Fabric Drop Inlet Protection

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] Block & aggregate, and mesh & aggregate drop inlet protection systems incorporating a geotextile filter are generally preferred in clayey soil areas.

Symbol

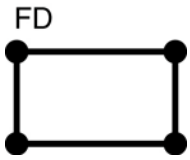

Photo 1 – Fabric drop inlet protection incorporating a timber support frame

Photo 2 – Fabric drop inlet protection (note, support stakes are too far apart)

Key Principles

1. Sediment trapping is primarily achieved through gravity-induced sedimentation within the settling pond that forms around the stormwater inlet.
2. The critical design parameter is the surface area of the formed settling pond.
3. Filter cloth should not be used as the fabric because it does not allow adequate ponding of water.
4. 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 turbidity of water passing through the fabric.
5. Non-woven composite sediment fence fabric can be used to improve the trapping of clay and silt-sized particles.

Design Information

Maximum catchment area 0.4ha on sites with low sediment runoff, or 0.1ha on sites with expected high sediment runoff yields.

Maximum 1m spacing of support stakes.

Desirable spill-through weir height of 300mm (min) above ground level, and 450mm (max).

Temporary flow control bunds may be required to control the depth and extent of ponding and to prevent water bypassing the inlet. The crest of these bunds should be at least 150mm above the estimated maximum water level.

Design of spill-through weirs

Where appropriate, spill-through weirs should be installed into the sediment trap (Figure 3) to reduce hydraulic pressure 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 1.

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

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

Table 1 – Flow rates passing over a spill-through weir (m^3/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

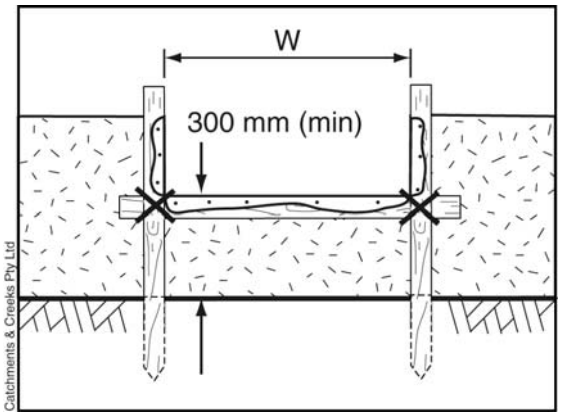

Figure 1 – Spill-through weir profile

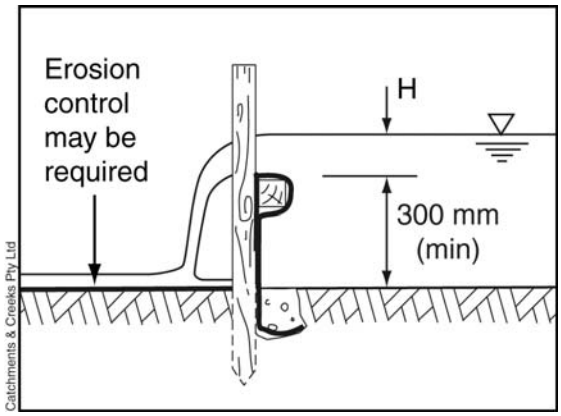

Figure 2 – Side profile of a spill-through weir

Photo 3 – Failed structure

Photo 4 – Stormwater inlet with no sediment protection

Installation of structure

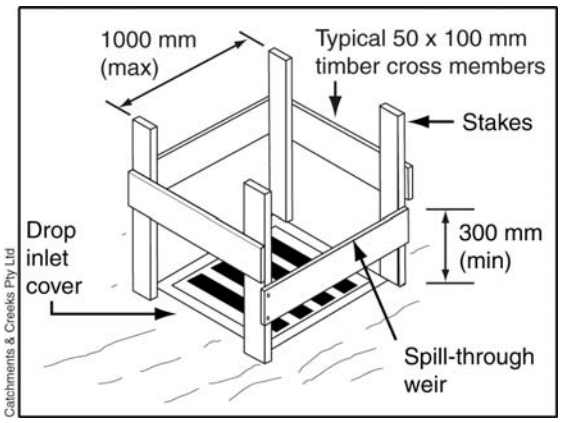

Figure 3 – Support frame

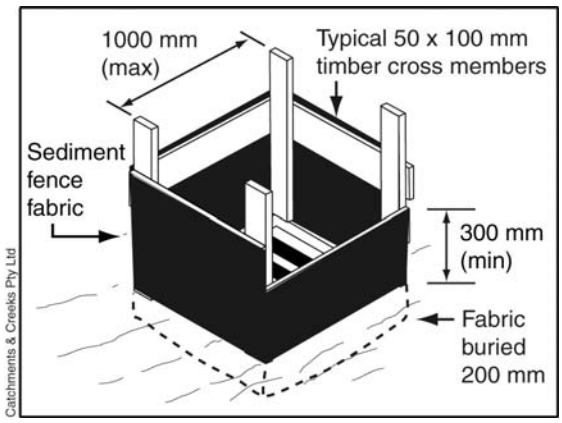

Figure 4 – Attachment of fabric

A temporary flow control bund (Figure 5) may be required to control the depth and extent of ponding, and to prevent water bypassing the inlet.

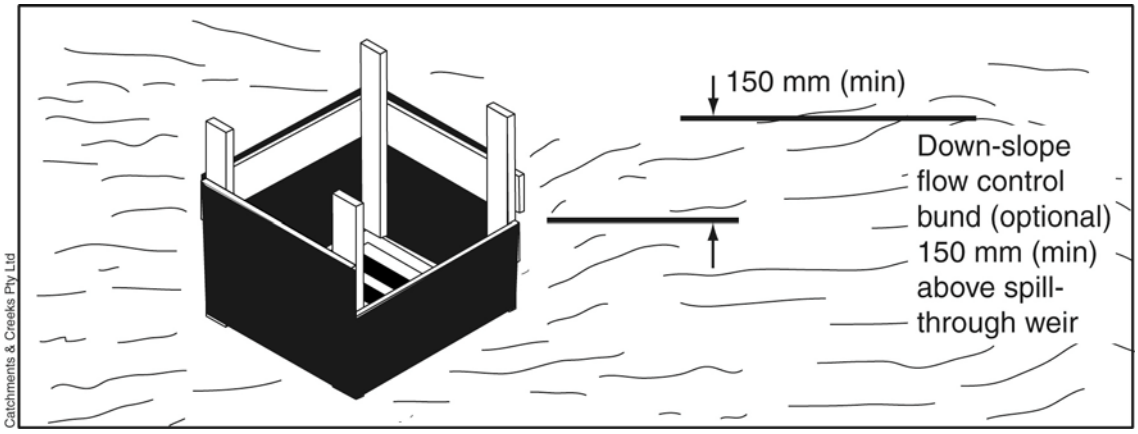

Figure 5 – Fabric drop inlet protection shown with an optional flow control bund to manage water ponding around the stormwater inlet

Where appropriate, an excavated pit (Figure 6) can be used to increase the sediment trapping efficiency of a fabric drop inlet protection system.

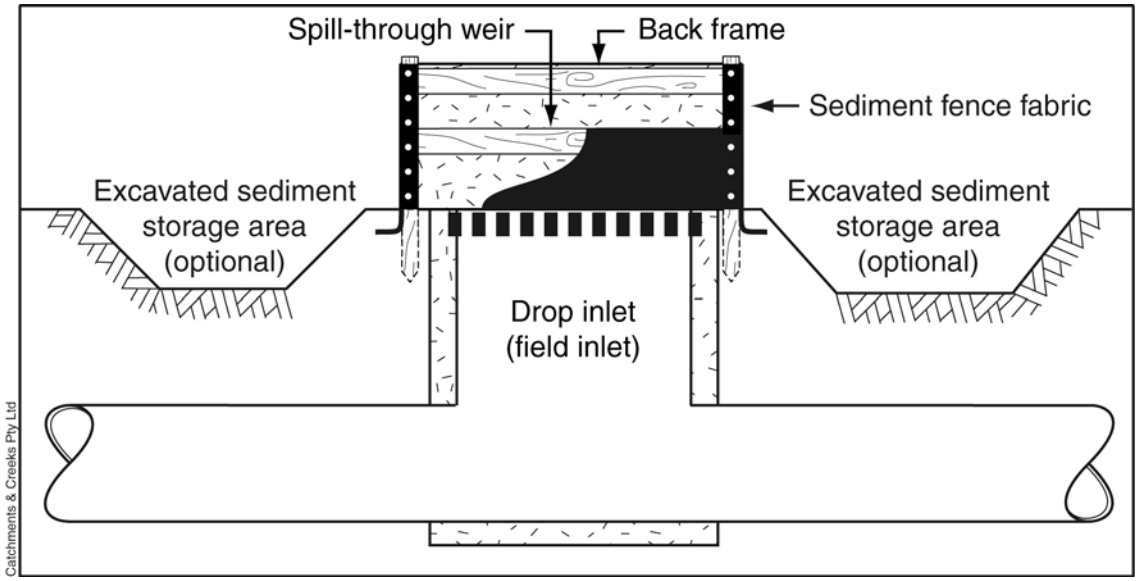

Figure 6 – Fabric drop inlet protection shown with excavated trench to increase sediment storage capacity

Description

Fabric drop inlet protection systems consist of sediment fence fabric staked around the stormwater inlet.

A spill-through weir is normally installed into the structure to control the height of ponding and prevent the hydraulic failure (collapse) of the trap.

Purpose

Used to minimise coarse sediment entering underground drainage systems.

Best used in sandy soil areas.

Limitations

These sediment traps provide only limited turbidity control.

Best used in sandy soil areas, or when only coarse sediment trapping is required. Otherwise use a *Block & Aggregate*, *Mesh & Aggregate* or *Rock & Aggregate* drop inlet protection system.

Catchment area limited to around 0.4 ha.

Not suitable for inaccessible areas where regular maintenance cannot be performed on the sediment trap.

Advantages

Relatively cheap and simple to construct.

Results in only minor site disturbance.

Can assist in reducing sediment build-up in stormwater drains, thus reducing the cost of post storm clean-up.

Disadvantages

Requires regular maintenance.

Drainage problems can occur if poorly designed or poorly maintained.

Can be damaged by construction traffic.

Common Problems

Due to the relatively cheap cost and ease of construction, this form of inlet protection is often used in situations where a more durable structure should have been used such as a *Block & Aggregate*, *Mesh & Aggregate*, or *Rock & Aggregate* drop inlet protection system.

The support stakes are often placed too far apart. The spacing of stakes should be limited to 1m.

Special Requirements

Allowance should always be made for potential bypass flows in the event of severe storms.

Ponding must be allowed to occur around the sediment trap in order to achieve particle settlement.

The bottom of the fabric must be secured in a trench to prevent the free flow of water under the fabric.

A spill-through weir is usually required to control the maximum depth of ponding and to prevent undesirable flooding or traffic hazards.

Where necessary, the sediment trap may need to be partially surround by a flow control bund to limit the extent of ponding and control the movement of bypass flows.

Location

Surrounding field (drop) inlets when only coarse sediment collection is required.

Best used in partnership with a downstream sediment basin.

Site Inspection

Look for potential flooding or traffic safety problems.

Take note of where bypass water will flow.

Ensure that any water that bypasses the inlet will not cause flooding problems.

Check the maximum allowable pond depth.

Check for damage to the fabric.

Check the sturdiness of the support frame.

Ensure the fabric is adequately buried.

Check if the device needs a spill-through weir installed.

Ensure the height of the spill-through weir set correctly to avoid undesirable flooding or flow bypassing.

Check the height and stability of the flow control bund.

Materials

- Fabric: polypropylene, polyamide, nylon, polyester, or polyethylene woven or non-woven reinforced fabric. The fabric width should be at least 700mm, with a minimum unit weight of 140gsm. Fabrics should 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.
- Stakes: minimum 1500mm^2 (min) hardwood, 2500mm^2 (min) softwood, or 1.5kg/m (min) steel star pickets.
- Timber cross members: 50 x 100mm timber or equivalent.
- Aggregate: 15 to 25mm crushed rock.

Installation

1. Refer to approved plans for location and dimensional details. If there are questions or problems with the location, dimensions or method of installation contact the engineer or responsible on-site officer for assistance.
2. Ensure that the installation of the sediment trap will not cause undesirable safety or flooding issues.
3. Where possible, excavate a 200x200mm trench around the inlet structure.
4. Space stakes evenly around the perimeter of the stormwater inlet at a maximum 1m spacing, and securely drive them into the ground.
5. Where necessary, install a horizontal spill-through weir to limit the maximum height water ponding around the structure.
6. Ensure the maximum pond height will not cause a safety hazard, including undesirable flooding of an adjacent property or roadway. Wherever practical, the spill-through weir should be at least 300mm above ground level.
7. If a spill-through weir is **not** installed, then frame the top of the stakes with horizontal cross members.
8. Cut fabric from a continuous roll to eliminate joints.
9. Place the bottom 300mm of fabric in the excavated trench.
10. Securely fasten the fabric to the stakes and cross members. At the fabric joint, overlap the fabric to the next stake.
11. Backfill the trench with at least 200mm of aggregate or compacted soil. If a trench cannot be excavated, lay the bottom 300mm of fabric evenly on the ground surface and cover with a 300mm layer of aggregate, not earth or soil.
12. Where required, install a flow control bund to maintain the specified pool depth and control the movement of water.
13. Take all necessary measure to minimise the safety risk caused by the structure and to prevent unsafe entry into the stormwater inlet.

Maintenance

1. Inspect the sediment trap after each runoff-producing rainfall event and make repairs as needed to the sediment trap and associated flow control bunds.
2. Remove collected sediment and dispose of in a suitable manner that will not cause an erosion or pollution hazard.
3. Sediment deposits should be removed immediately if they represent a safety risk.

Removal

1. When the up-slope drainage area has been stabilised, remove all materials included deposited sediment and dispose of in a suitable manner that will not cause an erosion or pollution hazard.
2. Bring the disturbed area to a proper grade, then smooth, compact and stabilise and/or revegetate as required.