

# Guidelines for Developing a Sediment and Erosion Control Plan for Dam Works Sites



## What is this?

A general overview of sediment and erosion control measures that are typically required for dam works and ongoing operation of the dam. Use this Guide to develop a Sediment and Erosion Control Plan that meets the requirements of element 5.3 of the Dam Works Assessment Decision Framework.

## Why is it important?

Sediment generated from erosion on dam works sites can be a major source of pollution at the dam site and to downstream watercourses. Excessive amounts of sediment in a watercourse can:

- increase the rate of reservoir sedimentation within the dam and to downstream dams, diminishing the capacity of those dams to store water;
- adversely affect the quality of water (e.g. increased turbidity, nutrients and pesticides) being taken downstream for domestic purpose, stock water, irrigation and etc;
- harm flora and fauna and/or their habitat by filling in deep holes and pools, impacting riparian, wetland and aquatic vegetation and exacerbating flooding.

Excessive amounts of sediment may also adversely affect off-stream resources such as roads, drains, buildings and other public and private assets, or natural values.

Follow the practices discussed in this guideline and you will minimise erosion and control sediment run-off from your dam works site, meet your legal requirements and help protect our waterways.

## What is a Sediment and Erosion Control Plan?

A Sediment and Erosion Control Plan (SECP) can be developed by overlaying information on a copy of the engineering drawings. The SECP should detail the site development and all the systems intended to minimise erosion and trap sediment. The SECP should include:

1. Date and author.
2. North arrow and scale.
3. Property boundaries.
4. General soil description.
5. Location and amount of ground disturbance (see [Ground Disturbance](#), [Retain Vegetation](#)).
6. Initial and final contours.
7. Location of watercourses and surface drainage.
8. Location of roads, drains, buildings and other public and private assets.
9. Location of significant natural values (e.g. environmental values listed under the *Threatened Species Protection Act 1995* or *Nature Conservation Act 2002* ).
10. A table identifying the likely potential sources of sediment and their potential impact, risk level and the proposed mitigation measure.
11. Location of all proposed temporary drainage control measures (see [Temporary Drainage Control Measures](#)).

12. Location of vegetation to be retained and removed, including within the area to be inundated (see Retain Vegetation).
13. Location of material stockpiles.
14. Location and details of all proposed erosion control measures. (see Erosion Control Mats and Blankets, Drainage Control Measures, Retain Vegetation, Revegetation and Limit Ground Disturbance, Dust Control).
15. Location and details of all proposed sediment control measures. (see Sediment Fences & Fibre Rolls, Erosion Control Mats and Blankets, Sediment Basins and Instream Sediment Control Techniques).
16. A statement of who is responsible for establishing and maintaining all erosion and sediment control measures.
17. The installation and un-installation sequence of the different sediment and erosion controls (see Timing of Works and Installation of Control Measures).
18. The maintenance program of the sediment and erosion controls.
19. The revegetation and rehabilitation program (see Site Revegetation, Limit Stock Access).

Keep a copy of the Department approved SECP at the dam works site at all times. Ensure that all on-ground workers understand the SECP. Implement, update and maintain the control measures shown in the SECP.

## What Do I Need To Do?

What follows is a description of Sediment and Erosion Control Measures that should be considered for inclusion in your SECP. The detail contained in a SECP will depend on the size and complexity of the proposed dam works and may require preparation by a qualified engineer.

### ***Limit Ground Disturbance***

Limit the area of soil disturbance to the minimum required. Damage to the ground cover should be minimised and confined to the dam works site. Identify areas, including vegetated buffers, around the dam works site to preserve throughout the works period. Mark these areas as machinery exclusion zones on the ground and on the SECP. Ensure that the operators of earthmoving equipment are aware of the machinery exclusion zone(s).

When using heavy machinery (i.e. non-wheeled vehicles) on exposed slopes:

- Don't smoothly grade slopes with compacted soils. This will increase runoff, is hard to revegetate and is highly susceptible to soil erosion.
- Don't track heavy machinery across the slope. The track marks will create furrows that water will flow down when it rains.
- Do track machinery up and down the slope to create grooves from the tracks that will catch seeds, fertilizer, and rainfall. The grooves will roughen the surface in a way that will slow runoff over the slope

*\* Note that this advice applies to tracked vehicles only. Wheeled vehicles should be driven across the slope, not up and down.*

### ***Limit Watercourse Disturbance***

Existing watercourse crossings should be used to move equipment across the channel. If there is no crossing and a watercourse must be crossed, any disturbance should be minimised. If crossing once, the machinery should be carefully 'walked' across the watercourse. If crossing many times, a

temporary crossing should be made by laying a pad of clean rock at a shallow point of the channel. The rock should be removed when works have finished.

Ensure machinery is operated from the bank of the watercourse and not in the channel where practicable, to minimize impacts and to better enable mitigation of sedimentation.

### ***Instream Sediment Control Techniques***

The selection and design of an appropriate instream sediment control technique depends on site conditions. Table 1 provides guidance on the selection of appropriate instream sediment control techniques.

**Table 1 Selection of Instream Sediment Control Techniques**

<b>Site Condition During Dam Works</b>	<b>Technique</b>
Dry watercourse where flows are unlikely	Sediment Weir <sup>1</sup> .
Dry watercourse where flows are possible	Sediment Weir with downstream rock splash pad for scour protection.
Watercourse with minor base flow	Delay works until a suitable low-flow period where possible.  Filter Tubes <sup>2</sup> may be incorporated into a Sediment Weir; and/or  A temporary diversion channel(s), protected by a lining of non-erodible materials to the high water mark, could be constructed.  Suitably Qualified Expert advice is required.
Watercourse with significant base flow	Delay works until a suitable low-flow period where possible.  A Cofferdam <sup>3</sup> with a base flow bypass pipe may be an acceptable solution. The cofferdam should be constructed using sandbags, clean rock or other non-erodible material.  Suitably Qualified Expert advice is required.

<sup>1</sup> Sediment Weir: Two or more parallel wire mesh fences with filter material (strawbales or aggregate) sandwiched between the wire mesh fences. The fences are placed across the channel.

<sup>2</sup> Filter Tubes: generally 200mm to 300 mm ribbed pipes with a filter bag at the tail end to capture sediment.

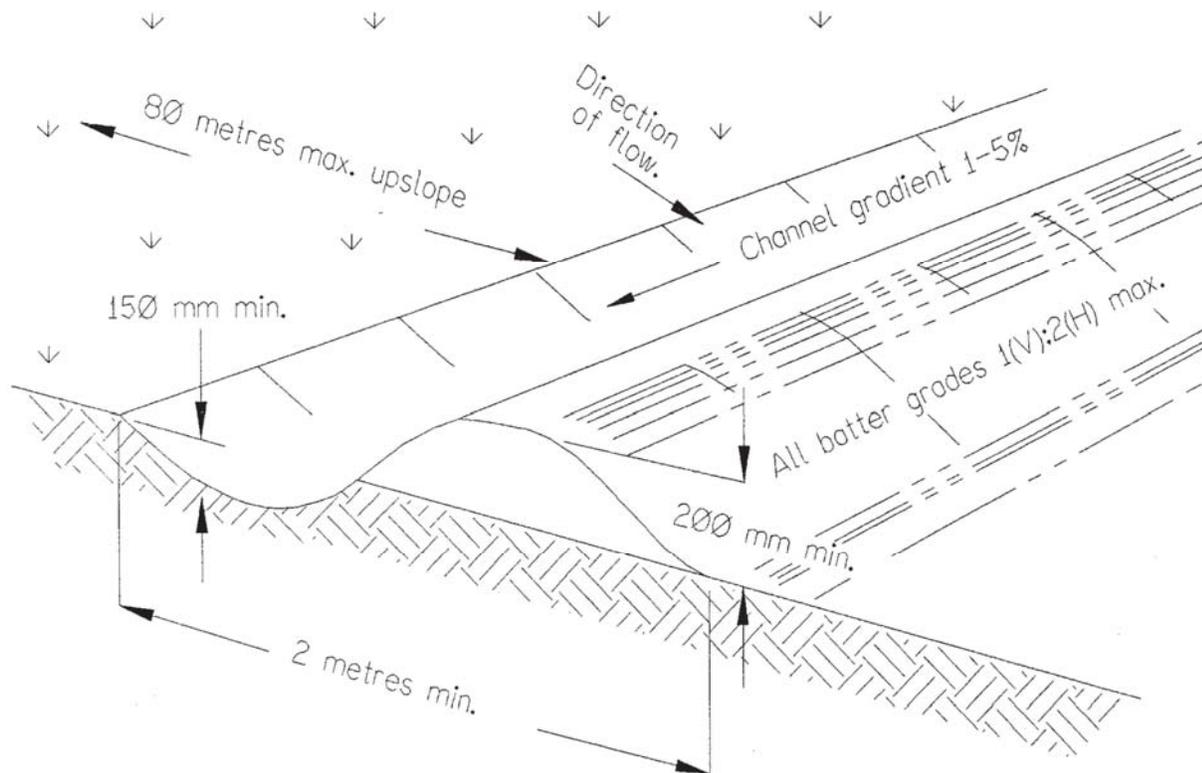
<sup>3</sup> Cofferdam: a temporary enclosure built within, or in pairs across, a body of water and constructed to allow the enclosed area to be pumped out, creating a dry work environment for the major work to proceed.

### ***Drainage Control Measures***

Look at the dam works site plans to identify areas where stormwater can be diverted around the disturbed or active work area. Stormwater can be diverted with the use of small diversion drains. A diversion drain is a channel constructed on the high side of a site to divert surface runoff from rainwater that would otherwise flow down onto the disturbed or active work area. Diversion drains need to be properly designed (see Figure 1) to ensure that they can convey water without

overflowing or accumulating sediment. The channel should be about 150 mm deep with a curved cross-section. Place the excavated soil from the channel on the down-slope side to increase the diversion drain's capacity. The diversion drain should divert flows to a stable drainage line to ensure that the channel does not itself cause erosion where it discharges.

**Figure 1**     **Diversion Drain**



*Illustration from NRM South Soil and Water Management Fact Sheet 7 December 2008*

### **Erosion Control Mats and Blankets**

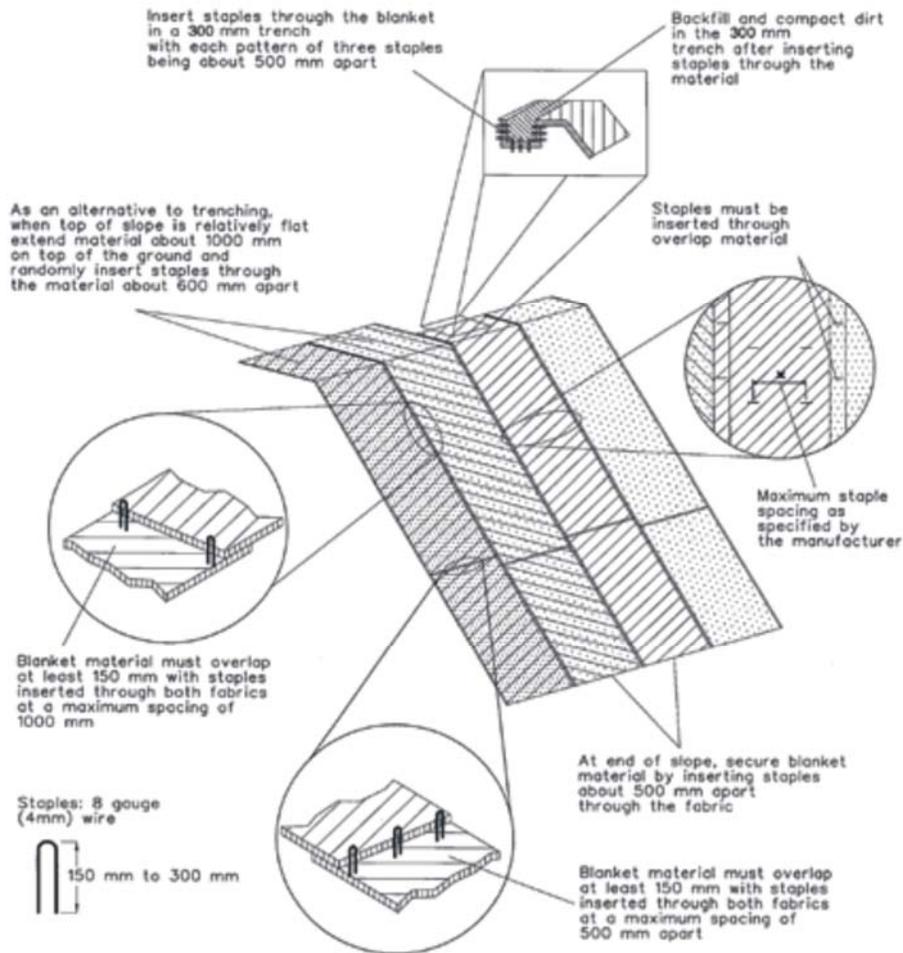
Erosion mats and blankets (see Figures 2 & 3) are used as a soil cover and a protective barrier for vegetation establishment. They are applied on soils with a high erosion risk, on steep slopes or for site rehabilitation. When applied correctly, they are one of the most effective and practical means of controlling runoff and erosion on disturbed land prior to vegetation establishment.

*Erosion control mats:* are heavier, synthetic and non-degradable, they are designed to add stability to soils and are often filled with topsoil, and vegetated when installed. Erosion control mats are suitable on slopes and in channel-lining applications.

*Erosion control blankets:* are light-weight and open-weave made from mulch, straw and wood fibre and held together by natural or synthetic netting. They are used for establishing and reinforcing vegetation. Their application depends on the blanket materials. Synthetic netting and wood fibre is stronger and can be used on steeper slopes compared to jute and straw blankets, which rapidly

degrade and are more suitable for flatter areas. Erosion control blankets can be used in conjunction with soil seeding, preventing the seed washing away and erosion of the prepared seedbed. Once established, the vegetation provides permanent erosion control.

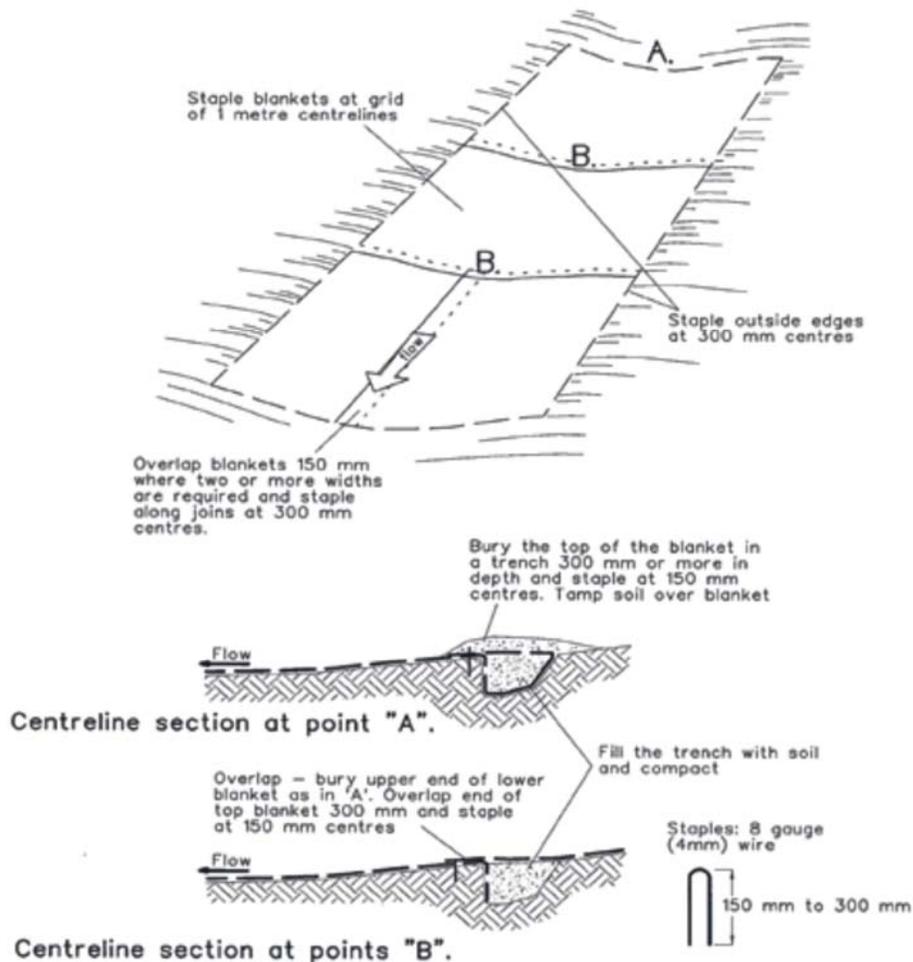
**Figure 2 Erosion Control Blanket**



*Illustration from NRM South Soil and Water Management Fact Sheet 8 December 2008*

Erosion control mats should be installed immediately on exposed soils, while erosion control blankets should be fitted on newly seeded or landscaped areas. Close inspection after rainfall events and major runoff occurrences is essential. Check for damage due to water running under the mat or blanket or if it has been displaced by wind. Restabilise with anchor pins or wooden spikes. If significant erosion has occurred repair the fabric. Grading and reseeding may also be necessary. Continue inspections until vegetation is firmly established.

**Figure 3 Erosion Control Mat**



*Illustration from NRM South Soil and Water Management Fact Sheet 8 December 2008*

### **Sediment Fences & Fibre Rolls**

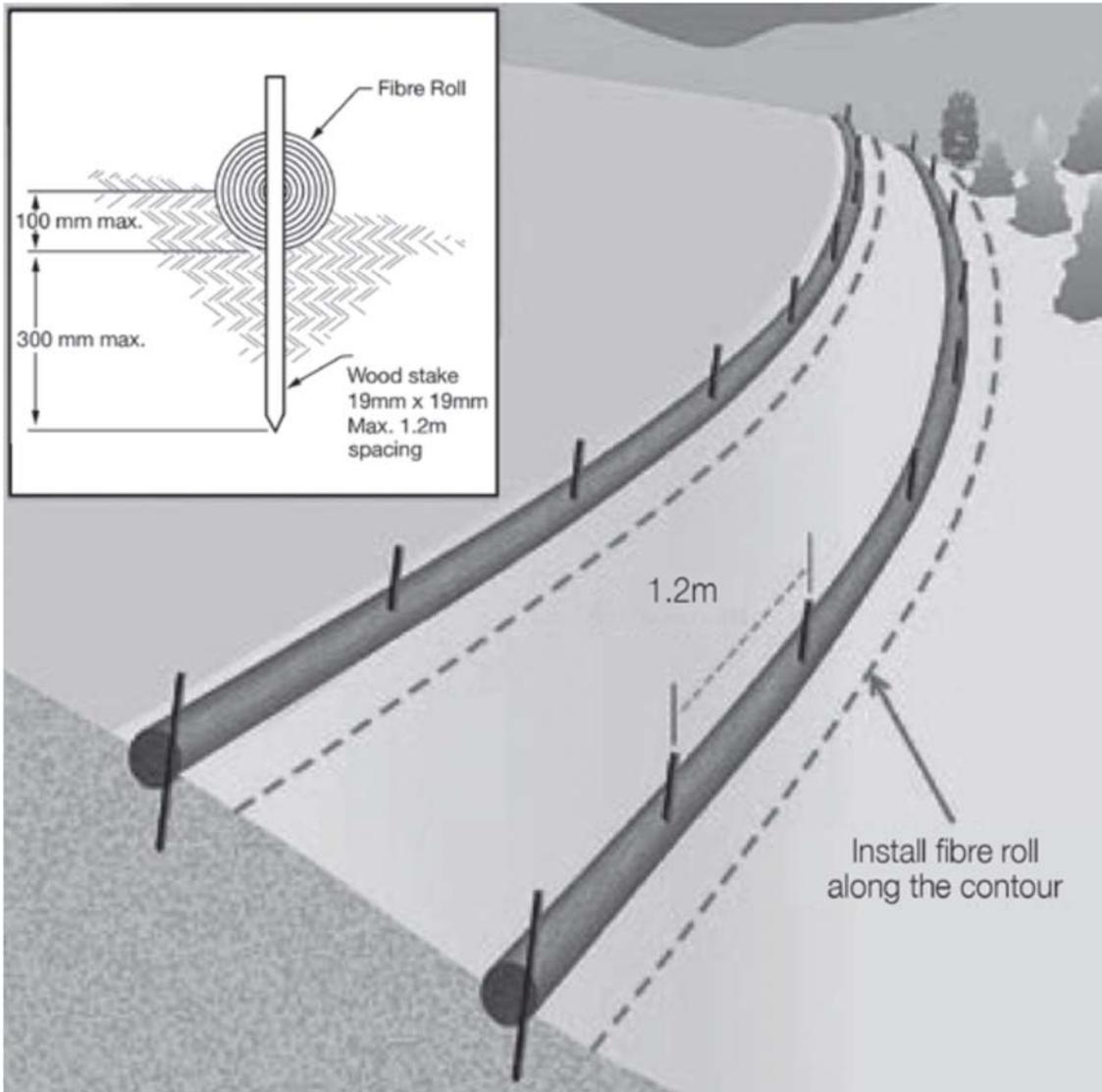
Sediment fences and fibre rolls are sediment control measures installed across slopes, along the perimeter of dam works sites or parallel to watercourses downslope of works. Fibre rolls are a range of organic products (coconut fibre, straw, flax) that are rolled into large diameter logs. Sediment fences are vertical barriers made from woven geotextile that are held in place by star pickets and a backfilled trench.

Identify drainage flow pathways that will intercept runoff from the site. Decide whether to use fibre rolls or sediment fences. Use fibre rolls at the base of an embankment, on slopes that are exposed, or on vegetated slopes where vegetation is failing to control erosion. Sediment fences should be used on small drainage areas and placed down-slope of potential areas of erosion.

Sediment control measures need to be in place prior to the start of dam works. They can be altered after ground disturbance activities and if the site's drainage patterns change.

Fibre rolls and sediment fences should be checked regularly, especially after every rain event and cleaned or repaired. For sediment fences, check that all the pickets and the bottom of the fence are secure and that there are no tears in the fabric.

**Figure 4 Fibre Roll Installation**

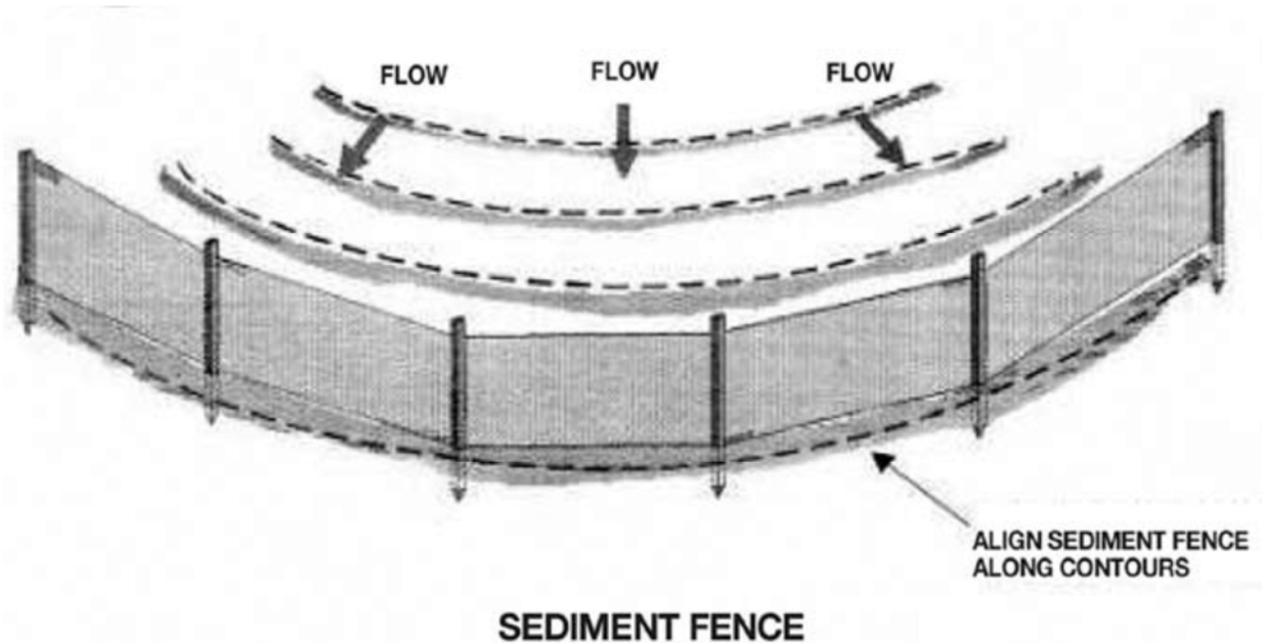


*Illustration from NRM South Soil and Water Management Fact Sheet 14 December 2008*

**Installing fibre rolls:**

- 1) Find a suitable installation site (if on a slope, place parallel to contours).
- 2) Remove large rocks and debris, and prepare a shallow concave trench (50–100 mm deep) to inset the fibre roll. (*Note: Place excavated material on the upside of the fibre roll to prevent undercutting.*)
- 3) Place the fibre roll in a shallow trench and stake through the fibre roll every 1.2 m.
- 4) When fibre rolls are placed in a row secure the ends tightly to one another without overlapping them.

**Figure 5 Sediment Fence Installation**



*Illustration from NRM South Soil and Water Management Fact Sheet 14 December 2008*

*Installing sediment fences:*

- 1) Survey and mark out the location of the sediment fence, ensure it is parallel to the contours of the site.
- 2) Dig a 150 mm trench immediately above the proposed fence line.
- 3) Place the bottom of the fabric to the base of the trench and run fabric up the down-slope side of the trench.
- 4) Backfill the trench and compact to secure anchorage of the fabric.
- 5) Drive 1.5 m star pickets into ground, 2 m apart to support the sediment fence fabric. Tension and fasten fabric to pickets using UV stabilised zip ties or wire ties.
- 6) Join sections of fabric at a support post with a 2 m overlap.
- 7) Angle the ends of the sediment fence upslope to reduce scouring. Don't place sediment fences across creeks or major drainage lines.

**Stabilise Stock Piles**

Stabilise soil stockpiles by placing sediment fences around their lower edges. Cover with fabric, plastic or vegetation to prevent dust. Excavated material should be placed well away from the watercourse to minimise erosion back into the stream. Fill should not be stored in flood-prone areas.

**Dust Control**

Assess the dust potential of your site. Maintain as much vegetation as possible. Existing trees and shrubs act as wind breaks, slowing wind velocities and provide coverage to surface soils. Install constructed wind barriers if there is high risk of dust generation. Wind fences (see Figure 6) divert the wind up and over the site. Ensure that the wind fence is semi-permeable (40% porosity),

otherwise down-wind turbulence can make erosion worse. If necessary, wet susceptible areas down during dam works.

### ***Sediment Basins***

For large dam works proposals, sediment basins may be required to effectively trap sediment carried by stormwater runoff. They allow sediment to settle out and sink rather than be transported away with the runoff. Sediment basins are formed by constructing an embankment of compacted soil at the lowest downstream point on the site and installing an outlet structure and overflow spillway. They are one of the most useful and cost-effective measures for treating sediment-laden runoff at large dam works sites. Do not install sediment basins on major drainage pathways. Access for machinery to remove sediment is crucial, as is an area designated for stockpiling the removed sediment so it can dry out (preferably in areas upslope of the sediment basin, so seepage water can drain back into the basin safely). Locate sediment basins off-line and up-stream of natural and constructed water bodies.

### ***Retain Vegetation and Minimise Bare Ground***

Vegetation is the most effective soil stabiliser available on dam works sites. Vegetation is an ideal and usually inexpensive method of stabilisation because it reduces soil erosion by:

1. Absorbing the impact of raindrops.
2. Reducing the volume and velocity of runoff.
3. Binding the soil with the roots.
4. Protecting the soil from the erosive effects of the wind.

Keep groundcover along surface drainage areas and on steeper slopes. Where possible, retain significant areas of healthy grass down-slope of the dam works site, these strips can be highly effective for filtering out coarse sediment. The flatter and wider the strips are, the more effective they become.

Vegetation along watercourses should be retained and protected from sediment by installing additional sediment control measures up-slope (e.g. fibre rolls and sediment fences). Where riparian vegetation needs to be removed, leave it in place for as long as possible and stage earthworks to minimise the amount of site cleared at any time.

Delaying harvesting within the catchment, until the dam is closed, is an acceptable and cost-effective way of managing sediment from vegetation clearance.

### ***Revegetation***

Temporary revegetation: annual grass species (e.g. rye) are effective temporary ground cover because they are fast growing and can quickly establish a root system. They can be planted to prevent erosion where:

1. Exposed soil needs to be stabilised until permanent revegetation grows or inundation occurs.
2. A disturbed area will be left and then be re-disturbed as part of the site works (e.g. topsoil stockpiles).

Permanent revegetation: options include seeding with perennial grasses (that will over time succeed the annual species) and planting of native plants from seed, tube stock or invasion from surrounding bushland. Seed the exposed topsoil, not the subsoil as the biological, physical and chemical characteristics of many subsoil materials inhibit the establishment of plants. Where practical to do

so, a seedbed should be cultivated and moistened before sowing seed. This may require deep ripping to 300 mm where there is a compacted layer. Include species native to the region to enhance the ecological values of the site. Some revegetation options may require mulching. Planting trees and shrubs tends to be more successful if combined with weed suppressing mulching and installation of tree guards and stakes. Apply mulch at a depth between 75-100 mm.

Ensure appropriate weed management is implemented to avoid infestation. Make yourself aware of your obligations under the *Weed Management Act 1999*.

### ***Restrict Stock Access***

During dam works, restrict stock access to the dam works site and watercourse to avoid additional erosion and resuspend materials.

After dam works are complete, manage stock access to the dam to avoid erosion, pugging and damage to the vegetation cover on the banks around the dam. These problems can contribute sediment to the dam and over time they can damage the dam wall and spillway. Preventing or limiting stock access to the dam is the best long-term answer to maintain clean and reliable water, and to minimise damage to your dam. You can control stock access by fencing around the dam and piping water to other watering points such as troughs or tanks. Where it isn't possible to exclude stock, plan drinking points to allow only limited access at the dam edge. You can use a single access point if it is supported with a hard base made of rock, stone or gravel. However, the inflow, dam wall and spillway areas should be protected from stock access in these designs

### ***Spillway Vegetative Cover***

The spillway has to be capable of safely carrying flood flows of water from the full supply level of the dam back to the drainage line. A good vegetative cover along the spillway is essential for this, and also minimises erosion. It needs to be actively growing, robust and relatively uniform. Fertilize, reseed and trim as appropriate. Do not let it become 'clumpy' or 'weedy'

### ***Timing of Works and Installation of Control Measures***

Works should be timed to coincide with periods of low flow and more conducive weather. It should be completed quickly, and works should be stopped if conditions are not suitable, such as during and after heavy rain. Schedule earthworks so that the ground is disturbed for the shortest time possible. Prior to dam works commencing:

1. Choose a single, stabilised site access point.
2. Designate an appropriate location within the site where sediment generating activities can be managed.
3. Retain as much vegetation as possible to minimise soil erosion and reduce rainwater running across the site. Mark this area on site as a machinery exclusion zone.
4. Install sediment fences or fibre rolls at the low end of the site and/or upslope of any watercourse to trap sediment.
5. Divert up-slope catchment runoff around the site by installing a diversion drain.
6. Designate a location where topsoil and other excavation material will be stockpiled during building and construction. Provide suitable controls to prevent erosion.
7. Install instream sediment control devices immediately prior to commencing instream works.

After dam works have commenced, and until the site is stabilised:

1. Monitor sediment and erosion control measures at least once a week and after each rainfall event.

2. As soon as practicable, stabilise areas of exposed soil with vegetation or erosion control blankets and mats.
3. Uninstall sediment control devices as soon as practicable, particularly instream sediment control devices, once the affected site is stabilised.

## **Further Guidance Resources**

Waterways and Wetlands Works Manual – DPIPWE

Dispersive Soils and their Management – DPIPWE

Soil Management a Guide for Tasmanian Farmers – DPIPWE