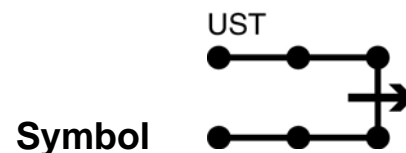


# U-Shaped Sediment Traps

## SEDIMENT CONTROL TECHNIQUE

Type 1 System		Sheet Flow		Sandy Soils	✓
Type 2 System		Concentrated Flow	✓	Clayey Soils	[1]
Type 3 System	✓	Supplementary Trap		Dispersive Soils	

[1] Generally only limited control of clay and silt-sized particles.



**Photo 1 – U-shaped sediment trap within a wide drainage swale**



**Photo 2 – U-shaped sediment trap within a mild gradient table drain**

### Key Principles

1. Primarily used to collect the coarser sediment particles. Provides limited collection of clay-sized particles and thus there is usually no measurable change in the colour of water passing through the fence.
2. Functions by temporarily ponding sediment-laden water within the chamber to allow the coarser sediment particles to settle.
3. Critical design parameters are the design flow rate, which determines the size (width) of the spill-through weir, and the shape and fall of the drain, which determines the length and/or width of the sediment trap.
4. It is critical that the ends of each wing wall extends to a location that is higher (at least 100mm) than the crest elevation of the spill-through weir (see Figures 5 and 10).
5. When located within a table drain, the allowable width of the sediment trap may be governed by restrictions placed on the location of support posts within the road shoulder. Typically, it is not advisable to disturb the compacted shoulder of a road, thus the trenching of a sediment fence, or the placement of support posts close to the road may not be allowed. In such cases, a sandbag flow diversion bank can be used to direct flow into a narrow U-shaped sediment trap (refer to Figure 5).
6. Critical operational issues include:
  - (i) ensuring the width of the sediment trap is sufficient to allow maintenance (clean-out) by a backhoe; and
  - (ii) ensuring all flow is directed into the sediment trap, thus avoiding flow bypass.

## Design Information

The maximum support post spacing is 1m (Figure 9).

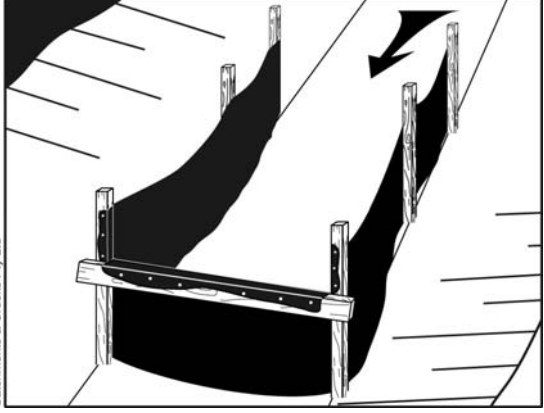
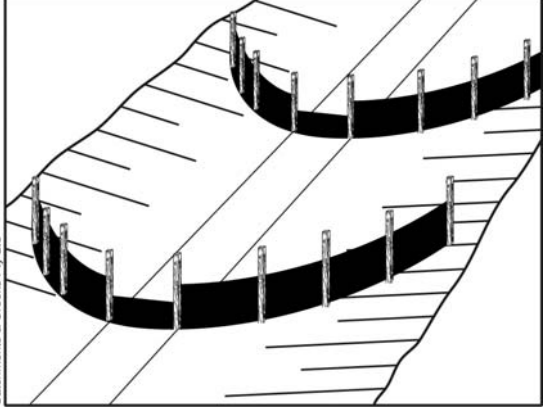
Wherever practical, the fabric should be anchored into a 150 to 200mm deep trench (Figure 8).

Unless placed on a very steep slope, a spill-through weir (Figure 3) must be installed at the low point in the sediment trap. The spill-through weir crest must not be less than 300mm above the ground surface.

### Design procedure:

1. Select the preferred type of U-shaped sediment trap from Table 1.

**Table 1 – Selection of sediment trap layout**

	<p><b>Preferred usage:</b></p> <ul style="list-style-type: none"><li>• Steep table drains (drains adjacent a roadway) with a gradient of at least 6%.</li><li>• Locations where it is not practical to disturb the adjacent earth batters for the purpose of installing the sediment trap.</li><li>• Shallow drains where good elevation can only be gained by extending the wing walls up the drain's invert to elevate the ends of the fence above the spill-through weir crest.</li></ul>
	<p><b>Preferred usage:</b></p> <ul style="list-style-type: none"><li>• Wide drainage swales where good elevation can be gained by extending the wing walls up the batter slopes to elevate the ends of the fence above the spill-through weir crest.</li></ul>

2. Determine the design discharge,  $Q$  ( $m^3/s$ ).
3. Calculate the required width of the spill-through weir (refer to Table 2). The minimum width of the sediment trap is usually set by the width of the backhoe bucket that will be used to de-silt the trap.
4. Nominate the height of the spill-through weir. Usually set to 300mm on drains with a gradient less than 25% (refer to Table 3).
5. Determine the required ground elevation at the ends of each wing wall. Usually set at least 100mm above the height of the spill-through weir.
6. Knowing the required ground elevation at the ends of each wing wall, determine the overall dimensions (width and length) of the U-shaped sediment trap. For narrow sediment traps, Table 3 can be used to estimate the required length ( $L$ ) of the sediment trap.

### Design of spill-through weir

Where appropriate, spill-through weirs should be installed into the end of the sediment trap to prevent flows bypassing around the structure, and reduce the risk of hydraulic failure.

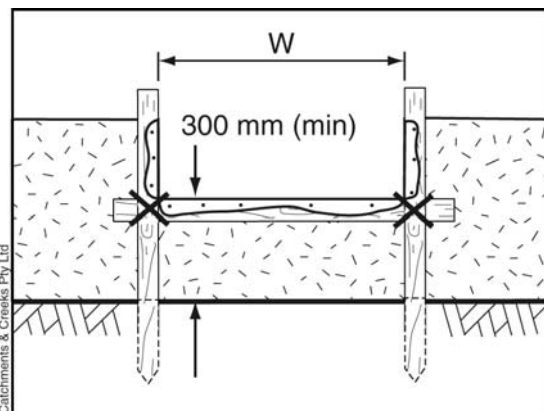
The required width (W) of the spill-through weir depends on the nominated design flow rate. The weir flow equation for a rectangular spill-through weir is provided below as Equation 1, as well as being tabulated in Table 2.

$$Q = 1.7 W H^{3/2} \quad (\text{Eqn 1})$$

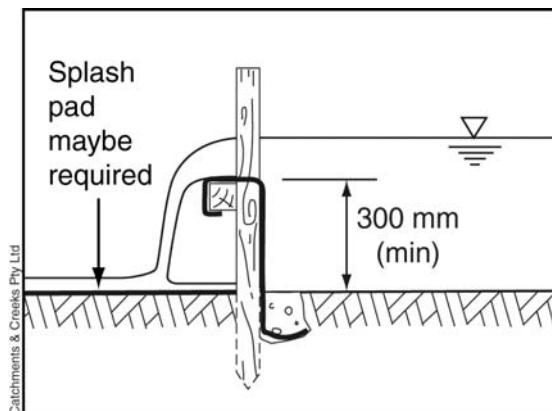
where: Q = Design flow rate (usually 0.5 times the 1 in 1 year ARI peak discharge) [m<sup>3</sup>/s]  
 W = Weir width [m]  
 H = Hydraulic head = height of upstream water level above weir crest [m]

**Table 2 – Flow rates passing over a spill-through weir (m<sup>3</sup>/s)**

Hydraulic head, H (m)	Spill-through weir width, W (m)									
	0.3	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
0.10	0.016	0.027	0.054	0.081	0.108	0.134	0.161	0.188	0.215	0.242
0.15	0.030	0.049	0.099	0.148	0.198	0.247	0.296	0.346	0.395	0.444
0.20	0.046	0.076	0.152	0.228	0.304	0.380	0.456	0.532	0.608	0.684
0.25	0.064	0.106	0.213	0.319	0.425	0.531	0.638	0.744	0.850	0.956
0.30	0.084	0.140	0.279	0.419	0.559	0.698	0.838	0.978	1.12	1.26
0.35	0.106	0.176	0.352	0.528	0.704	0.880	1.06	1.23	1.41	1.58
0.40	0.129	0.215	0.430	0.645	0.860	1.08	1.29	1.51	1.72	1.94



**Figure 3 – Spill-through weir profile**



**Figure 4 – Side profile of a spill-through weir**

If the sediment trap is to be installed within a table drain (i.e. a side drain of a road adjacent to the shoulders), then it may not be appropriate to disturb the compacted road shoulder to bury the fabric, or even drive support posts. Reasons for such restrictions include:

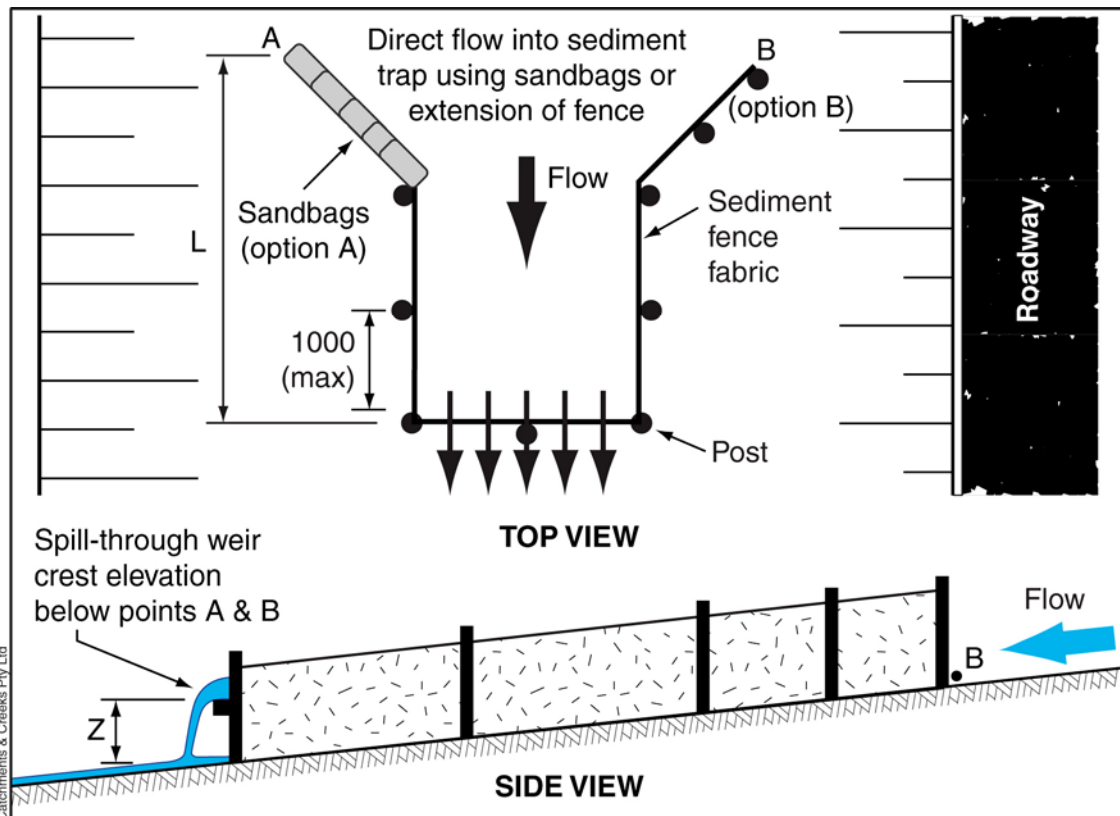
- disturbance of the heavily compacted road shoulder can allow water to enter the road foundations causing early failure of the road;
- safety risks associated with support posts and other structures placed too close to a roadway.

In order to construct a suitable sediment trap within such a drain it is usually necessary for the sediment trap to be relatively narrow, and for the wing walls to extend up the drain invert a distance (L) such that the ground elevation is above the crest of the spill-through weir. The minimum required length of the sediment trap is provided in Table 3 for various drain gradients.

**Table 3 – Required length of a Type AU sediment trap**

Drain grade (%)	Required length, L (m) <sup>[1]</sup>	Height of spill-through weir, Z (m)
< 6%	Use a Sandbag Check Dam Sediment Trap	
6%	6m	0.3m
8%	5m	0.3m
10%	4m	0.3m
14%	3m	0.3m
20%	2m	0.3m
25%	3m	No spill-through weir required
> 35%	2m	

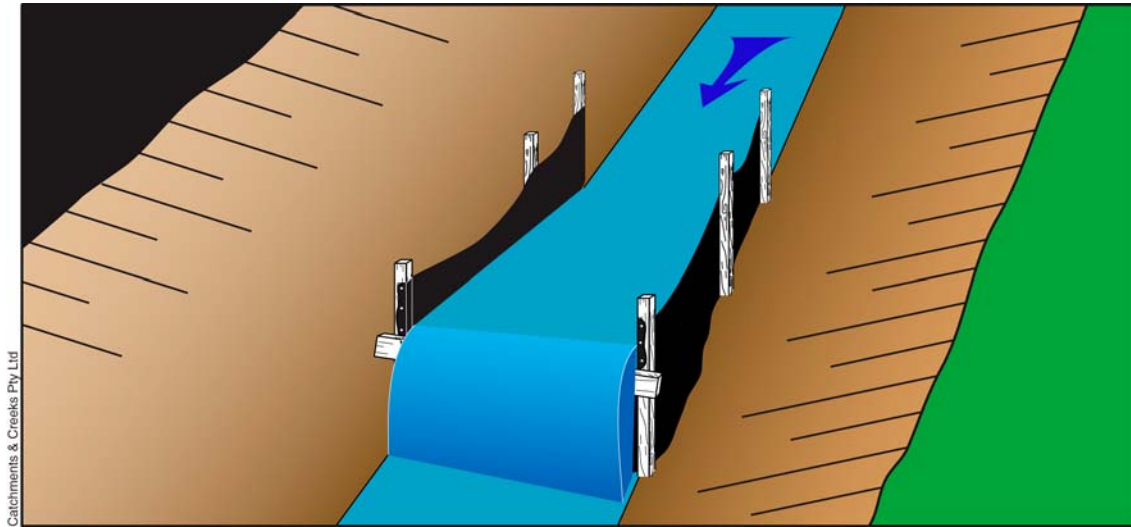
[1] Length assumes minimal bank slope. The required length may be reduced if the wing walls can be extended up the bank slope.



**Figure 5 – Profile of a Type AU 'narrow' sediment trap**

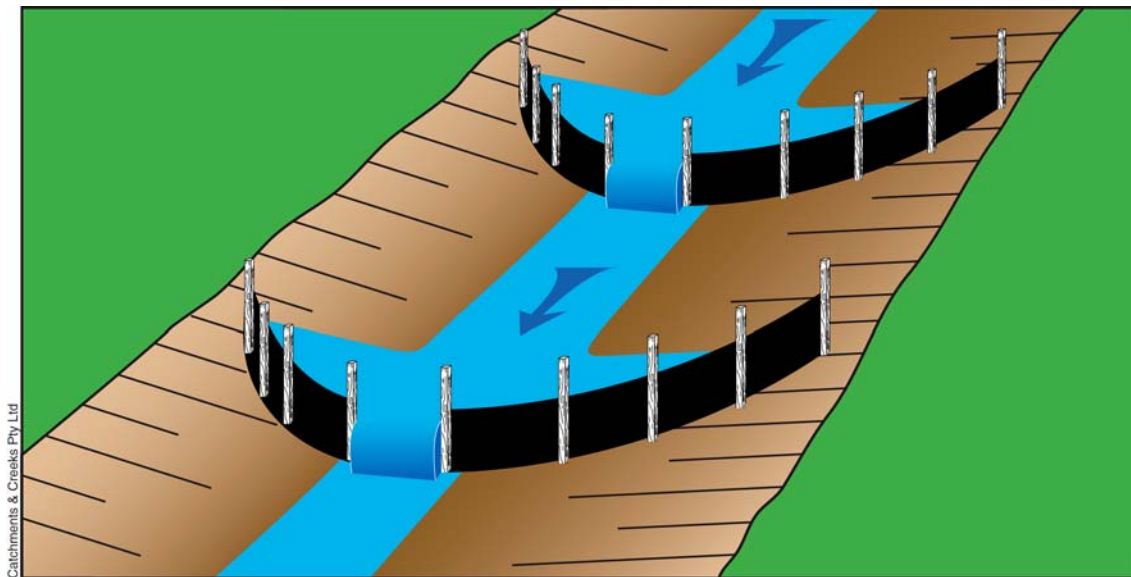


Type AU (narrow) sediment traps (Figure 6) use the fall in the drain's invert to elevate the ends of each wing wall above the height of the spill-through weir crest.

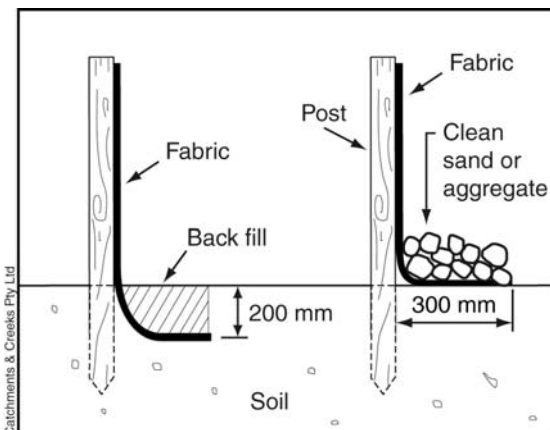


**Figure 6 – Type AU sediment trap**

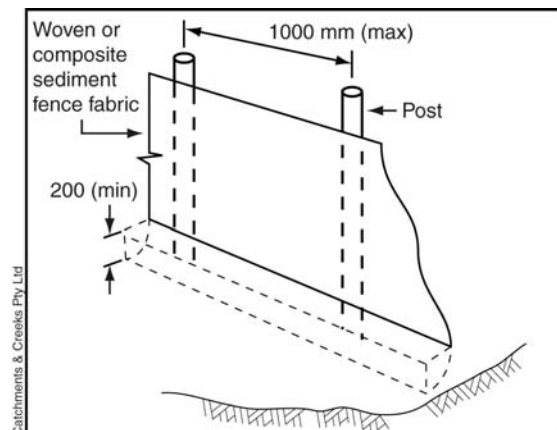
Type BU (wide) sediment traps (Figure 7) use the gradient of the drain's banks to elevate the ends of each wing wall above the height of the spill-through weir crest.



**Figure 7 – Type BU sediment trap**



**Figure 8 – Trenching fabric**



**Figure 9 – Spacing of support posts**

Care must be taken when placing any form of sediment trap within an area of concentrated flow such as a drainage swale. Issues for consideration include:

- potential increase in flood waters, possible causing water to bypass into adjacent properties, or cause the flooding of adjacent roadways;
- undesirable flow bypassing around the sediment trap;
- damage to the sediment trap caused by the deep and/or high velocity floodwaters;
- potential flood and/or erosion damage caused by flows in excess of the nominated design discharge.

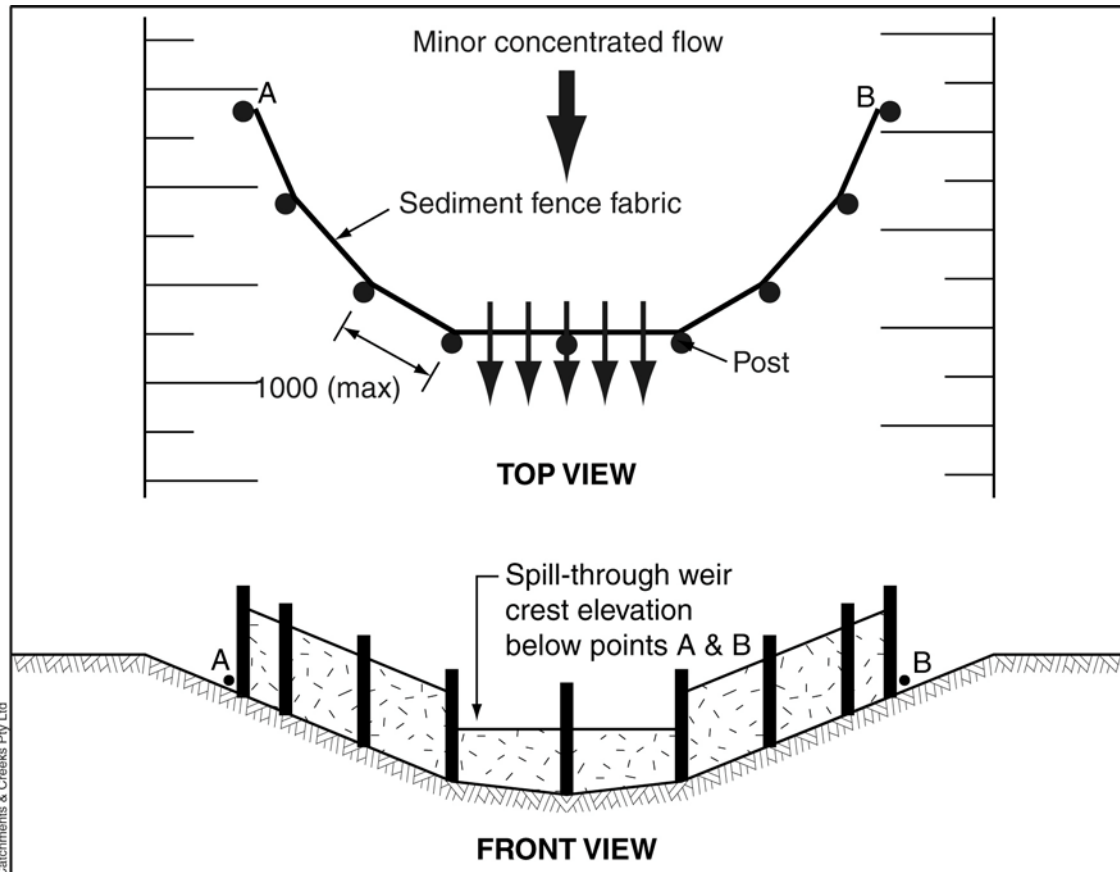


Figure 10 – Profile of a Type BU 'wide' sediment trap

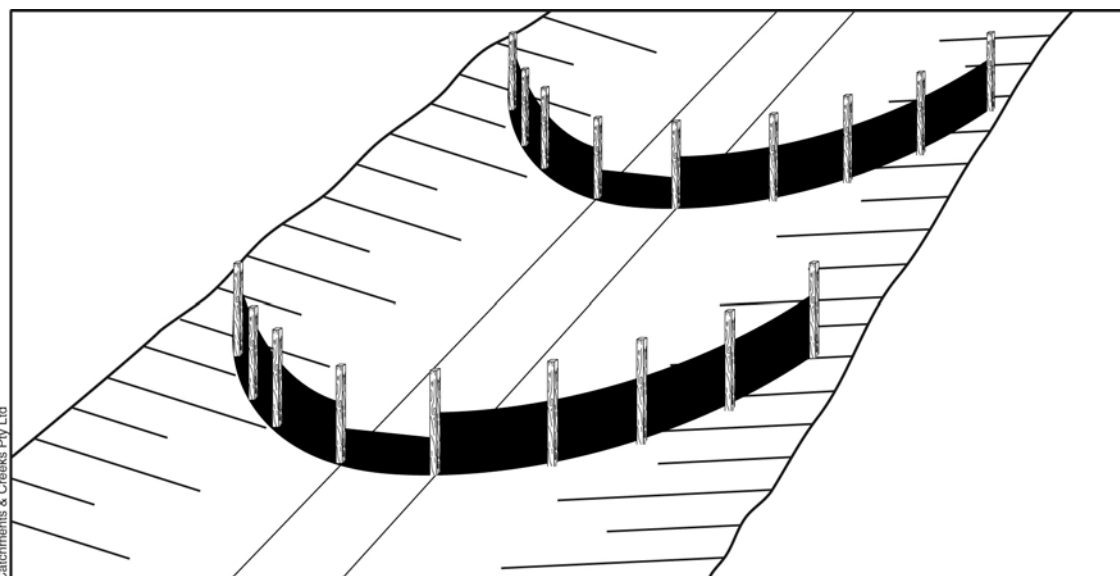
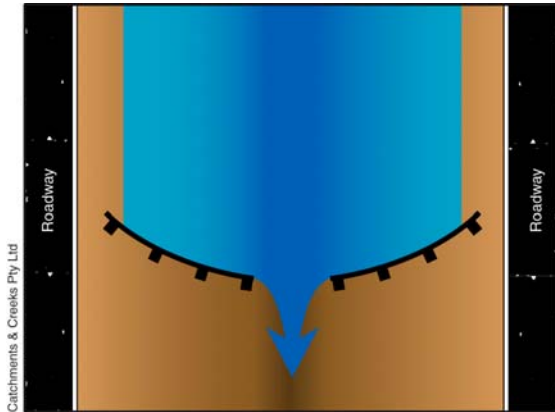


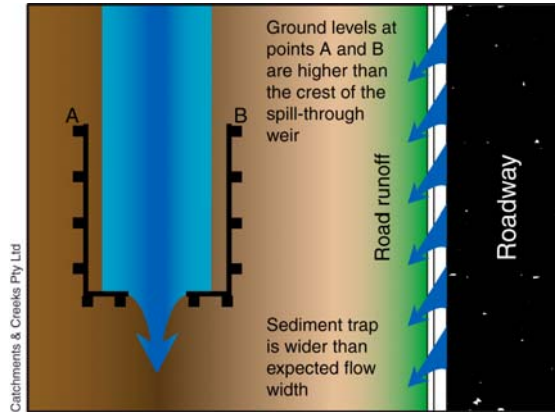
Figure 11 – Type BU sediment trap

## Design examples

The nominated design discharge should not bypass around the ends of the sediment trap as shown in Figures 12 and 13.



**Figure 12 – When placed in a wide drainage swale, the sediment trap takes the shape of a gradual arc**



**Figure 13 – When placed in a narrow table drain, the sediment trap normally needs to be installed as a narrow U-shape trap**



**Photo 3 – Up-slope ends of the fence are flared out to adequately capture the inflow**



**Photo 4 – U-shaped sediment trap incorporating a filter tube and geotextile outlet chute (note the sediment trap is formed from impervious plywood panels covered in fabric)**



**Photo 5 – U-shaped sediment trap within a steep table drain**

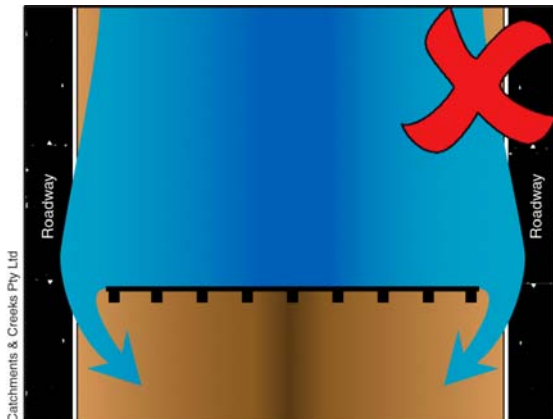


**Photo 6 – U-shaped sediment trap within a mild-sloping table drain**



## What not to do!

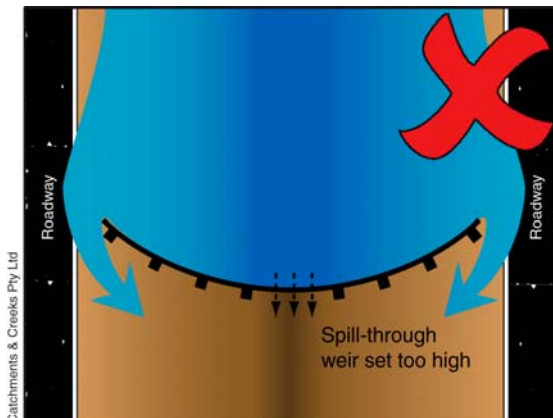
U-shaped sediment traps have often been inappropriately designed and/or installed. The following figures and photos discuss common design and installation problems.



**Figure 14** – A sediment fence must not be placed 'straight' across a drain



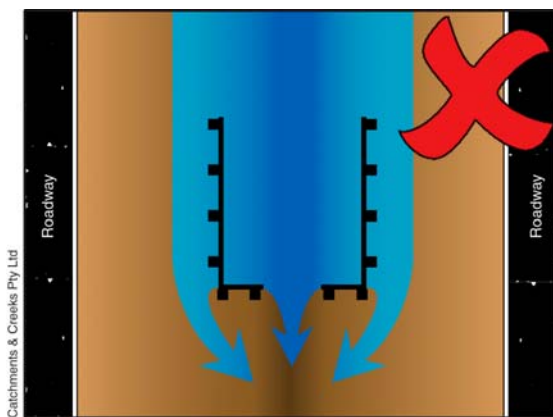
**Photo 7** – Clearly, this sediment trap will not allow adequate ponding, and the shape of the structure prevents the spill-through weir from being functional



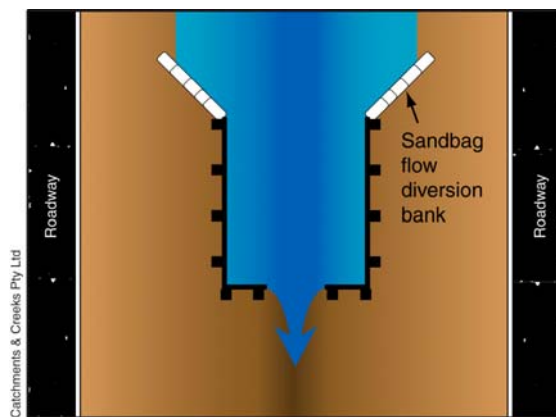
**Figure 15** – The spill-through weir needs to be at least 300mm high, and the ends of the fence need to be extended to ground that is higher than the weir's crest



**Photo 8** – If the ends of the fence are lower than the spill-through weir, then flows will bypass around the sediment trap causing erosion (as above)



**Figure 16** – The width of the U-shaped sediment trap should be wider than the expected width of flow



**Figure 17** – One solution to the problem (left) is to use sandbags to direct all flow into a narrow sediment trap



**Description**

A sediment trap formed from typical sediment fence materials, but heavily curved in a U-shape.

The sediment trap is designed such that the essential 'ponding' is confined between the two wing walls of the sediment trap.

**Purpose**

Used as a coarse trap sediment within minor drainage swales and roadside table drains.

**Limitations**

Application is generally limited to steep drains with a gradient exceeding 5%.

The design flow rate is limited by the available width of the spill-through weir.

Potential service life of around 6 months.

**Advantages**

Reasonably easy to install.

Controls sediment runoff close to the source of the erosion.

A highly visible sediment control measure.

Generally more effective, durable and cheaper than straw bale sediment traps.

**Disadvantages**

The spill-through weir is often incorrectly installed.

Can be difficult to appropriately bury the bottom of the fabric within the shoulder of the road.

**Common Problems**

Often incorrectly installed in a 'straight' alignment instead of a U-shape.

Ends of the fence not turned up the slope to prevent flow bypassing.

The spill-through weir is set too low (<300mm), or not placed within the low point of the fence.

Excessive spacing of support posts.

Fabric not adequately attached to the support posts.

**Special Requirements**

The crest of the spill-through weir must be at least 300mm high, and must be below the ground level at the ends of the wing walls.

**Location**

Normally located as a series of sediment traps along the drain.

**Site Inspection**

Check for excessive sediment deposition.

Investigate the source of any excessive sediment.

Ensure the appropriate selection of fabric (i.e. woven or non-woven composite).

Ensure the fabric is adequately buried.

Check the spacing of support posts/stakes.

Check if flow will bypass the wing walls.

## Materials

- Fabric: polypropylene, polyamide, nylon, polyester, or polyethylene woven or non-woven fabric, at least 700mm in width and a minimum unit weight of 140gsm. All fabrics to contain ultraviolet inhibitors and stabilisers to provide a minimum of 6 months of useable construction life (ultraviolet stability exceeding 70%).
- Fabric reinforcement: wire or steel mesh minimum 14-gauge with a maximum mesh spacing of 200mm.
- Support posts/stakes: 1500mm<sup>2</sup> (min) hardwood, 2500mm<sup>2</sup> (min) softwood, or 1.5kg/m (min) steel star pickets suitable for attaching fabric.

## Installation

1. Refer to approved plans for location, extent, and required type of fabric (if specified). If there are questions or problems with the location, extent, fabric type, or method of installation contact the engineer or responsible on-site officer for assistance.
2. Install the fabric in a U-shape, extending the wing walls either up the side slopes and/or up the channel invert (as directed) to a point where the ground level is at least 100mm higher than the crest of the spill-through weir.
3. Ensure that the expected channel flow will enter the sediment trap, either by extending the wing walls up the bank slope, or constructing sandbag flow diversion banks.
4. Unless directed by the site supervisor, excavate a 200mm wide by 200mm deep trench along the alignment of the spill-through weir and wing walls.
5. Along the lower side of the trench, appropriately secure the stakes into the ground spaced no greater than 1m.
6. Construct the sediment trap from a continuous roll of fabric.
7. Securely attach the fabric to the support posts/stakes using 25mm staples or tie wire at maximum 150mm spacing with the fabric extended at least 200mm into the trench.
8. Install a spill-through weir at the lowest point in the fence. The weir must be at least 300mm above adjacent ground level, and below the lowest ground level at the ends of the wing walls.

9. Securely tie a horizontal cross member (weir) to the adjacent support posts. Cut the fabric down the side of the posts and fold the fabric over the cross member and appropriately secure the fabric.
10. If directed, install a suitable splash pad immediately down-slope of the spill-through weir to control soil erosion downstream of the sediment trap.
11. Backfill the trench and tamp the fill to firmly anchor the bottom of the fabric and mesh to prevent water from flowing under the fence.

## Maintenance

1. Inspect the sediment trap at least weekly and after any significant rain. Make necessary repairs immediately.
2. Repair any torn sections with a continuous piece of fabric from post to post.
3. When making repairs, always restore the system to its original configuration unless an amended layout is required or specified.
4. If the fabric is sagging between stakes, install additional support posts/stakes.
5. Remove accumulated sediment if the sediment deposit exceeds a depth of 150mm.
6. Dispose of sediment in a suitable manner that will not cause an erosion or pollution hazard.
7. Replace the fabric if the service life of the existing fabric exceeds six months.

## Removal

1. When disturbed areas up-slope of the sediment trap are sufficiently stabilised to restrain erosion, the sediment trap must be removed.
2. Remove materials and collected sediment and dispose of in a suitable manner that will not cause an erosion or pollution hazard.
3. Rehabilitate/revegetate the disturbed ground as necessary to minimise the erosion hazard.