

# Monitoring Guide for 'Catch the Rain'

## Instructions:

This guide includes;

- What equipment you will need
- How to establish your **monitoring transects**
- How to install **runoff catchers**
- How to do a **ring infiltration** test
- How to measure **ground cover**
- All of the **photos** that you will need for **scoring soil health** using the VSA metrics in Soil Mentor

*\*Each measure in the Soil Mentor phone app has instructions/methodology that you can find using the 'i' button when you click into each measure.*

## How often should you monitor?

- **Every spring and/or autumn** (when there is moderate soil moisture):
  - *Ring infiltration test x 4 (if flat)*
  - *Basic Soil/Plant (VSA+) measures*
- **Every grazing rotation BEFORE AND AFTER** animals enter your trial/control paddock:
  - *Ground cover (photos only)*
  - *Soil temperature 25mm & 100mm*
- **Peak summer dry** (optional)
  - *Ground cover (photos only)*
  - *Water drop penetration test (this test if your soils become water repellent)*
- **Monthly or after significant rain** (runoff catchers only)
  - *Total rainfall*
  - *Runoff*

# Equipment List

## **Transect set up**

- Some kind of markers that will help you find the exact same site each time  
I.e. fibreglass posts, orange markers/baling twine/paint on existing fences etc

## **Overland Flow Collectors (Runoff catchers)**

- See relevant section below

## **Ring Infiltration Test**

- See relevant section below

## **Ground Cover**

- Mobile phone with the Soil Mentor app

## **Basic Soil/Plant Monitoring (VSA+)**

- Decent spade
- Fish bin (or equivalent)
- 10inch+ wide piece of wood (for shattering soil sample)
- Small tarpolean (or equivalent)
- Tape measure

# How to establish monitoring sites

Selecting good monitoring sites helps minimise 'interference' in your results from variations in soil type, pasture species, grazing behaviour etc.

For **simple comparisons** (*where you have one trial area and one control area*) we are setting up a basic 'monitoring transect' in each.

Monitoring transects are permanent 'lines' established across a paddock or trial area. They allow measurements to be taken in the same place each time. To set up a monitoring transect;

- Identify 50m transects that are representative of the whole area and as similar as possible between your trial and control.
  - Avoid areas near gates, fencelines, tracks, individuals trees, stock camps where livestock behave differently.
  - You can measure or simply pace out the 50m.
- Typically transects go through the middle of a paddock or trial area. Depending on the situation they can be vertical, horizontal or even on the diagonal.
- Mark each end of the transect.
  - Use something like a fibreglass post that animals can't shift, or markers on a fence. Make them obvious using coloured tape, labing twine, paint etc.
- Each time you come back to the trial site you can use the permanent markers to ensure you walk the same line and sample the same area.

For **replicated trials/comparisons** (*where you have multiple trial and control plots*) we are identifying one sampling site per plot.

As with transects, sampling sites need to be as similar as possible across each replicate. When setting up sampling sites;

- Avoid areas near gates, fencelines, tracks, individuals trees, stock camps where livestock behave differently.
- Try and match slope, aspect, distance from ridges/gullies

# Overland flow collector (Runoff catcher)

## Installation

### Equipment required

1. **Overland flow collector** (runoff catcher) with 20 mm hose / pipe connection.
2. **20 mm LDPE or hose pipe** to reach from collector to collecting drum
3. **20mm connection for collecting drum**
4. **Collecting drum(s)** - large enough to collect the overland flow over a period of a month (i.e. 200L barrel or 1000L IBC). *\*Catching area is  $2 \times 6\text{m} = 12 \text{m}^2$ . 50 mm of rain all running off the catching area will produce 600 L of water.*
5. **Tap or hand pump** for emptying drum and measuring jug for measuring runoff - fitted to the drum before taking to site.
6. **Plastic lawn edging** ~ 12 cm high and 4 m long for top of plot to divert upslope overland flow. Plus 20cm to stop water running off end of catcher.
7. **Rain Gauge** (250 mm rainfall holding capacity) and something to mount it on (nearby fence post or waratah)
8. Posts / waratahs and wire to fence off drum if required

### Tools required for installation

1. Tape measure - at least six metres long.
2. 2.5 metre long piece of string and a couple of pins to make a straight line to cut the slot for the collector.
3. A 2 m long straight edge, eg straight bit of wood (optional but helpful)
4. 10 to 20 L bucket for making soil slurry to bed collector in ground
5. ~10 L of fine soil from soil dug out for collector (about half what is dug out for fine textured soils)
6. ~ 10 L water for mixing with soil to make slurry
7. Regular spade
8. Customised spade for digging catcher trench (optional)
9. Pipe wrenches / spanners for pipe fittings
10. Silicone sealant for final sealing of drainage fitting on collector (if not already done)
11. Bindertwine, straps, wire etc for securing drum
12. Something to protect the barrel(s) from livestock (i.e. hotwire)
13. Mobile phone with soil mentor app for recording details, eg GPS location, photos, date, etc



## **How to install the collector (see images on next page)**

1. If the ground is hard and dry it will make the job much easier if it can be wetted up the day before.
2. Choose a site that is reasonably representative of the paddock / trial site. Avoid being close to gates, stock camps, fencelines, tracks (machinery, stock), channel bottoms and ridge tops.
3. Decide on the location of the collector - making sure you have 6+ metres of representative slope above.
4. At the same time choose the location for the collection drum. This needs to be sufficiently downslope that water can properly drain from the collector but not so far you need loads of connecting pipe. Options include securing to a fence post, or digging it partially into the ground. It needs to be secure from wind and stock. It may need to be fenced off. You also need to work out how you will empty it (by a tap at the bottom or a hand pump)
5. Using the the collector and a spirit level, get an exact level across the slope where you will put the collector
6. Then lower the end of the system that will collect the water by about 5% so the water will flow down to the collection end.
7. Mark the position with the string and then cut a first line through the top of the pasture with the spade. Then dig a trench 1-2cm wider than the collector, about 50mm deep.
8. The collector has holes in the internal bracing which means it has an up and a down side. Make sure the slots are at the bottom of the collector so water can flow through it.
9. Silicone in the ends of the collector (if required) and the 20 mm Hansen fitting into the lower end at the required angle. In most cases it will be easiest to connect the 20mm LDPE pipe at this point.
10. Make up a sloppy slurry of soil using about half the soil you have dug out - slightly more runny than cement mortar. This is to create a water-tight seal below the collector to prevent water seeping / flowing under it.
11. If the soil in the channel is dry pour some water into it so it does not suck the water out of the soil slurry.
12. Fill the bottom of the channel with all the slurry and bed the collector into it by pushing down and moving side to side to force the slurry up the sides. Make sure you have the collector the right way up - ie the drainage slots in the internal bracing are at the bottom. The mesh covered slot must face uphill with ~1 cm below the soil surface and ~2 cm sitting above it. Make sure the slurry does not cover the mesh.
13. Install the deflector - Measure six metres uphill from each end of the collector and use the string and pins to mark the location. Using a spade cut a slot along the string line leaning slightly uphill and 1/2 metre past either end (3m total). Then push in the garden edging / deflector, so there is ~5 cm sticking up above the pasture. Then tread / push the pasture down on either side of the deflector so it is firmed into the soil.
14. Connect the collector to the drum with the 20 mm LDPE pipe or hose. Make sure everything is secure and stock proof.
15. You are now all setup!

## **Using the collector**

Check and empty the rain gauge and collector after significant rain events or at least monthly. Record the data in Soil Mentor.



**Step 5&6:** set up collector position with a slight fall



**Step 7:** Dig trench for collector



**Steps 10-12:** Fill the trench with slurry and install collector with mesh slightly below soil surface



**Step 13:** Install the deflector 6m above the collector



# Ring infiltration test

This works best on stone free soil, or where there are only a few small stones / gravel, though there is a workaround for stony soil, described at the bottom. It also only works on moist soil - dry soil will shatter as you drive the ring in - if you can even get the ring in! See the methods for pre-wetting of soil if required. Due to the requirement for moist soil, its better to do the tests at a time when the soil is naturally moist but not just had a downpour in the last few days. So, through winter when farm work has reduced is a good time.

## Equipment required

1. If the ground is dry, a bucket with a small (5 mm) hole in the bottom and hessian to wet up the ground 24 hrs prior to the test, or, the ring can be used to pre-wet at test time
2. One or more infiltrometer rings
3. 2 x 4" wood batten for hammering the rings into the ground
4. 2 to 4 lb club hammer for hammering the rings in the ground
5. Spirit level or spirit level app on phone to check the ring is level
6. Sufficient water in a container that is easy to get it out of, eg 20 L with a tap
7. Jug to fill the rings, eg 1 L
8. Shears to cut back longer pasture / vegetation
9. Timing device, eg phone or watch

## Method

1. Choose a suitable area of the whole field, ie not near gates, fences, established wheelings etc
2. If the pasture is more than a couple of cm / inch high cut it close to the soil without disturbing the soil so you can see the soil surface.
3. If the ground is not moist enough then wet it by putting the bucket with the hole on on top of the hessian, fill it with water and allow it to drain in over 24 hrs. OR, place the ring on the ground and rotate just enough so it seals against the soil. Pour about an inch of water in an let that drain. Push the ring in a bit more and put another inch in. Repeat until the soil is wet enough to depth to hammer the ring into the ground. Then fill the ring and allow all water to infiltrate. Then refill and take timings.
4. Hammer the ring into the ground keeping it as straight as possible down to the 5 cm line on the outside. Make sure it is perfectly level when at the correct depth
5. Gently firm the soil round the inside of the ring to stop water flowing down the sides
6. Gently fill with water to the brim
7. Record the time to reach the first line inside the ring, which is your first inch (25 mm) then the time to reach the second line - second inch, and when all the water has soaked in and the soil surface is just glistening then record that time as the 3<sup>rd</sup> inch.
8. Ideally record several rings at the same time and location eg within a few meters of each other. Else, repeat several times with one ring.

## Variation for very slow infiltration

If the water is taking a long time to infiltrate, eg more than 15 mins for the first inch, then let it infiltrate for as long as you can and then measure the distance from the top of the ring to the water level. Use the following corrections to determine your infiltration per hour

- Measure over 15 mins multiply by 4
- Measure over 30 mins multiply by 2

- Measure over 60 mins the amount of mm the water has dropped is your infiltration rate

### **Variation for stony soil**

1. Place the ring on the prepared soil surface and then cut around the outside with a knife about 1 cm deep
2. If you find any small stones while cutting with the knife, remove them if you can do so without causing too much soil disturbance.
3. Gently knock the ring into the cut circle in the soil about 1 cm deep
4. Then push and firm the soil on both sides of the ring to seal it as well as possible especially where stones were removed - soil needs to be moist and ideally plastic to get the best seal.
5. As the depth lines on the ring no longer correspond to the depth it is inserted, measure out 422 ml of water which equals 1" / 25 mm depth of water, add it to ring, time how long it takes to infiltrate and that is your 1<sup>st</sup> inch.
6. Repeat with another 422 ml, for the 2<sup>nd</sup> inch
7. Repeat a third time with another 422 ml for the 3<sup>rd</sup> inch

# Ground cover:

## Pasture covers transect

The pasture cover transect measures how much pasture foliage - both alive and dead - there is covering your soil and thus how protected your soil is from sun and rain. This differs from the basal ground cover transect when looks at the amount of bare earth underneath the foliage and the proportion that has plant stems.

1. Using your transect (see above) put in three permanent electric fence posts as markers, roughly equally spaced. Electric fence posts are preferred as stock are less likely to rub on them and thus impact pasture around them, than, ridged posts like wood or waratahs.
2. When taking a photo at the markers, to avoid pasture impacted by stock directly around the marker, take two to three steps away from the marker. Always take the same number of steps in the same direction for all the markers.
3. Just before you put stock into the area, take photos to record the pre-grazing covers.
4. Just after you remove stock from the area, take another set of photos to record the residuals.

## Basal ground cover transect

This metric feeds into the **% Bare Earth Regen Indicator**. Measuring the approximate proportion of a field that is exposed to the sun, wind and rain is a good indication of your soil's risk of erosion and drought. Basal cover refers to the proportion of plant that extends into the soil (not just the proportion covered by canopy or foliage).

## Equipment

- Electric fence post or stick
- Optional: 60m measuring tape / 60m length of rope

## How to

1. If using a 60m measuring tape or length of rope, leave one side of the tape at the relevant sample location you begin at, and walk the other end in a straight line away from the sample point (otherwise, you can follow the next steps by moving in an approximate line away from your sample location.)
2. Walk along your line transect, sticking your post into the ground every 2 feet (or 60cm).
3. Look at where the post goes into the ground, and record in the dropdown list whether your stick hits bare soil, forbs (broadleaves / herbs), grasses, ground litter, legumes or undesirables each time.  
N.B. You should **only record the result as a plant option if your post is touching the stem of the plant going into the soil** - i.e. not an outer leaf or stem partly covering the soil.
4. Continue these steps as you move along your transect, or as far as your field borders will allow you to. Ideally, you should do 100 of these readings along your transect, so this is a good test to enlist some help for!

# Structure:

## PLATE 2 Visual scoring (VS) of soil structure



**GOOD CONDITION VS = 2**  
Soil dominated by friable, fine aggregates with no significant clodding. Aggregates are generally sub-rounded (nutty) and often quite porous.



**MODERATE CONDITION VS = 1**  
Soil contains significant proportions (50 percent) of both coarse clods and friable fine aggregates. The coarse clods are firm, sub-angular or angular in shape and have few or no pores.



**POOR CONDITION VS = 0**  
Soil dominated by coarse clods with very few finer aggregates. The coarse clods are very firm, angular or sub-angular in shape and have very few or no pores.

# Porosity:

## PLATE 3 Visual scoring (VS) of soil porosity



### **GOOD CONDITION VS = 2**

Soils have many macropores and coarse micropores between and within aggregates associated with good soil structure.



### **MODERATE CONDITION VS = 1**

Soil macropores and coarse micropores between and within aggregates have declined significantly but are present in parts of the soil on close examination. The soil shows a moderate amount of consolidation.



### **POOR CONDITION VS = 0**

No soil macropores and coarse micropores are visually apparent within compact, massive structureless clods. The clod surface is smooth with few or no cracks or holes, and can have sharp angles.



# Mottles:

## PLATE 4 Visual scoring (VS) of the number and colour of soil mottles



**GOOD CONDITION VS = 2**  
Mottles are generally absent.



**MODERATE CONDITION VS = 1**  
Soil has many (10–20 percent) fine and medium orange and grey mottles.



**POOR CONDITION VS = 0**  
Soil has profuse ( 50 percent) medium and coarse orange and particularly grey mottles.



# Colour:

## PLATE 6 Visual scoring (VS) of soil colour



**GOOD CONDITION VS = 2**  
Dark coloured topsoil that is similar to, or darker than that under the fenceline.



**MODERATE CONDITION VS = 1**  
The colour of the topsoil is somewhat paler than under the fenceline, but not markedly so.



**POOR CONDITION VS = 0**  
Soil colour has become significantly paler compared with under the fenceline.

# Earthworms:

PLATE 8 *Lumbricus rubellus*



A very active surface litter and dung feeding earthworm; commonly red-brown or red-purple in colour with a paler underside; has a distinctly flattened tail; commonly 25–220 mm long.

PLATE 9 *Aporectodea caliginosa*



A medium-sized (40–90 mm) topsoil dwelling earthworm; commonly grey-pink on both the dorsal and ventral surfaces; does not have a flattened tail.

PLATE 10 *Aporectodea longa*

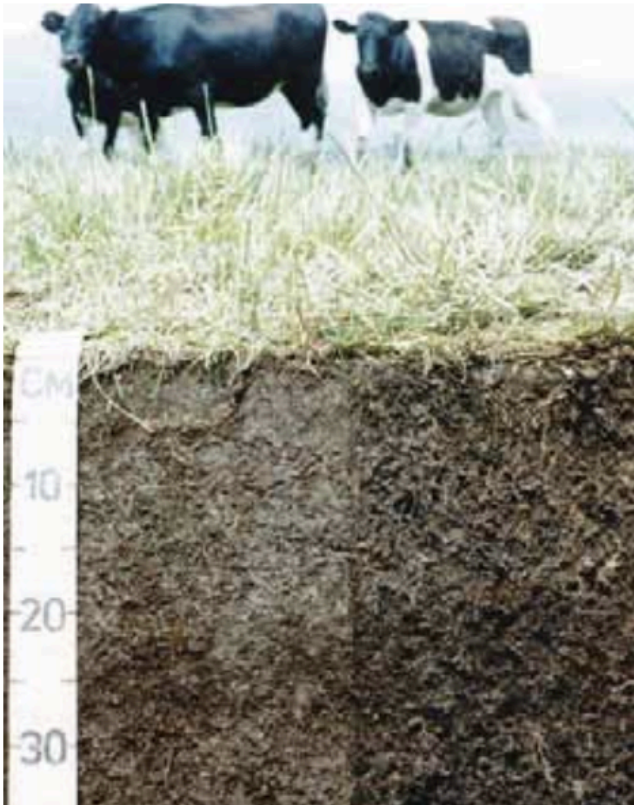


A long (90–180 mm) deep burrowing earthworm; commonly dark grey-brown with a black head; tail end is paler and slightly flattened. Underside is paler than the dorsal surface.



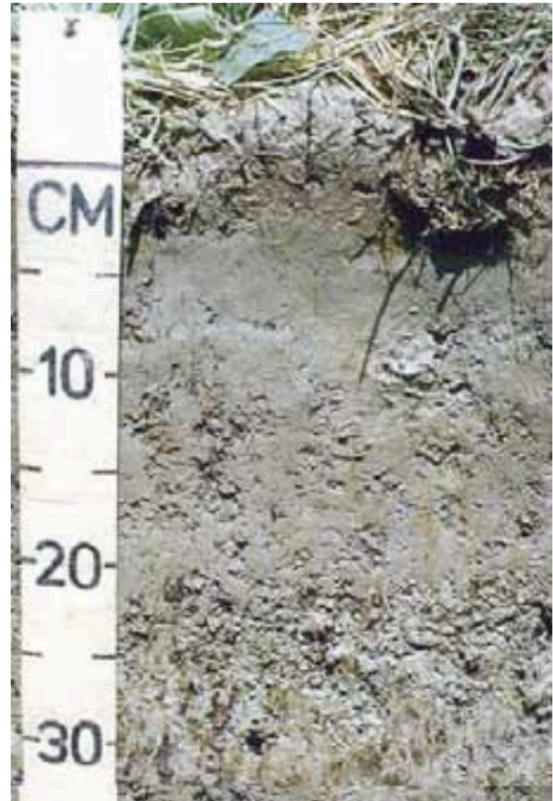
# Smell:

PLATE 14 Soil with a moderately good smell



Soil has a moderately rich, earthy, sweet smell with a smell score of 1.5.

PLATE 15 Soil with a poor smell



Soil has a putrid, unpleasant smell of hydrogen sulphide with a smell score of 0.

## Rooting Depth:

### PLATE 16 Potential rooting depth

Photo: Courtesy of Aaron Topp



Hole dug to assess the potential rooting depth.  
Photo showing good potential rooting depth with abundant fine roots extending beyond the bottom of the photo at 810 mm depth.

# Surface Relief:

## PLATE 20 Visual scoring (VS) of surface relief



**GOOD CONDITION VS = 2**  
Surface is relatively smooth and unbroken.



**MODERATE CONDITION VS = 1**  
Surface terrain is somewhat broken up and incised by occasional heavy treading events but it is not difficult to walk over.



**POOR CONDITION VS = 0**  
Surface is very broken and deeply incised by severe repeated treading. The terrain is difficult to walk across and care must be taken to avoid twisting ankles.

# Pasture DM/ha

Assess your forage volume using a compressed sward stick or plate meter. The value on the sward stick is a pre-calibrated number with the units kg DM / ha (kg of Dry Matter per hectare). You take 40+ measures per field generally.

## When to record

All year round - weekly or fortnightly.

Determine your forage volume, using a compressed Sward Stick.

**Equipment:** Sward Stick/Plate Meter, Clipboard

## How to do the test

1. Walk in a 'W' shape across the field taking readings to approximate the sward as you go.
2. Place clipboard onto sward.
3. Push Sward Stick firmly down to soil surface.
4. Read value on the Sward Stick level with the underside of the clipboard.
5. Record value and take a photo.