES

*Conducted in the paddock or home*

You will not identify any land classes in this step.

You will need:
Property plan
Overlay 1
Red permanent marker
Black permanent marker

At this stage of the land classing you are left with gentle slopes. Now the general lie of the land becomes important. This impacts on the drainage of the land as well as the ease of management.

*Figure 21 Dissected plain - note that the dissections form gentle drainage lines.*

*Dissected Plains*

When rolling land or plains are regularly dissected with drainage lines or have a clear break of slope from the crest to the lower slope, the whole area requires more complex management to cope with the differences in soil type and drainage.

*Level Plains*

Level plains or low rolling plains have fewer dissections and therefore not as many different soil types and drainage patterns to manage.

Step 9: Landscape

The landscape boundaries can be drawn directly onto the plan. It will be less messy if you label the landscape areas on Overlay 1 and refer to the overlay for Steps 10 and 11.

*Figure 22 Level plain - note few, if any, drainage lines.*

On the plan, draw a boundary around any change in landscape from level to dissected using the red marker.
On Overlay 1 label with the following codes using the black marker.
D - when dissected
L - when level


*Figure 23 Step 9: Drawing the boundary between level landscape and dissected landscape on the plan.*


*Figure 24 Step 9: Labelling Dissected (D) and Level (L) Landscapes on Overlay 1.*

step 10

## DETERMINING TOPSOIL DEPTH

*Conducted in the paddock*

You will not identify any land classes in this step.

You will need:
Property plan
Overlay 1
Blue permanent marker
Red permanent marker
Shovel/auger
Ruler

Note: Steps 10 and 11 should be conducted together. It is more accurate if you conduct them in the paddock by digging a hole to at least a depth of 20 cm.

The topsoil is the area where most of the nutrients accumulate, and therefore the deeper it is, the better it is for agriculture.

Shallow topsoil is less than 10 cm and deep topsoil is more than 10 cm.

A simple way to identify the topsoil is by colour. Due to the high levels of organic matter it is usually the darkest layer of soil. Measure the depth of topsoil to the point where the soil underneath becomes lighter in colour or the texture changes (usually becoming more clayey).

In some soils the colour is consistent throughout. In these soils there is commonly a difference in the structure of the topsoil and the subsoil. Often when you dig holes, you can feel a change in the structure of the soil, for example it may become harder to dig. This is often when the subsoil begins.

*Figure 25 Digging a shallow hole to assess the topsoil properties.*

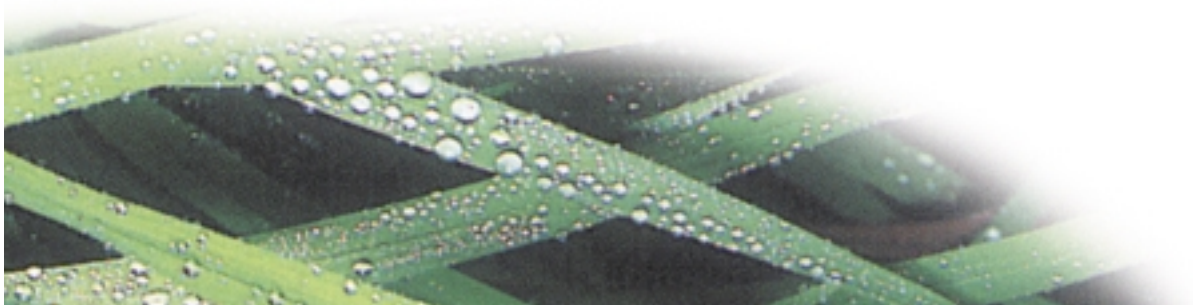
Step 10: Topsoil depth

When digging holes be careful not to take samples from disturbed areas, such as sheep camps, stock routes or access tracks.

Measure the topsoil in a number of places within the areas you established in Step 9 that have similar landscape features. In dissected landscapes (D), you should check the depth of the topsoil on the crests, upper slopes, lower slopes and drainage depressions. In level landscapes (L) you should check the topsoil depth every 100-150 metres (depending on the size of your property) or when there are subtle changes in the landscape. A gentle crest, slope or drainage line will need checking for different topsoil depth. The number of holes you dig will depend on the size of the area.

On Overlay 1 label the following codes using the blue marker:
s - shallow topsoil (<10 cm)
d - deep topsoil (>10 cm)
If there are obvious differences in topsoil depth within the same landscape area, mark the boundary of the change in topsoil depth using the red marker on the plan.


*Figure 26 Step 10: Marking out the boundary between shallow topsoil and deep topsoil in each of the landscape areas on the plan. When in place, the overlay shows the landscape code (in black) and the depth of topsoil (in blue).*



step 11

## DETERMINING TOPSOIL STRUCTURE

*Conducted in the paddock*

In this step you will identify Land Classes 1, 2, 3 and 4:

Land Class 1: Land suited to a wide range of uses especially horticulture and cropping. Very high levels of production possible with standard management levels. Land degradation is possible if the land is poorly managed therefore conservation practices are recommended.

Land Class 2: Land suited to a wide range of land uses including horticulture, cropping, grazing and farm forestry. Low risk of land degradation but still requiring high levels of management for production and protection of the land.

You will need:
Property plan
Overlay 1
Red permanent marker
Shovel/auger
Ruler

Land Class 3: Land suited to a wide range of land uses including less intensive horticulture, cropping, grazing and farm forestry. Moderate risk of land degradation requiring very high levels of management such as conservation tillage and maintenance of a vegetative cover on the soil surface.

Land Class 4: Semi-arable land. Land suitable for a range of land uses including occasional cropping, grazing and farm forestry. High risk of land degradation requiring the highest level of management for arable land such as conservation tillage, maintenance of a vegetative cover on the soil surface and surface water control.

Poorly structured topsoils are commonly hardsetting or experience surface crusting. These soils are very hard to penetrate when dry and become boggy quite quickly when wet.

If a soil has responded well to gypsum application, then this soil would be considered poorly structured in its natural state.

Loose topsoils such as sands or sandy loams that are low in organic matter are also referred to as poorly structured and they tend to be prone to wind erosion.

*Figure 27 Poorly structured topsoil.*

*Figure 28 A self-mulching topsoil is referred to as well structured.*

Well structured topsoils are characterised by many small aggregates of soil that can resist disturbance by machinery and raindrop impact. These soils are often referred to as self-mulching.

*Figure 29 A moderately structured topsoil.*

Moderately structured topsoils have many different sized aggregates that resist disturbance in most years by stock, machinery or water, although if over-used at the wrong moisture content, surface crusting can occur.

The structure of the topsoil influences the success of crop establishment, water infiltration, susceptibility to degradation and management of cropping land.

Step 11: Topsoil structure

Try to sample on areas you know have not had gypsum applied. Gypsum improves soil structure, therefore does not give an indication of the natural structure of the soil.

1. Using the same hole as Step 10, determine the structure of the topsoil by referring to the definitions above.
2. If after assessing the topsoil structure, it differs in areas with the same landscape and topsoil depth, draw in another boundary on the plan using the red marker to separate areas of differing topsoil structure.
3. Refer to the landscape code (in black) you wrote on Overlay 1 in Step 9.
4. Refer to the topsoil depth (in blue) you wrote on Overlay 1 in Step 10.
5. Using the combination of landscape and topsoil depth, refer to the appropriate combination below and using the red marker label the plan with the appropriate land class code:

If you have this combination on the overlay:

D - Dissected rolling rises and plain, hills

s - Less than 10 cm topsoil depth

Write these codes on the plan using the red marker:
Poorly structured - 4DsP (dissected landscape, shallow topsoil, poor topsoil structure)
Moderately structured - 4DsM (dissected landscape, shallow topsoil, moderate topsoil structure)
Well structured - 3Ds (dissected landscape, shallow topsoil)

If you have this combination on the overlay:

D - Dissected rolling rises and plain, hills

d - Greater than 10 cm topsoil depth

Write these codes on the plan using the red marker:
Poorly structured - 4DP (dissected landscape, poor topsoil structure)
Moderately structured - 3DM (dissected landscape, moderate topsoil structure)
Well structured - 2D (dissected landscape)

If you have this combination on the overlay:

L - Level plain and low rolling plains

s - Less than 10 cm topsoil depth

Write these codes on the plan using the red marker:
Poorly structured - 3sP (shallow topsoil, poor topsoil structure)
Moderately structured - 2sM (shallow topsoil, moderate topsoil structure)
Well structured - 2s (shallow topsoil)

If you have this combination on the overlay:

L - Level plain and low rolling plains

d - Greater than 10 cm topsoil depth

Write these codes on the plan using the red marker:
Poorly structured - 3P (poor topsoil structure)
Moderately structured - 2M (moderate topsoil structure)
Well structured - 1

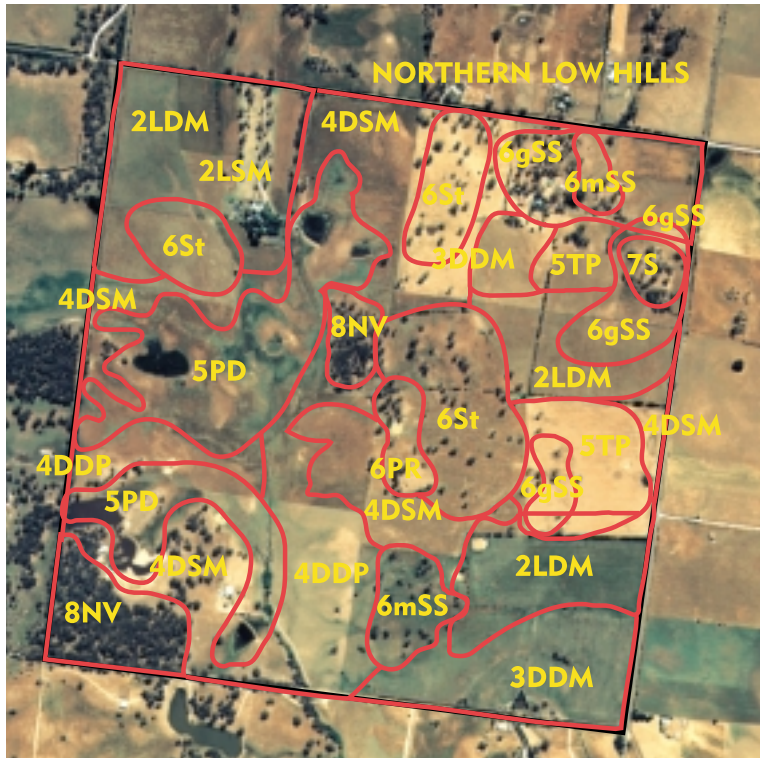



*Figure 30 Step 11: Labelling the topsoil structure on the plan.*

*Congratulations,*
*you have completed the land classing exercises!*

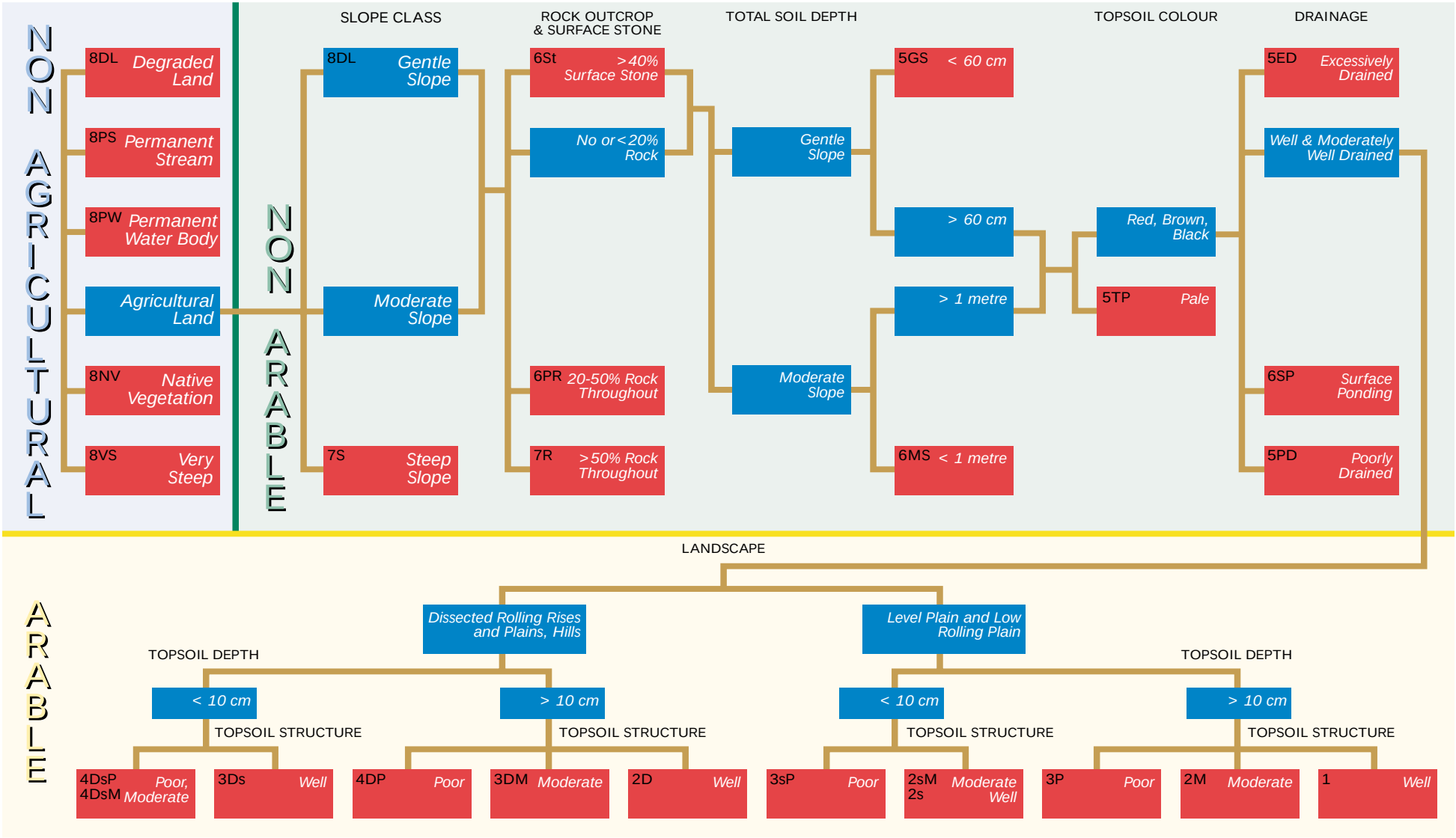
*You now have a land class plan of your property. This plan is the first stage of a Whole Farm Plan. You can now start to look at general farm layout and develop alternative layouts that may simplify management of your property, and allow the tailoring of inputs to the various land classes.*

*For more information or assistance with Whole Farm Planning and Farm$mart business planning courses contact your local DNRE office.*

appendix

# A

## FLOW CHART OF LAND CLASSING STEPS AND CODES



appendix

# B

## INTERPRETING THE LIMITATION

The land can be a particular land class for a number of different limitations. Therefore, in order to readily interpret the particular limitation, a coding system as outlined is used. Having these codes on your plan will make it easy for you to identify exactly what the constraints are, and you may be able to manage the land in order to overcome the limitation, thereby producing better returns from a particular area or paddock.

| Land Class No. | Major Limitation | Major Limitation Symbol | Final Code |
|---|---|---|---|
| 8 | Very steep | VS | 8VS |
| 8 | Permanent stream | PS | 8PS |
| 8 | Native vegetation | NV | 8NV |
| 8 | Permanent water body | PW | 8PW |
| 8 | Very rocky | VR | 8VR |
| 8 | Degraded land | DL | 8DL |
| 7 | Steep slope | S | 7S |
| 7 | 50-70% rock outcrop throughout (rocky) | R | 7R |
| 6 | 20-50% rock outcrop throughout (partially rocky) | PR | 6PR |
| 6 | Greater than 40% surface stone | St | 6St |
| 6 | Moderate slope - shallow soil | mSS | 6mSS |
| 6 | Gentle slope - shallow soil | gSS | 6gSS |
| 6 | Surface ponding | SP | 6SP |
| 5 | Pale topsoil colour | TP | 5TP |
| 5 | Poorly drained | PD | 5PD |
| 5 | Excessively drained | ED | 5ED |
| 4 | Dissected rolling rises, plains and hills(D), shallow topsoil (s), poor topsoil structure (P) | D,s,P | 4DsP |
| 4 | Dissected rolling rises, plains and hills (D), shallow topsoil (s), moderate topsoil structure (M) | D,s,M | 4DsM |
| 4 | Dissected rolling rises, plains and hills (D), poor topsoil structure (P) | D,P | 4DP |
| 3 | Dissected rolling rises, plains and hills (D), shallow topsoil (s) | D,s | 3Ds |
| 3 | Dissected rolling rises, plains and hills (D), moderate topsoil structure (M) | D,M | 3DM |
| 3 | Shallow topsoil (s), poor topsoil structure(P) | s,P | 3sP |
| 3 | Poor structure (P) | P | 3P |
| 2 | Dissected rolling rises, plains and hills (D) | D | 2D |
| 2 | Shallow topsoil (s), moderate topsoil structure (M) | s,M | 2sM |
| 2 | Shallow topsoil (s) | s | 2s |
| 2 | Moderate structure (M) | M | 2M |
| 1 | No limitations | | 1 |

# CLINOMETER INSTRUCTIONS

This is used to measure the slope of the land. Measure as many slopes as possible on your property.

1. Tie a piece of cotton or string through the hole. Attach a weight to the end of the cotton or string. Something sticky such as 'Blu Tack' is ideal as it will stick to the paper and make it easier for you to make a reading.

2. To measure a slope you either stand at the bottom of the slope and take a measurement upwards, or you stand at the top of the slope (usually a crest) and measure downslope.

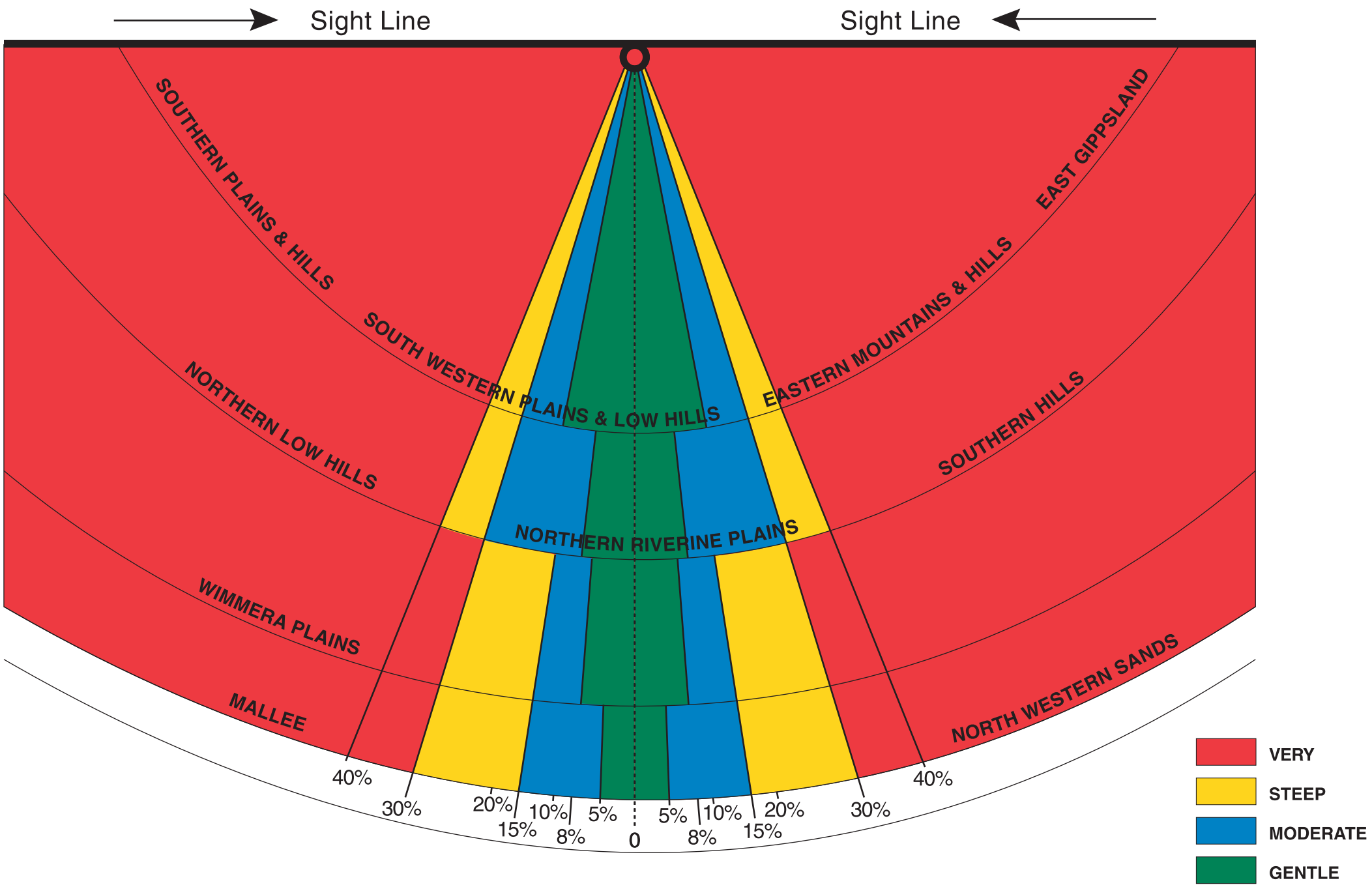
3. Crouch down so you are as close too the ground as possible.

4. Look along either sight line, whichever feels comfortable.

5. If you are looking upslope, align the clinometer until it is level with the break of slope (commonly a crest). If you are looking downslope, align the clinometer until it is level with the break of slope (commonly a drainage depression).

6. When level with the point, place your finger on the string to secure it in place.

7. Look at the appropriate climatic region in which you are located, read the slope range the string has fallen on by referring to the key underneath.


Sight Line
Sight Line
SOUTHERN PLAINS & HILLS
SOUTH WESTERN PLAINS & LOW HILLS
EASTERN MOUNTAINS & HILLS
EAST GIPPSLAND
NORTHERN LOW HILLS
NORTHERN RIVERINE PLAINS
SOUTHERN HILLS
WIMMERA PLAINS
MALLEE
NORTH WESTERN SANDS
40%
30%
20%
15%
10%
8%
5%
0
5%
8%
10%
15%
20%
30%
40%
VERY
STEEP
MODERATE
GENTLE