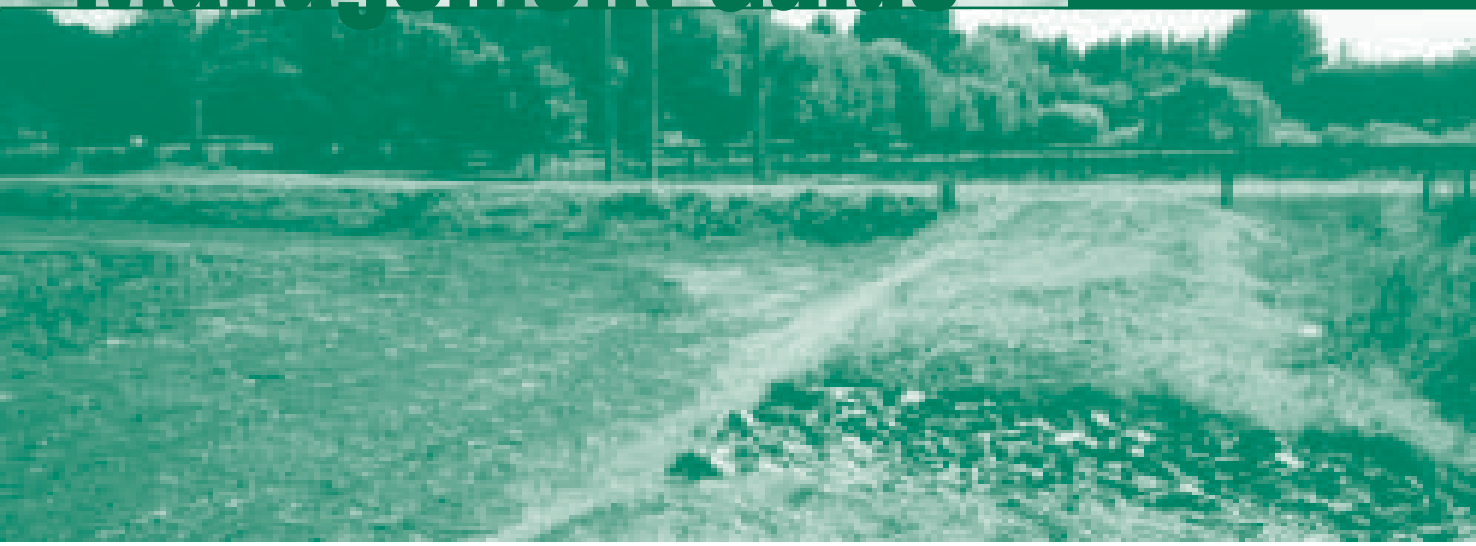
Soil and Drainage Management Guide

Franklin Sustainabilty Project



Management of drainage water on a property will influence how much soil movement occurs during rain. These guidelines have been split into two parts: Paddock Drainage and Erosion and Sediment Control.

Sustainable management of a commercial vegetable business requires quality drainage water and soil management to ensure soil movement (and associated loss of soil nutrients and soil biology) is minimised. When soil moves within or off a paddock, there will be a loss in productivity, because the soil loses its natural characteristics such as water holding capacity, soil nutrients and soil structure and biological activity (i.e. it becomes loose sediment).

When soil moves off a property it becomes an environmental cost to the community. Sediment and nutrients leaving a property can increase vegetation in drains and leave silt on roads. The resulting damage can be hazardous and expensive to remove.

Usually a number of measures can be implemented on a property to minimise potential soil movement. The measures you choose for each block will be influenced by factors such as the block topography, cropping system, resource availability and risk assessment of the property.

There are three steps to minimising soil loss from the property.

1. Minimise soil movement within the paddock.
   - Plant cover crops.
   - Retain crop stubble and residues on the surface during high erosion risk periods.
   - Undertake wheel track ripping.
   - Manage soil structure and soil organic matter levels.
   - Minimise soil compaction and ensure adequate infiltration of water.
2. Manage water movement across cropping areas.
3. Construct silt traps or bunds to minimise soil loss.

These guidelines are based on current scientific knowledge. They will be amended as further research results become available.

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For more information call

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Franklin District Council	**09 237 1300**	**Franklin Sustainability Project**	**09 237 1274**

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Erosion and Sediment Control

Your sediment control management should include a number of components, with silt traps as a final control measure.

There will be times of the year when the paddock is fallow. Silt traps will capture soil moving during this period, minimising the loss.

Whenever possible:

1. Break the paddock into smaller catchments with their own treatment measures and silt trap.
2. Treat runoff from a catchment only once, and discharge it from the paddock into a drain.

Wheel Track Ripping

Wheel Track Ripping has been shown to increase rainfall infiltration rates and decrease soil movement. Refer to Doing It Right a4 - Wheel Track Ripping. When paddocks are fallow it is recommended that any compacted areas are ripped to minimise soil movement.

Silt Traps

How big should they be?

The size of silt traps or bunds will depend on the amount of soil movement that could occur. This is influenced by:

- slope angle and length
- size of area draining into the trap (catchment area)
- soil type and soil aggregate size
- severity of significant rainfall events.

How do I determine the catchment area size?

This is the area of land that drains into a given silt trap or bund. If cut-off drains are not used to direct water from above the cropping area away from the crop, this area must be included as part of the catchment area.

Recommended Silt Trap Capacity

The following is a general guide where a silt trap is the only soil movement measure in place while the paddock is fallow. For specific information, please seek professional advice from, for example, a Franklin Sustainabilty Project field representative.

There are three options for capturing silt before it leaves your property:

1. Dig a silt trap, which often means excavating out a pond-like area.
2. Build a long bunded area.
3. Use a combination of these that provides the required capacity.

Catchment Area	Slope *	Row Length	Capacity	Silt Trap and Bund Capacity Examples ^
< 5 ha	< 6° or 10%	<200m	50m^3 / ha of catchment	1ha catchment, trap dimensions = 5m x 5m x 2m = 50m^3
				2.5 ha catchment, trap dimensions =10 x 10 x 1.3m =130m^3
5 ha	> 6° or 10%	< 200m	100m^3 / ha of catchment	5 ha catchment, trap dimensions = 19 x 19 x 1.5m = 541m^3
> 5 ha	> 6° or 10%	> 200m	>100m^3 / ha of catchment	6 ha catchment, trap dimensions = 18 x 17 x 2m = 612m^3

** Measure the slope as the steepest angle of the nearest 50m of land to the silt trap.*
*^ These silt trap dimensions are **one example** only of how to achieve the required trap capacity.*

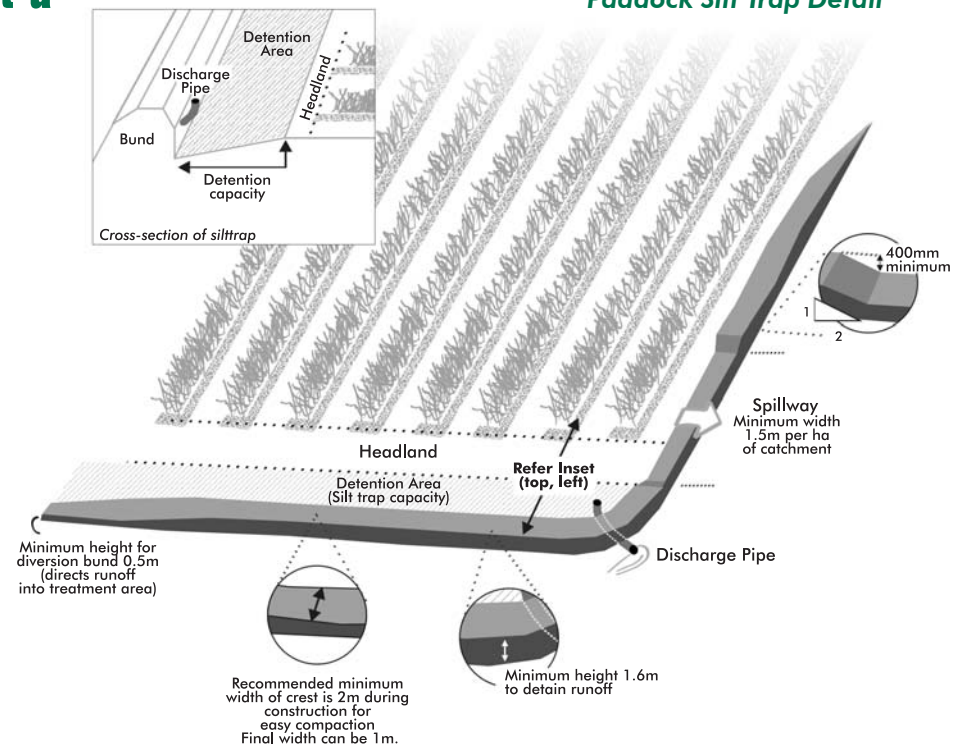
Note : Aim to maintain at least 50 percent capacity at any time for unexpected storm events. These measurements aim to detain the runoff long enough to allow most sediment to drop out of suspension. The capacity dimensions are based on current scientific knowledge, but do not account for different soil types. This will be amended as further appropriate research results are received. Refer also to Doing It Right Factsheet a5 - Silt Traps.

How do I construct a silt trap?

There are four components:

- the bund or walls
- the detention area
- the overflow or spillway
- the discharge mechanism or snorkel.

Paddock Silt Trap Detail



Planning

Check for cables, pipes etc before marking out the position of the silt trap or bund. Strip topsoil and vegetation from the area and form a firm foundation if the walls are to be built up.

If pasture for stock grazing is part of your rotation, consider erecting temporary electric fencing around the silt trap during wet weather - otherwise cattle will pug and damage the structure.

Bund or walls

1. They must be thoroughly compacted, otherwise they can blow out in storm events. Compact each 200mm of material added to the height of walls. Usually a minimum of three passes over the entire surface per layer is required.
2. Establish vegetation cover. It may be necessary to pin down coarse shade cloth to stabilise the slope face, and plant with grasses such as Yorkshire fog, Wana cocksfoot, Vulcan tall fescue, Browntop or Creeping bent.
3. If clay has been used it will be necessary to add a layer of topsoil over the clay. Grass establishment and fertiliser should be applied.

Detention Area

This is the area where runoff from the paddock will collect and settle for sufficient time to allow any sediment in suspension to drop out before the water drains away, through the snorkel or spillway. Benched headlands can direct water into the detention area. Refer to Doing It Right Factsheet a7- Headland.

Overflow or Spillway

An overflow or spillway discharges the excess water runoff in major storm events and stops bunds breaking. Select the position carefully to minimise construction and later maintenance.

1. Position spillway so it is not in line with water entrance points.
2. If possible, situate the spillway on firm, undisturbed ground.
3. Ensure runoff discharges won't cause erosion.
4. Ensure that the minimum width is 1.5m/ha of catchment.
5. Ensure that the spillway is level across its width.
6. Make sure you protect the spillway sides against erosion, using either coarse shade cloth and sowing grass or large rocks (especially in areas where soil type is silty or sandy).

Snorkel or discharge pipe

The snorkel or discharge pipe drains the silt trap between rainfall events.

How do I install the pipes?

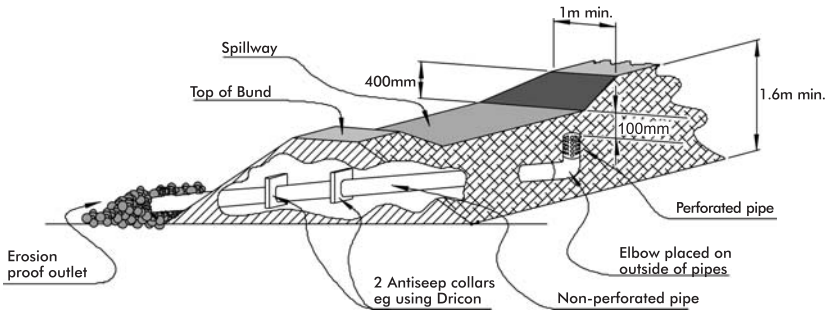
1. The pipes are placed at the lowest point of the silt trap, and should discharge to an erosion-proof outfall. This may be the water table, a drain or stream.
2. Avoid crushing the pipe during installation. The soil should be thoroughly compacted around the pipe by hand.
3. Use non-perforated pipe through the bund wall, for example, solid PVC pipe.
4. For the upstand, use solid drainage pipe with six rows of 10 mm diameter holes, drilled at 50 mm spacings.
5. Use an 88° elbow to join the upstand and the pipe. It may be necessary to install a waratah into the ground next to the pipes for support.
6. Ensure the top of the snorkel is 100 mm below the spillway.

How large should the pipes be?

Pipe diameters	Catchment Area
100 mm	< 1 ha
150 mm	1 – 2 ha
225 mm	> 2 ha

For larger catchments more pipes will be required.

Snorkel/Discharge Pipe



OSH considerations

If there is any potential for serious human harm as a result of installing these measures, you must warn people of this. Often the most practical way to warn people is to erect signage. These should be included in your property hazard list.

Don't forget maintenance!

- Inspect traps regularly and after each storm.
- Retain at least 50 percent storage capacity.
- Check snorkels are not blocked, for example with pine needles.
- Fix any damage.

Check list of key points for Erosion and Sediment Control

1. Use several measures.
2. Minimise soil movement within the paddock.
3. Manage water movement across cropping area.
4. Silt trap size depends on slope angle, slope length, catchment area.

Paddock Drainage

Paddock Drainage should achieve two objectives:
- prevent surface water from entering the paddock
- direct water that falls on the cropping area away through a silt trap.

Can I stop water entering my cropping areas?

Yes. Use cut-off or interception drains to divert water from the catchment area above the cropping block. Keep this water separate from in-paddock sediment control measures, and discharge it into the watertable in small volumes at regular intervals.

Recommended Drain Characteristics:

- Shape - to minimise channel erosion
  use ◡ not ◠
- Longitudinal gradient of less than five percent (3°)

How big does this drain need to be?

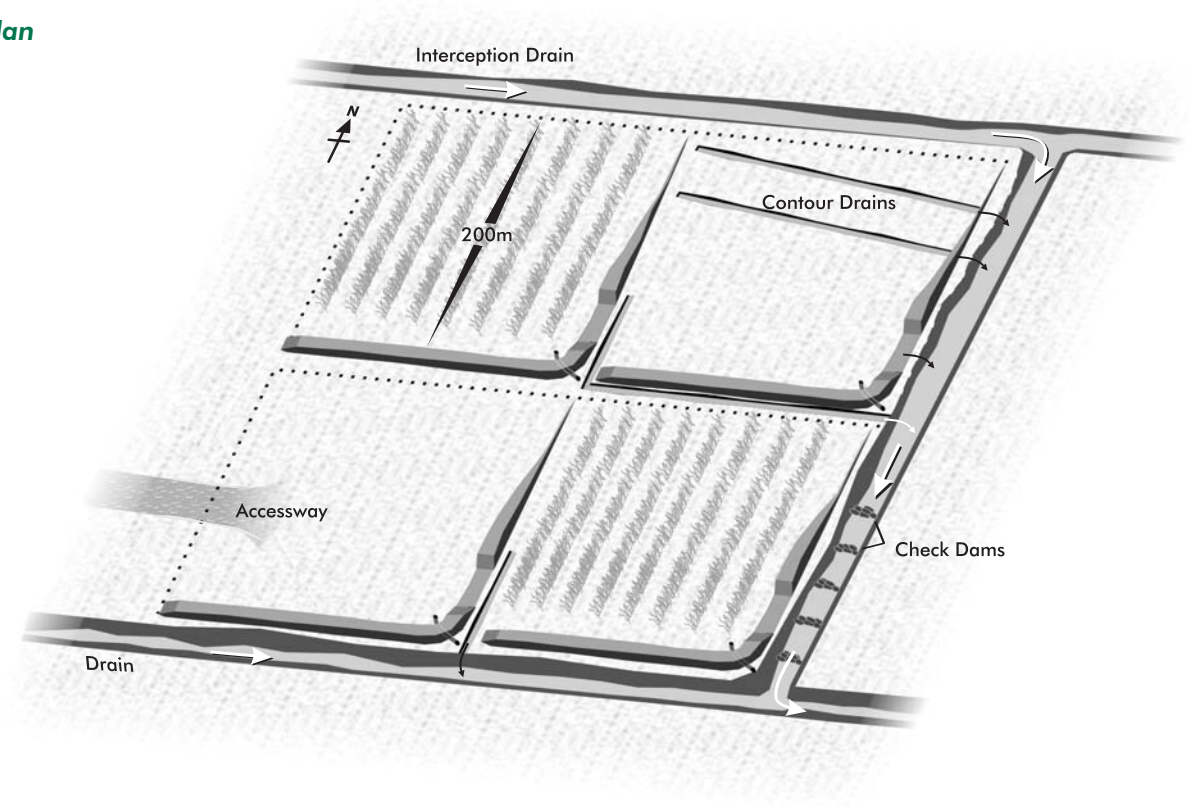
It is important to know how much water will flow down the drain. This will depend on the size of the catchment feeding the drain. See Erosion and Sediment Control for determining catchment area.

Drainage Specifications for drains diverting water from cropping areas and permanent drains

Catchment Area (ha)	Water Flow (m^3/s)	Depth of Drain (m)
1	0.21	0.2
2	0.42	0.3
4	0.84	0.45
5	1.05	0.5
10	2.1	0.8

Note : These figures have been determined for a grassed drain, with a two percent longitudinal slope (1° degree) that is 1m wide at the base and has 1:1 shaped sides. The water flow rates are for permanent drains with the ability to carry the 100-year storm. If any of these characteristics change the drain depth will need to be changed.

Paddock Plan



Check Dams

What are they?

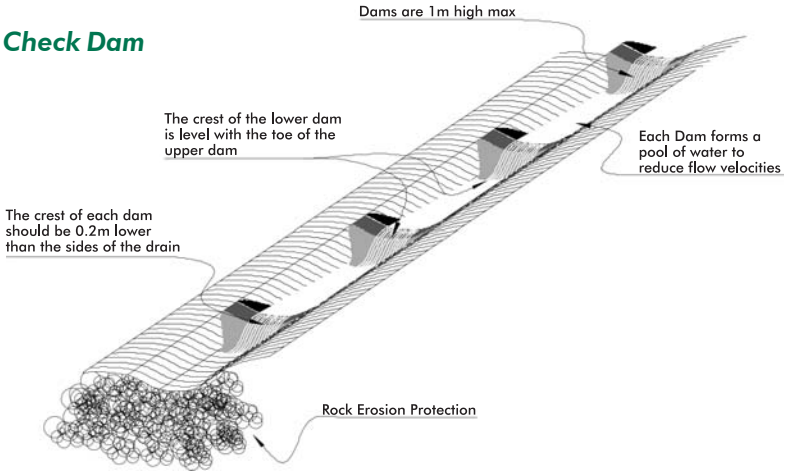
Check dams are barriers placed across drains to reduce drain erosion and water runoff speed.

If drain slopes are greater than five percent (3°), check dams or rock armouring are recommended to minimise erosion.

What they are not?

They are not silt traps. Sediment that collects behind the dams should be left to flatten the drain and reduce water flow speed.

Check Dam



How do I construct check dams?

1. Install the lowest check dam first. Ensure the discharge won't cause erosion of the channel downstream.
2. Set the spacings so the toe (bottom) of the upstream dam is level with the crest of the lower one. This means that on steeper slopes, the dams will be closer together.
3. Clear any vegetation in the dam areas.
4. Construct the dams. You can use concrete, or rocks and fabric, or sand / gravel / cement mix (preferably) in UV resistant plastic bags. Crushed rock is more suitable than rounded rock. If you are using rocks, they must be *placed by hand*, and the batters (sides of the spillway) must not be steeper than one vertical: two horizontal.
5. It may be necessary to first line the dam area with geotextile filter fabric before installing the dams to avoid erosion.
6. Check dams are not suitable for permanently flowing streams unless professional design advice has been sought, as they can restrict fish passage.
7. It may be necessary to enlarge the drain so its capacity is not reduced when the check dams are installed.

Maintenance

Maintenance is very important for the success of your drainage system, and should be undertaken regularly.

Accessways

Accessways should be raised, and should not be sited in the lowest point of the paddock. Refer to the Doing It Right Factsheet a3 - Accessways.

Contour Drains

Refer to the Doing It Right Factsheet a10 - Contour Drains for details.

Paddock Length

The length of cropping rows is important if the cropping area is on slopes of two percent (1°degree) or greater, and/or rows are orientated up and down the slope. If the rows are oriented up and down the slope, we recommend that rows are no longer than 200m.

Checklist of key points for Paddock Drainage

1. Use cut-off drains to stop water entering the cropping area. Discharge into the water table.
2. Drain size will depend on waterflows in the drain.
3. Discharge water from paddock control systems into the watertable in small volumes and at regular intervals.
4. Accessways should be raised and located away from the lowest point in the paddock.
5. Recommended maximum paddock length is 200m on slopes greater than two percent.
6. Check dams are recommended for drain slopes greater than five percent.