STORMWATER MANAGEMENT DESIGN GUIDELINES

For the City of Madison, Georgia

February, 2000

Table of contents:

Minimum Requirements For Stormwater Management Facilities: 2
Guidelines For Specific Stormwater Management Devices: 2
Examples and Efficiencies 2
Minimum Specifications 3
1. Extended Detention Ponds 3
2. Retention (Wet) Ponds 4
3. Sand Filters 4
4. Constructed Wetlands 5
5. Infiltration Trenches/Devices 5
6. Filter Strips and Flow Spreaders 6
7. Grassed Swales 6
8. Oil/Grit Separators 6
Maintenance and inspection Schedule: 7
refeerences: 8
Illustrations: 9

MINIMUM REQUIREMENTS FOR STORMWATER MANAGEMENT FACILITIES:

All stormwater management facilities shall be subject to the following minimum requirements:

- 25 foot wide easement with a cleared for maintenance and inspection access
- 20 foot easement and buffer along the perimeter of the stormwater management facility for maintenance and inspection access
- All required easement plats for recordation shall be provided by the development Applicant or Owner
- Outlet structures shall be designed to safely pass the 100-hundred year storm event
- Maximum velocity in any storm sewer not to exceed 15 FPS
- Stormwater detention and storm sewer systems to be designed for the 25-year storm event
- Detention facilities shall be designed to detain flows from the 2, 5, 10, and 25-year storm events
- Minimum of 18-inch freeboard above the 100-year ponding limits shall be provided for all detention facilities
- Design calculations, coefficients, and BMPs in accordance with the MANUAL FOR EROSION AND SEDIMENT CONTROL IN GEORGIA, as amended.
- A maintenance agreement shall be executed by the Owner and the City of Madison for stormwater management facilities in accordance with the Required Standard Specifications
- All stormwater culverts greater than 24-inch in diameter to be constructed underneath public streets shall be reinforced concrete pipe (RCP)
- Normally dry headwater pools with side slopes of 3 horizontal to 1 vertical or less are exempt from the fencing requirement
- Chain link fences a minimum of 4 feet in height with a minimum of 12 foot wide gate shall be required for all stormwater detention/retention facilities not meeting the following specifications:
  - -Side slopes of the pond are 3 horizontal to 1 vertical or less
  - -Depth of water in the pond will not exceed 3 feet at one hour after the duration of the storm event

GUIDELINES FOR SPECIFIC STORMWATER MANAGEMENT DEVICES:

Examples and Efficiencies

Where additional stormwater management facilities are required to satisfy the minimum control requirements, Table A below provides examples of what may be used. If designed according to the specifications indicated in the following section, the stormwater BMPs will be reviewed based on the assumed sediment removal efficiencies in Table A. The devices can be used alone or in combination to achieve the required sediment removal rates.

Table A

Device	Estimated Sediments Removed
1. Extended Detention Ponds	80% to 90%
2. Retention (Wet) Ponds	60% to 80%
3. Sand Filters	85%
4. Constructed Wetlands	90% to 95%
5. Infiltration Trenches/Devices	90% to 95%
6. Filter Strips and Flow Spreaders	
- 20' wide grassed filter spreader:	30%
-100' wide grassed filter spreader:	70%
7. Grassed Swales	
- Minimum 100' at 5% slope	10% to 15%
- Minimum 100' at less than 5% slope	30%
8. Oil/Grit Separators (mainly for hydrocarbons removal)	10% to 15%

Stormwater BMPs not listed above may be used. However, all proposed stormwater management structures shall be designed and certified by an appropriate state approved professional, shall be subject of the approval of the Municipal Engineer, and shall meet the requirements of the Official Zoning Ordinance for the City of Madison, Georgia.

Minimum Specifications

This section gives specifications to be utilized as a guide in the design of the BMPs listed in Table A. In order for credit to be given for any specific design of BMPs, the stormwater management facility must include or address its corresponding standard specifications. Following are the minimum required standard specifications for eight different structural BMPs. Attached at the end of this document are example illustrations of Structural BMPs to provide some guidance in the design.

1. EXTENDED DETENTION PONDS

- Side slopes shall be no greater than 3:1, if mowed.
- Inlet and outlet located to maximize flow length.
- Design for full development upstream of control.
- Riprap protection (or other suitable erosion control means) for the outlet and all inlet structures into the pond.
- 18" minimum freeboard above the peak stage for top of embankment.
- Emergency spillway designed to pass the 100-year storm event (must be paved in fill areas).
- Maintenance access of 25 feet wide.
- Trash racks, filters or other debris protection on control.
- Anti-vortex plates.
- Insure no outlet leakage and use anti-seep collars.
- Benchmark for sediment removal.

- Two stage design with bottom slope between 2% and 5%.
- Top stage dry with depth between 2 and 5 feet.
- Bottom stage maintained as shallow pool or marsh with depth between 6 to 12 inches.

2. RETENTION (WET) PONDS

- Minimum Detention time of 48 hours.
- Minimum length to width ratio of 3:1.
- Inlet and outlet located to maximize flow length.
- Minimum depth of permanent pool 2 to 3 feet, maximum depth of 9 to 12 feet, average depth should 3 to 7 feet.
- Design for full development upstream of control.
- Side slopes shall be no greater than 3:1, if mowed.
- Riprap protection (or other suitable erosion control means) for the outlet and all inlet structures into the pond.
- Anti-vortex plates.
- Anti-seep collars on principal spillway.
- 18" minimum freeboard above the peak stage for top of embankment.
- Emergency drain capable of draining within 24 hours.
- Emergency spillway designed to pass the 100-year storm event (must be paved in fill areas).
- Trash racks, filters or other debris protection on control.
- Maintenance access of 25 feet wide.
- Benchmark for sediment removal.
- Paved or concrete channel.

3. SAND FILTERS

- Maximum contributing drainage area of 50 acres.
- Designed to completely empty in 48 hours or more.
- Inlet structure shall be designed to spread the flow uniformly across the surface of the filter media.
- Riprap or other dissipating devices shall be installed to prevent gouging of the sand media and to promote uniform media.
- Final sand bed depth shall be 18 inches.
- Underdrain pipes shall consist of main collector pipes and perforated lateral branch pipes.
- Internal diameters of lateral branch pipes shall be 4 inches or greater and perforations shall be 3/8 inch.
- Maximum spacing between rows of perforations shall not exceed 6 inches.
- All piping shall be schedule 40 PVC or greater strength.
- Minimum grade of piping shall be 1/8 inch per foot (1% slope).
- Access for cleaning all underdrain piping shall be provided.
- A minimum infiltration rate of 0.5 inches per hour should be used for all infiltration designs, including sand filters.

4. CONSTRUCTED WETLANDS

- Inflow of water must greater than outflow from the basin by infiltration or exfiltration.
- Designed for an extended detention time of 48 hours.
- Protection against blockage for the orifice.
- Surface area of the wetland shall account for a minimum of 3 percent of the area of the watershed draining into it.
- The length to width ratio shall be at least 3:1.
- A soil depth of at least 4 inches shall be used for shallow wetland basins.
- Approximately 75 percent of the wetland shall have water depth less than 12 inches, and 25 percent of the wetland shall have depths ranging from 2 to 3 feet.
- A forebay shall be established at the pond inflow points to capture larger sediments and shall be 4 to 6 feet deep.
- Depth markers for sediments shall be provided
- Maintenance access of 25 feet wide.
- A minimum of two aggressive wetland species (primary) of vegetation shall be established in quantity on the wetland.
- Three additional wetland species (secondary) of vegetation shall be planted on the wetland, although in far less numbers than the primary species.
- 30 to 50 percent of the shallow (12 inches or less) areas of the basin shall be planted with wetland vegetation.
- Approximately 50 individuals of the secondary species shall be planted per acre.
- A minimum of 25-foot buffer, for all but the pocket wetlands, shall be established and planted with riparian and upland vegetation.

5. INFILTRATION TRENCHES/DEVICES

- Allowed in small drainage areas less than 15 acres.
- A minimum of one soil boring, 5 feet below trench depth, is required for every 50 feet of trench length, and no less than 2 soils logs for each proposed trench location.
- For runoff treatment, the soil infiltration rate shall be between 0.5 and 2.4 inches per hour.
- The use of infiltration systems on fill is not allowed due to the possibility of creating an unstable subgrade.
- A minimum of 3 feet separation is required between the bottom of the trench and the seasonal high water table and to bedrock.
- The proximity of building foundation shall be at least 10 feet horizontally.
- A minimum of 100 feet from water supply well shall be maintained when runoff is from industrial or commercial areas.
- The design infiltration rate shall be one half the infiltration rate found from the soil textural analysis.
- Water quality infiltration trenches must be preceded by a pretreatment BMP.
- The aggregate material for the trench shall consist of a clean aggregate with a maximum diameter of 3 inches and a minimum diameter of 1.5 inches. The aggregate must be completely surrounded with an engineering filter fabric.

- An observation well shall be installed for every 50 feet of trench length.
- The observation well shall consist of perforated PVC pipe, 4 to 6 inches in diameter, located in the center of the structure, and be constructed flush with the ground elevation of the trench. The top of the observation well shall be capped.

6. FILTER STRIPS AND FLOW SPREADERS

- The use of the filter strips shall be limited to drainage areas of 10 acres or less with the optimal size being less than 5 acres.
- The capacity of the spreader and/or filter strip length shall be based on the 25-year storm event.
- Drainage area into spreaders shall be restricted so that the maximum flow will not exceed 30 CFS.
- Channel grade for the last 20 feet of the dike or diversion entering the level spreader shall be less than or equal to 1%.
- Grade of level spreaders shall be 0%.
- Depth of level spreader as measured from the lip shall be at least 6 inches.
- Level spreader lip shall be constructed in undisturbed soils.
- Slope of filter strip from level spreader shall not exceed 10%.
- Filter strips width shall be minimum of 20 feet.

7. GRASSED SWALES

- Grassed swales shall be limited to peak discharges of 5 to 10 CFS.
- Limited to runoff velocities less than 2.5 feet per second.
- Maximum design flow depth to be 12 inches.
- Swale bottom slope shall not exceed 2%.
- Side slopes shall not be steeper than 3:1 (H:V).
- Underlying soils to have a permeability rate of greater than 0.5 inches per hour.
- Swale must be 100 feet in length to obtain credit as a water quality BMP.
- Dense vegetative cover shall be established for swales.

8. OIL/GRIT SEPARATORS

- Separators shall be structurally sound and designed for acceptable traffic loadings where subjected to traffic.
- Separators shall be designed to be watertight.
- Volume of separator shall be at least 400 cubic feet per acre tributary to the facility (first two chambers).
- Forebay or first chamber shall be designed to collect floatable and larger settleable solids. Its surface area shall not be less than 20 square feet per 10,000 square feet of drainage area.
- Oil absorbent pads, oil skimmers, or other approved methods for removing accumulated oil shall be provided.
- Separator pool shall be at least 4 feet deep.
- Weirs, openings, and other pipes shall be sized to pass the 25-year storm event.

- Manholes shall be provided to each chamber to provide access for cleaning.

MAINTENANCE AND INSPECTION SCHEDULE:

Inspections shall be scheduled and periodic to achieve a comprehensive maintenance program. Detailed inspections, occurring at least semi-annually, shall be conducted by a qualified inspector to ensure that the stormwater facilities are operating as designed and to provide a chance to schedule any maintenance needed for the facility.

It is recommended that these inspections be conducted during wet weather to ensure that stormwater management facilities are maintaining the desirable retention times. In addition to the semi-annual inspections, the facilities shall be checked after major stormwater events for clogging of the outlet structure.

The following is a partial list of items that should be checked periodically and corrective action taken as required for detention/retention facilities.

- Settling of dam/berm
- Accumulation of sedimentation
- Woody growth on the dam
- Signs is piping/leakage
- Signs of seepage or wet spots on the downstream face of a dam
- Riprap failures
- Deterioration of principal and emergency spillways
- Various stage/outlet controls
- Effectiveness of debris racks
- Outlet channel conditions
- Safety features (access controls to hazardous areas)
- Access for maintenance equipment
- The following actions should be taken on stormwater facility dams/berms, as required to ensure that the dam will not present operation or safety problems.
  - Replace soil removed by rodent burrows
  - Inspect drainage systems and relief wells annually for proper function and clean out or replace if necessary.
  - Maintain riprap or other wave-protective measures and replace as needed
  - Remove and/or stabilize slide material as soon as practical
  - Replace eroded material and establish vegetation in eroded areas in emergency spillways, swales and other areas.
  - Repair any unusual seepages, boils or settlement in fill areas, or sinkholes in pool areas.

REFEERENCES:

Arnold, J.A., ed. D.E. Line, S.W. Coffey, and J. Spooner. 1993. Stormwater Management Guidance Manual. North Carolina Cooperative Extension Service and North Carolina Division of Environmental Management. Raleigh, NC

Berman, Laurel, C. Hartline, N. Ryan, and J.D. Thorne, P.E. 1991. Urban Runoff: Water Quality Solutions. The American Public Works Association Research Foundation. 58 pp.

Birch, P.B., Ph.D. and H.E. Pressley (eds.) 1992. Stormwater Management Manual for the Puget Sound Basin. Review Draft. Dept. of Ecology. Publication number 90-73.

Gibb, A., B. Bennett, and A. Birkbeck. 1991. Urban Runoff Quality and Treatment: A Comprehensive Review. File number 2-51-246(242). British Columbia Research Corporation. Vancouver, British Columbia.

North Carolina Department of Environment, Health, and Natural Resources, Division of Land Quality, Raleigh, NC. September 1988. Erosion and Sediment Control Planning and Design Manual.

Schueler, T.R., P. A. Kumble, and M. A. Heraty. 1992. A Current Assessment of Urban Best Management Practices: Techniques for Reducing Non-Point Source Pollution in the Coastal Zone. Publication number 92705. Metropolitan Washington Council of Governments. Washington, DC. 127 pp.

Schueler, T.R. 1987. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Publication number 87703. Metropolitan Washington Council of Governments. Washington, DC. 275 pp.

Stahre, P. and B. Urbonas. 1990. Stormwater Detention For Drainage, Water Quality, and CSO Management. Prentice Hall, Inc. Englewood Cliffs, NJ. 338 pp.

U.S. EPA. 1990. Urban Targeting and BMP Selection. Information and Guidance Manual for State Nonpoint Source Program Staff Engineers and Managers. The Terrene Institute. EPA No. 68-C8-0034. 54 pp.

U.S. EPA. 1992. Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices. Office of Water. Government Institutes, Inc. Rockville, MD.

Urbonas, B. and L.A. Roesner, eds. 1986. Urban Runoff Quality--Impact and Quality Enhancement Technology. American Society of Civil Engineers. New York, NY. 477 pp.

Whipple, W., N.S. Grigg, T. Grizzard, C. W. Randall, R. P. Shubinski, and L. S. Tucker. 1983. Stormwater Management in Urbanizing Areas. Prentice Hall, Inc. Englewood Cliffs, NJ. 234 pp.

American Association Of State Highway And Transportation Officials, Model Drainage Manual, 1992.

Georgia Soil and Water Conservation Commission, Manual For Erosion And Sediment Control In Georgia, Fourth Edition, P.O. Box 8024, Athens, Georgia 30603, 1996.

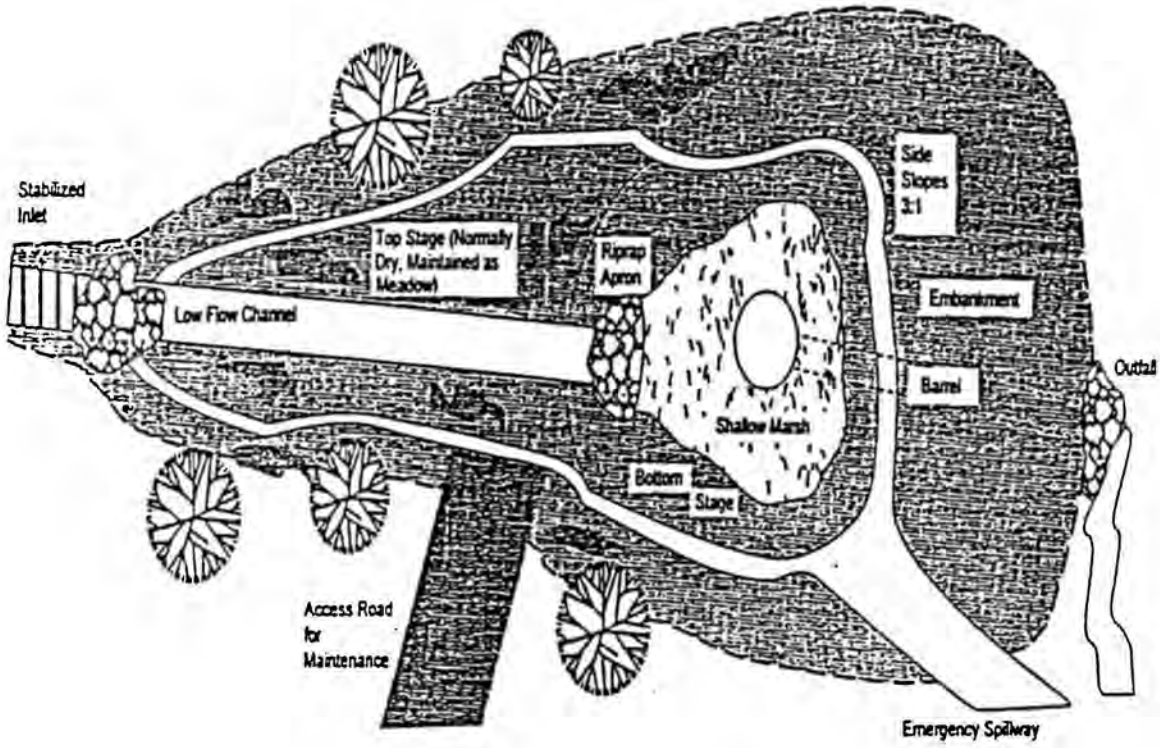
Maestri, B. and others, "Managing Pollution From Highway Stormwater Runoff", Transportation Research Board, National Academy of Science, Transportation Research Record Number 1166, 1988.

Metropolitan Washington Council of Governments, A Current Assessment Of Urban Best Management Practices - Techniques for Reducing Non-Point Source Pollution in the Coastal Zone, 777 North Capital Street, Suite 300, Washington, D.C., 1992.

State of North Carolina, Erosion And Sediment Control Planning And Design Manual, North Carolina Sedimentation Control Commission, North Carolina Department of Natural Resources And Community Development, 1988.

ILLUSTRATIONS:

The following pages provide illustrations of examples of Stormwater Management Systems. They are not intended to serve as blueprints for all stormwater management facilities in the City. They are intended only to provide visual examples of the types of BMPs that have been discussed in this manual.



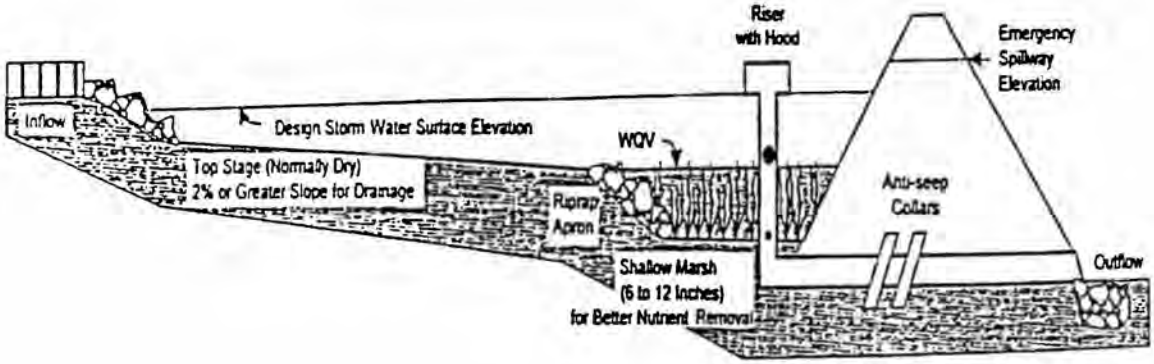


Figure 8-1 Extended Detention Pond

Source: Controlling Urban Runoff

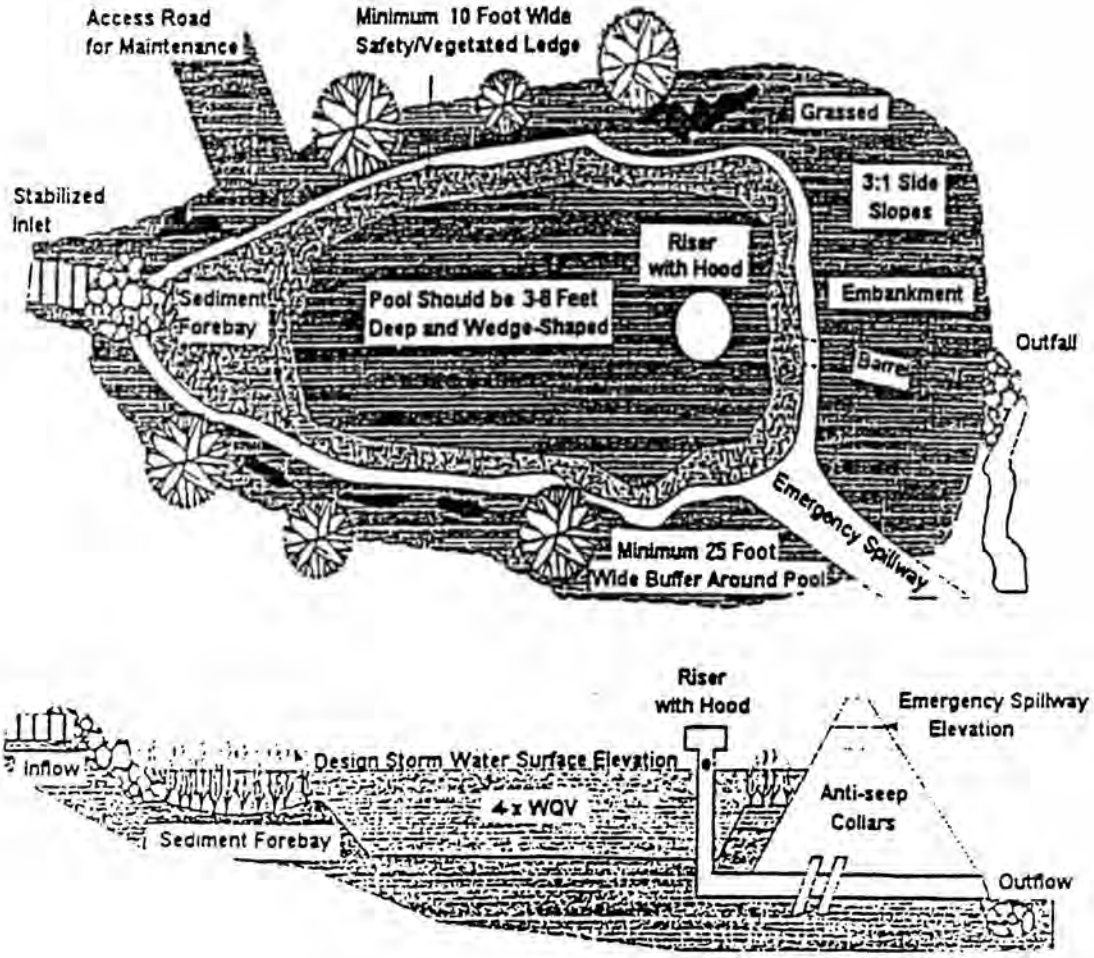


Figure 8-2 Retention (Wet) Pond

Source: Controlling Urban Runoff

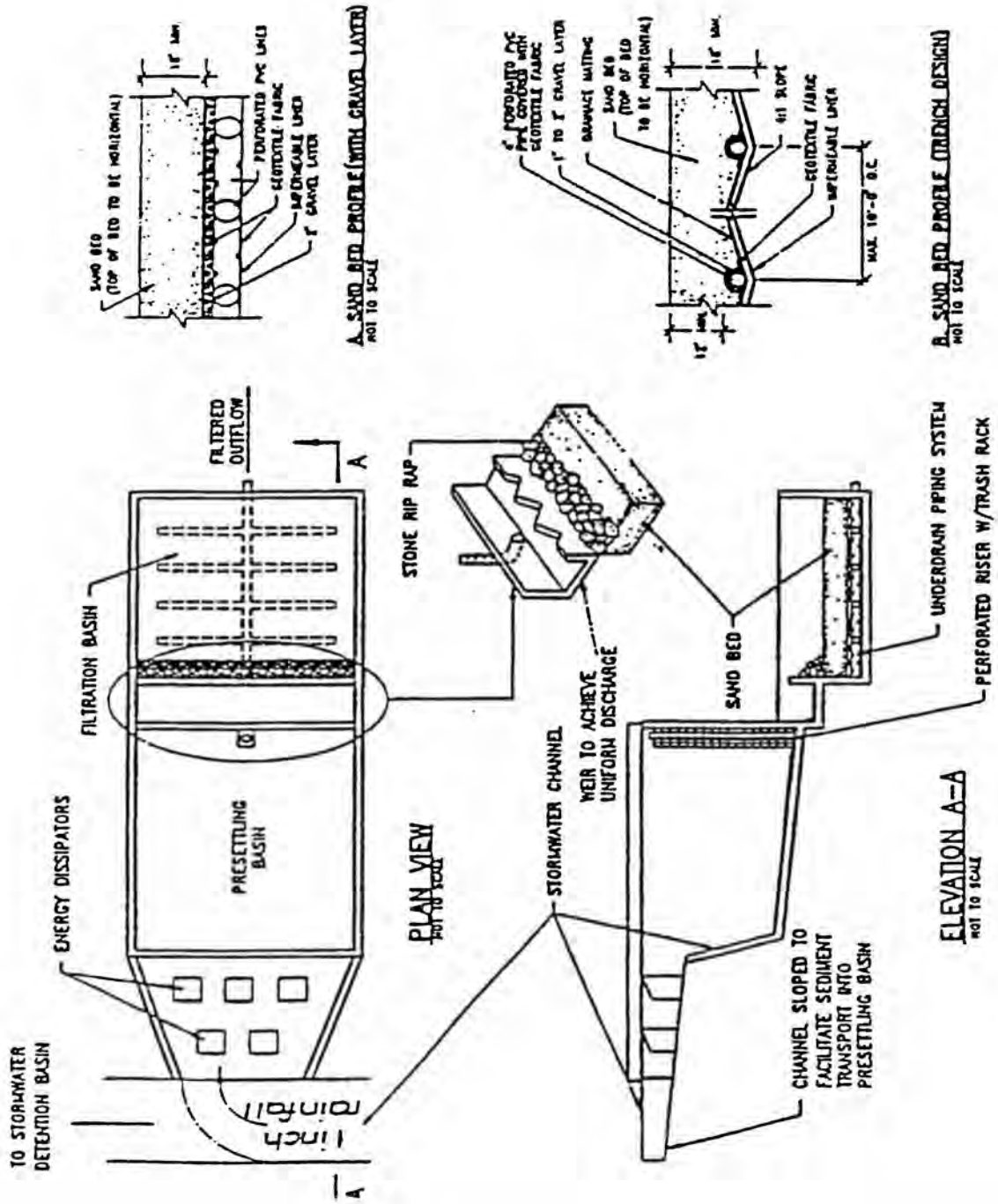


Figure 8-3 Sand Filtration Basin

Source: Stormwater Management Manual For The Puget Sound Basin

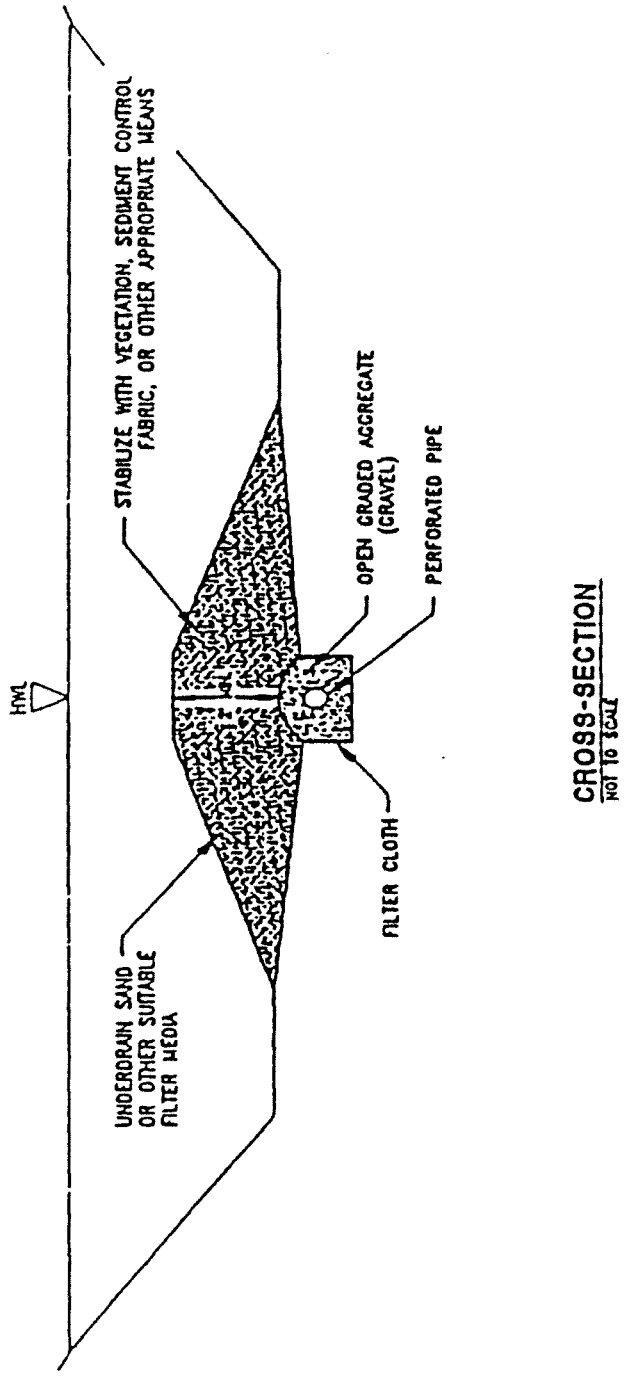


Figure 8-4 Cross-Section Of Elevated Sand Filter

Source: Florida Erosion And Sediment Control Handbook

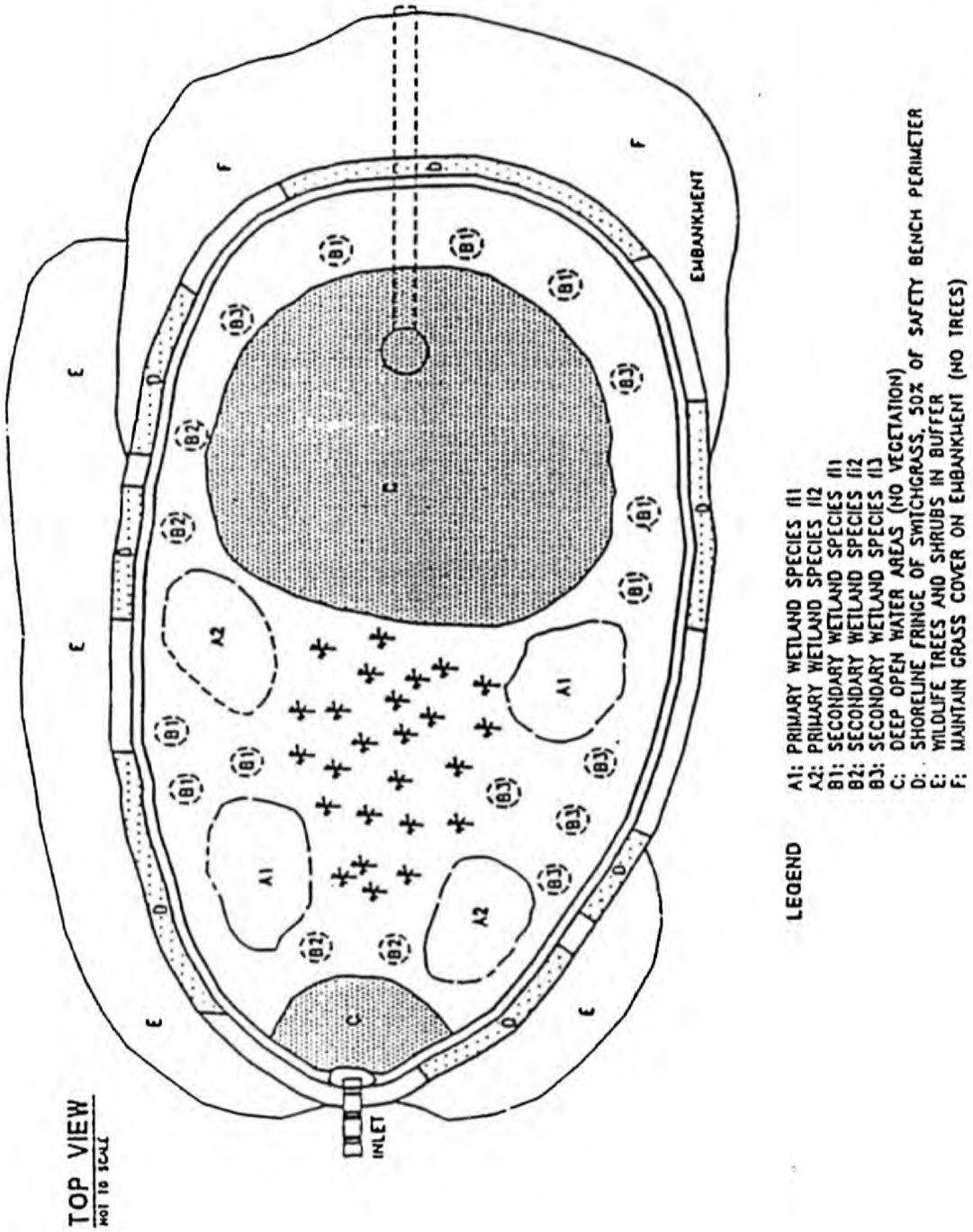


Figure 8-5 Shallow Marsh Planting Strategies

Source: Controlling Urban Runoff

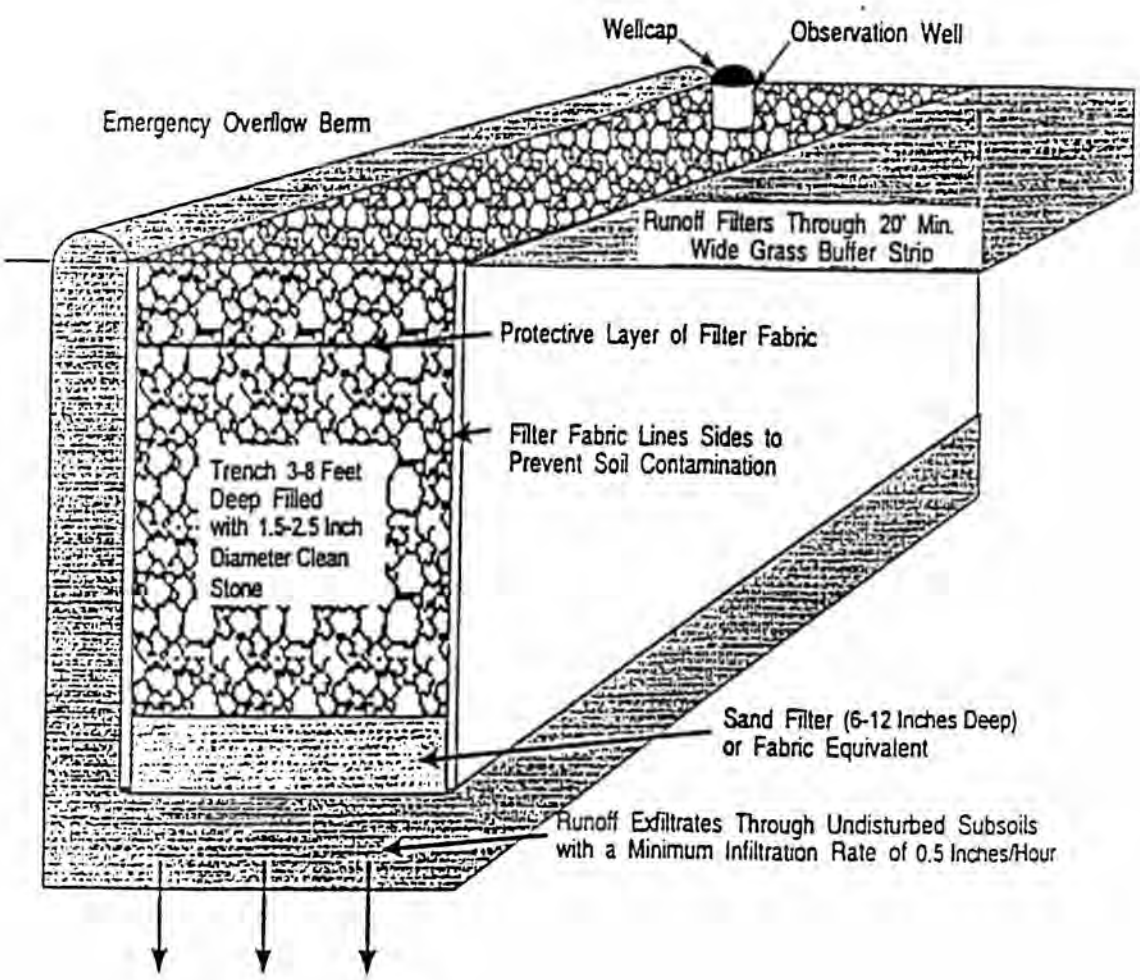


Figure 8-6 Infiltration Trench

Source: Stormwater Management Manual For The Puget Sound Basin

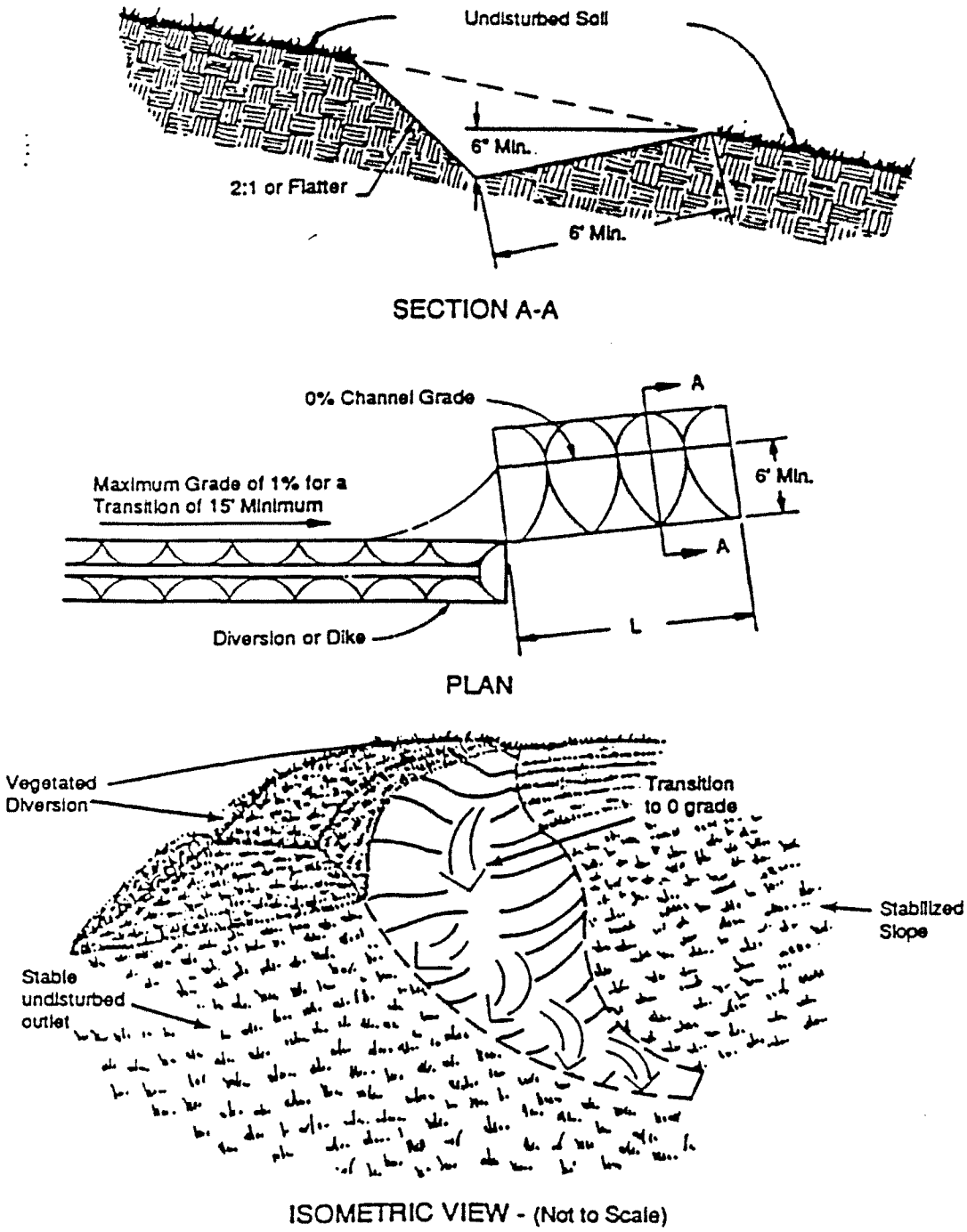


Figure 8-7 Flow Spreader

Source: North Carolina Erosion And Sediment Control Planning And Design Manual, 1988

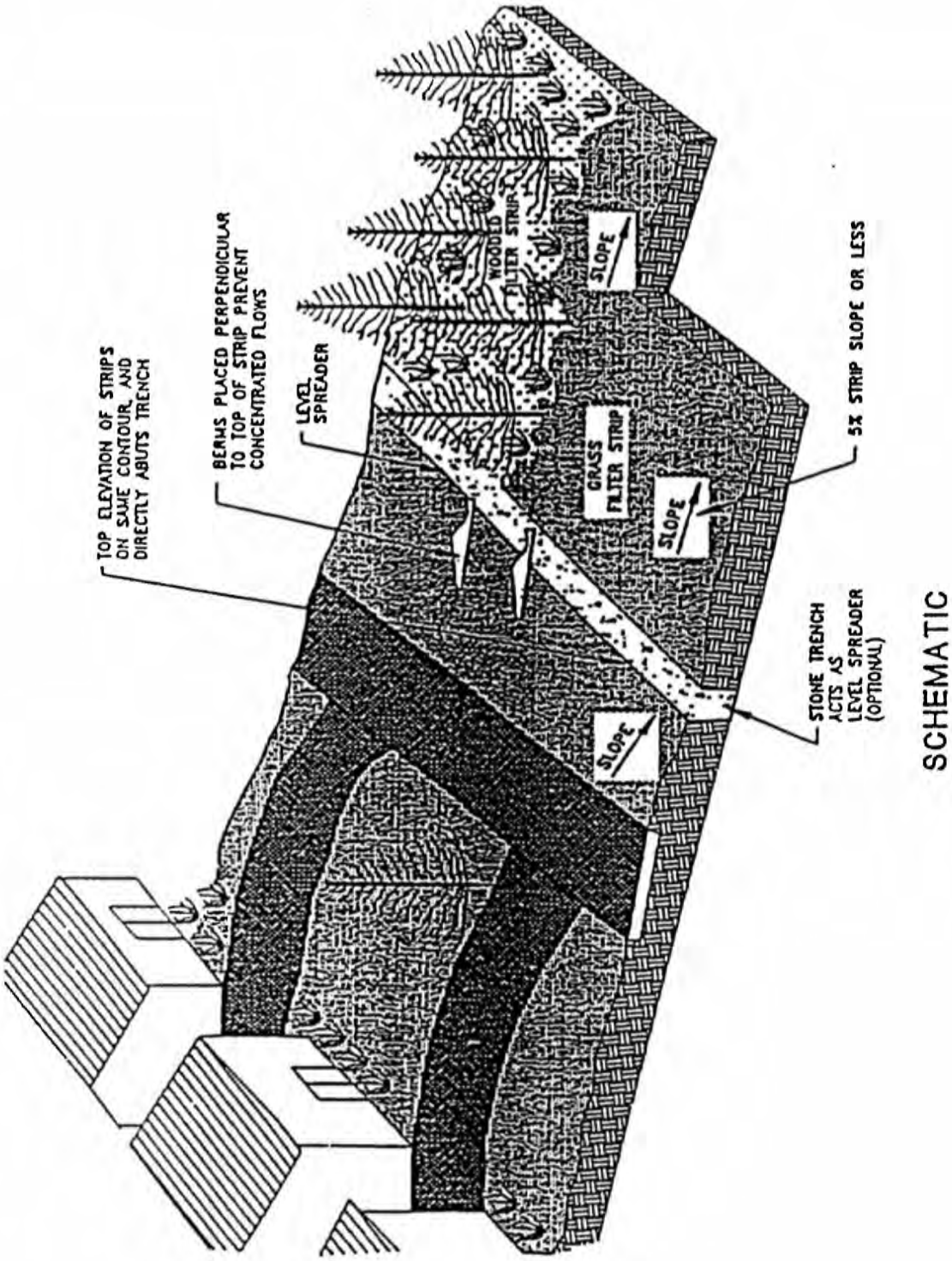


Figure 8-8 Schematic Of A Filter Strip

Source: Controlling Urban Runoff

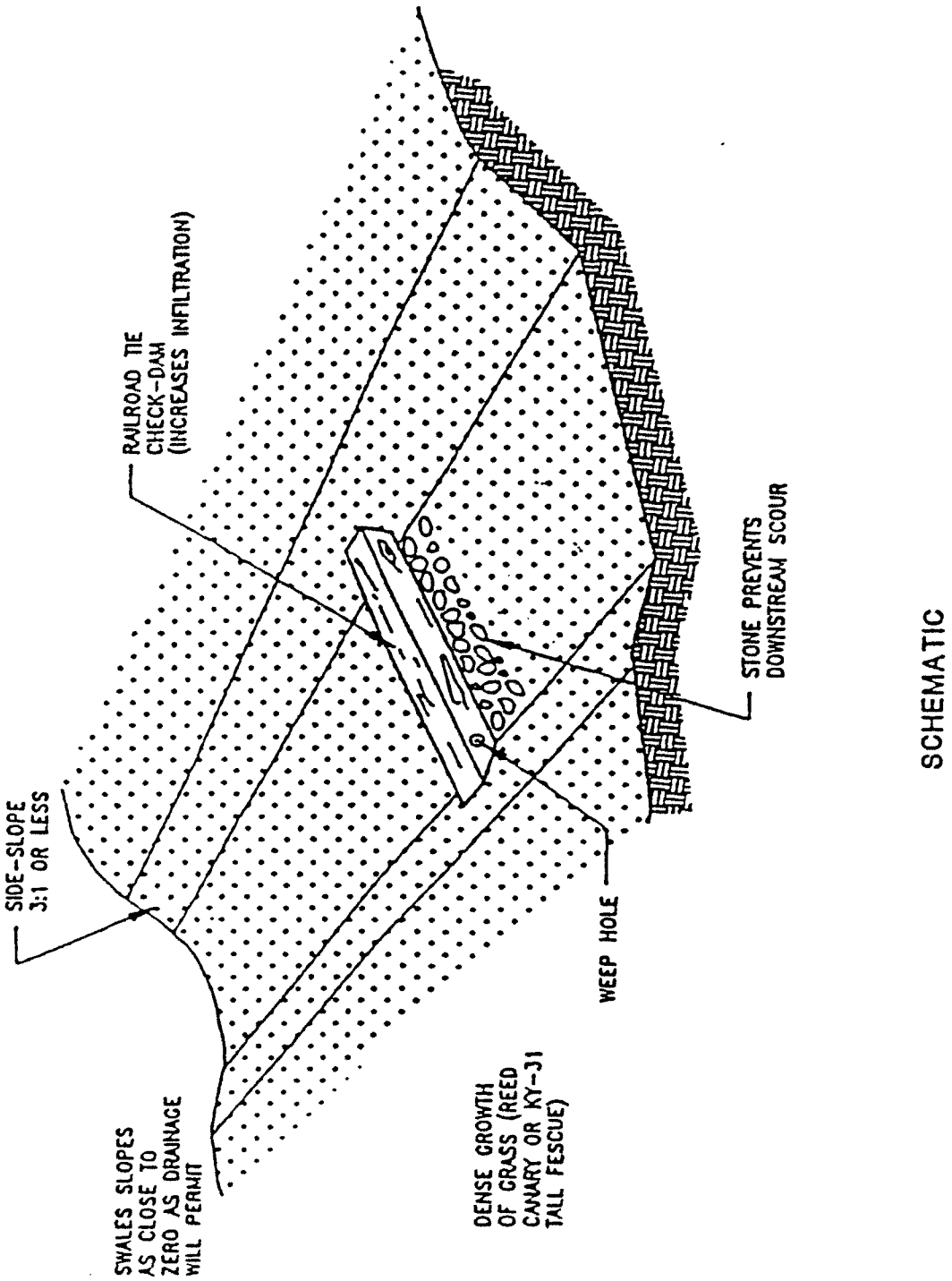


Figure 8-9 Schematic Of A Grass Swale

Source: Controlling Urban Runoff

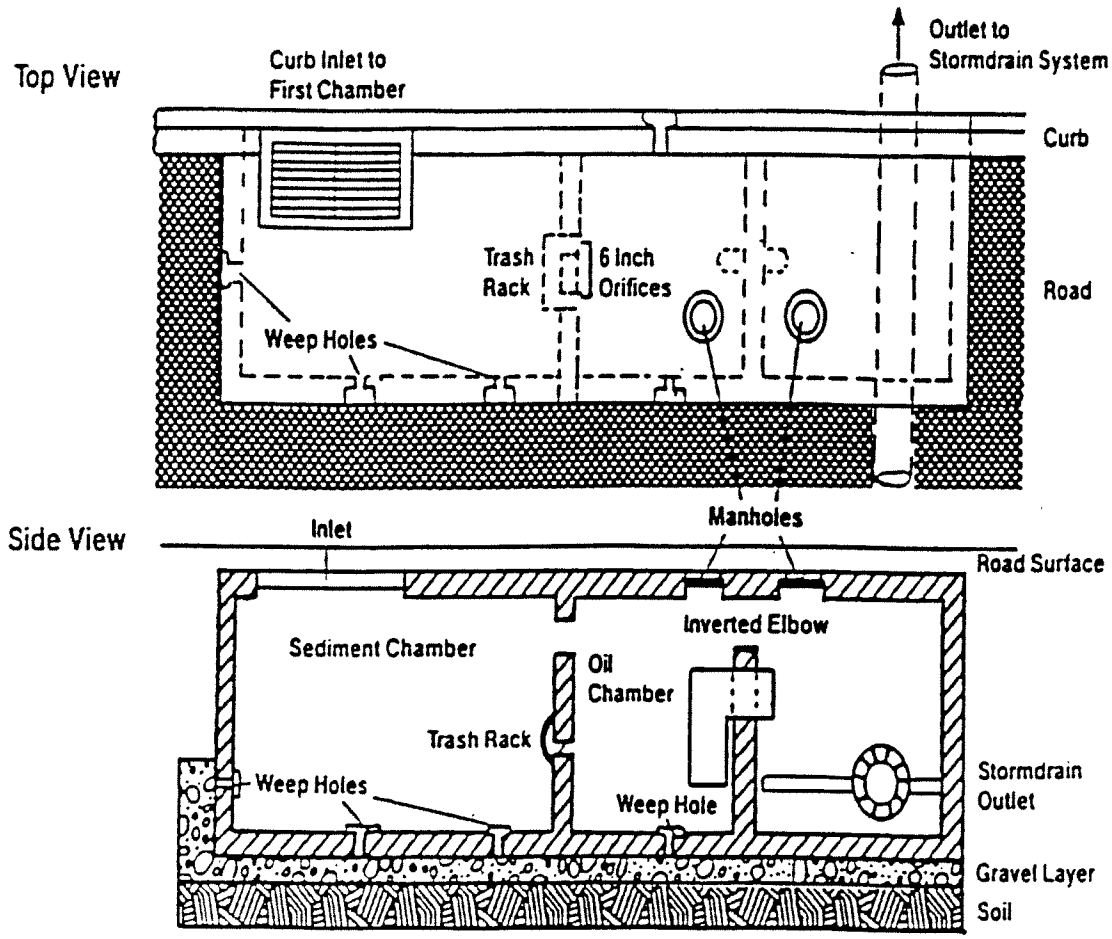


Figure 8-11 Oil/Grit Separator

Source: City of Rockville, MD

Figure 6, Modified Delaware Sandfilter Design Schematic

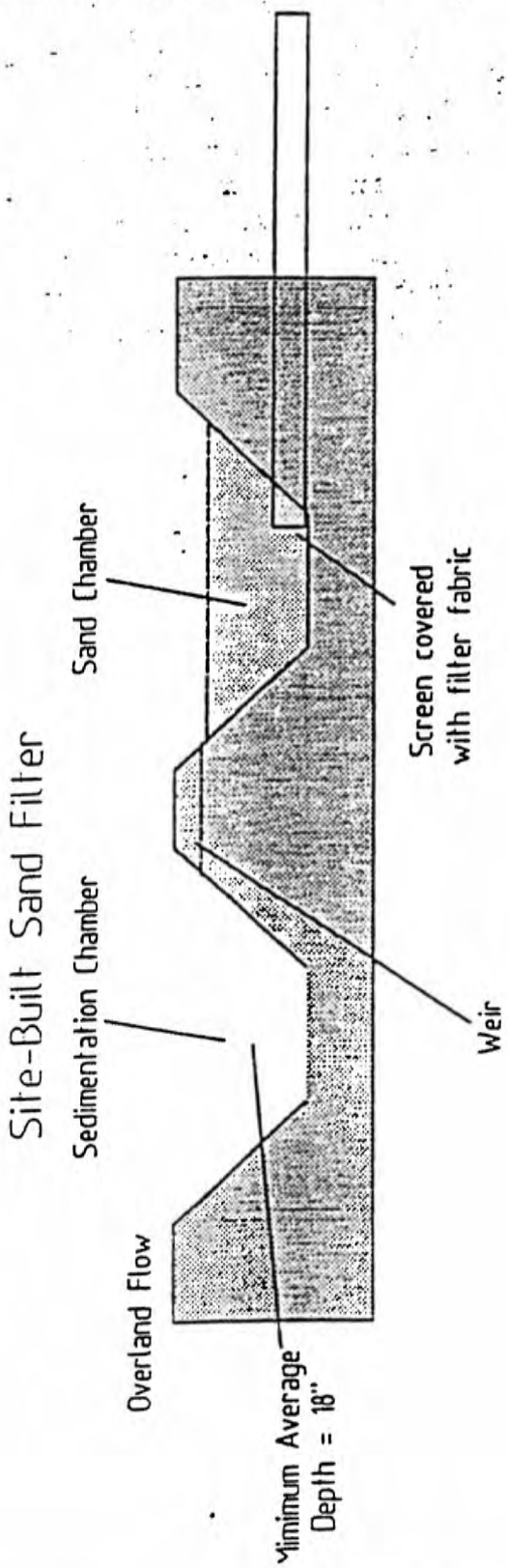


Figure 7, Bioretention Area Conceptual Layout, From Prince George's Co. Design Manual for Use of Bioretention in Stormwater Management, 1993

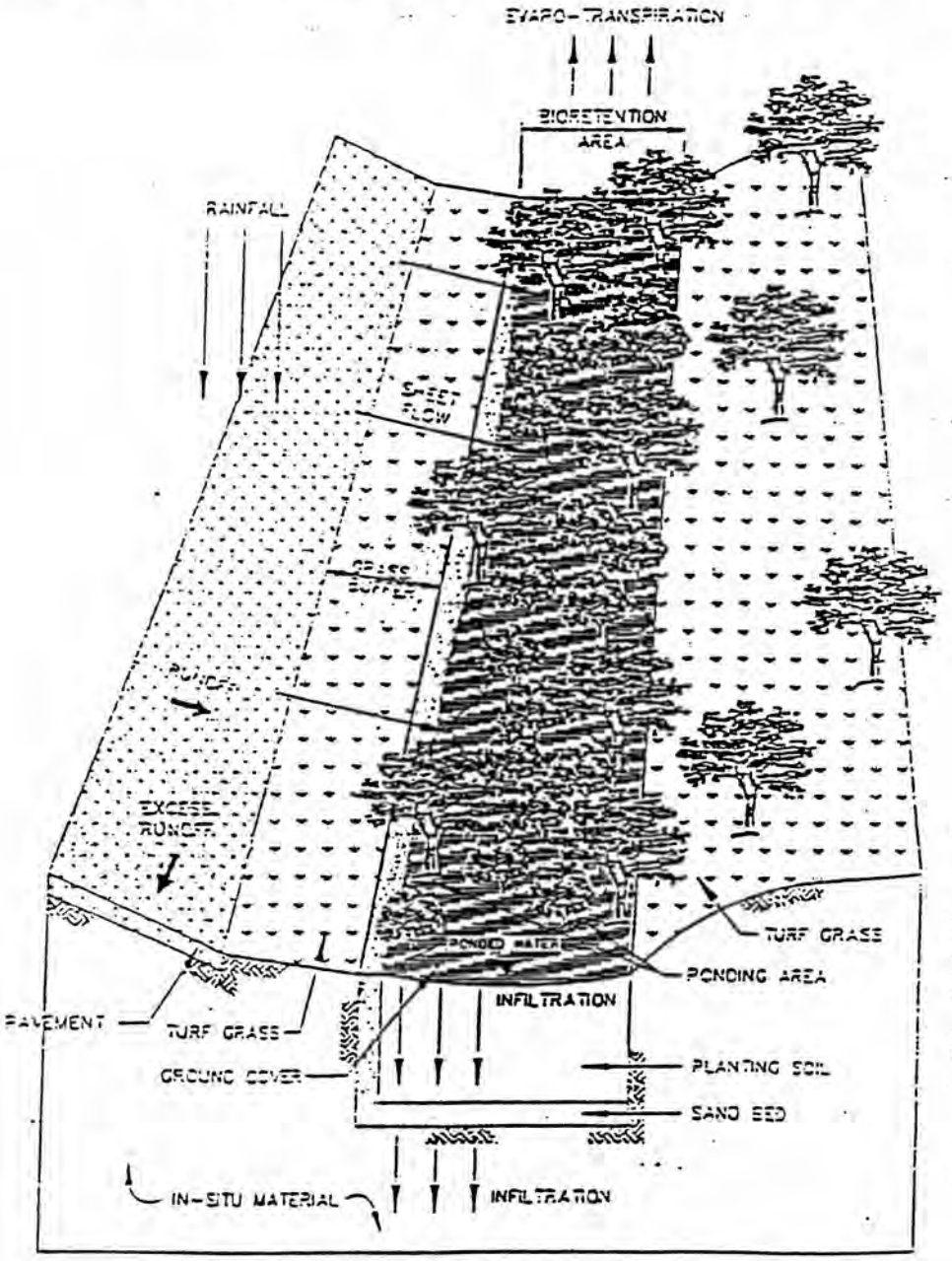


Figure 2, Extended Detention Stormwater Wetland, From Design of Stormwater Wetland Systems, Schueler, 1992

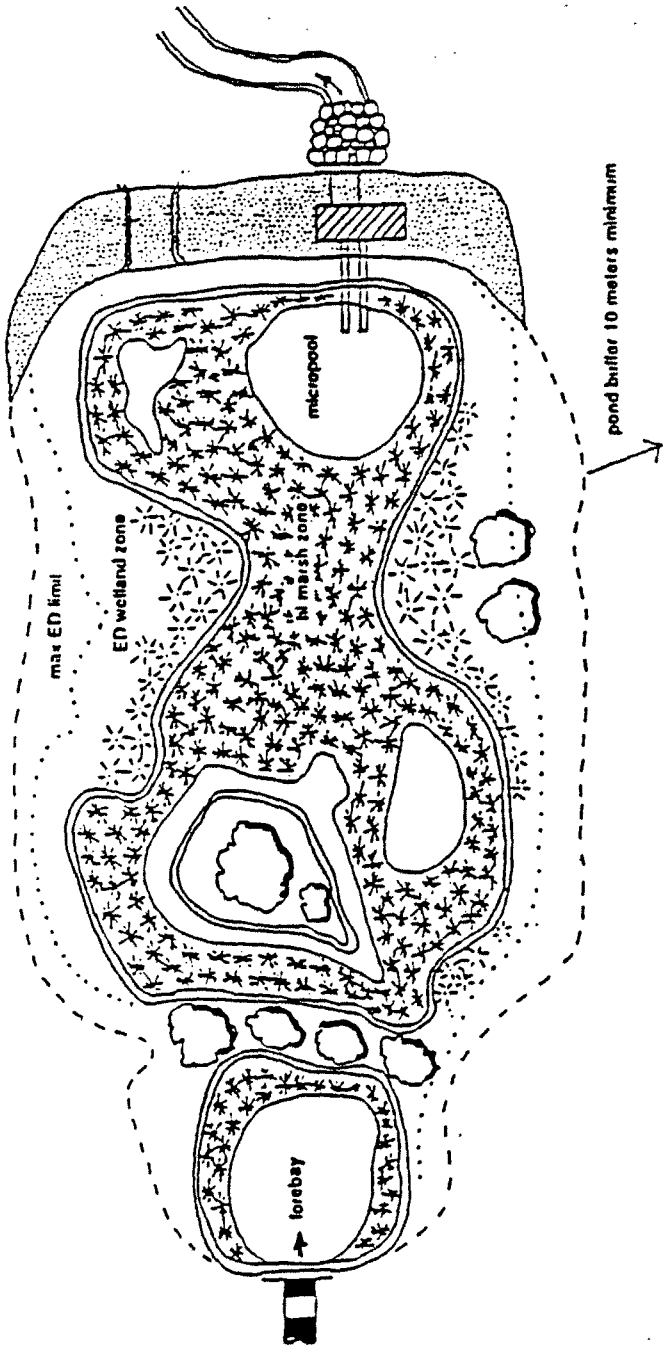
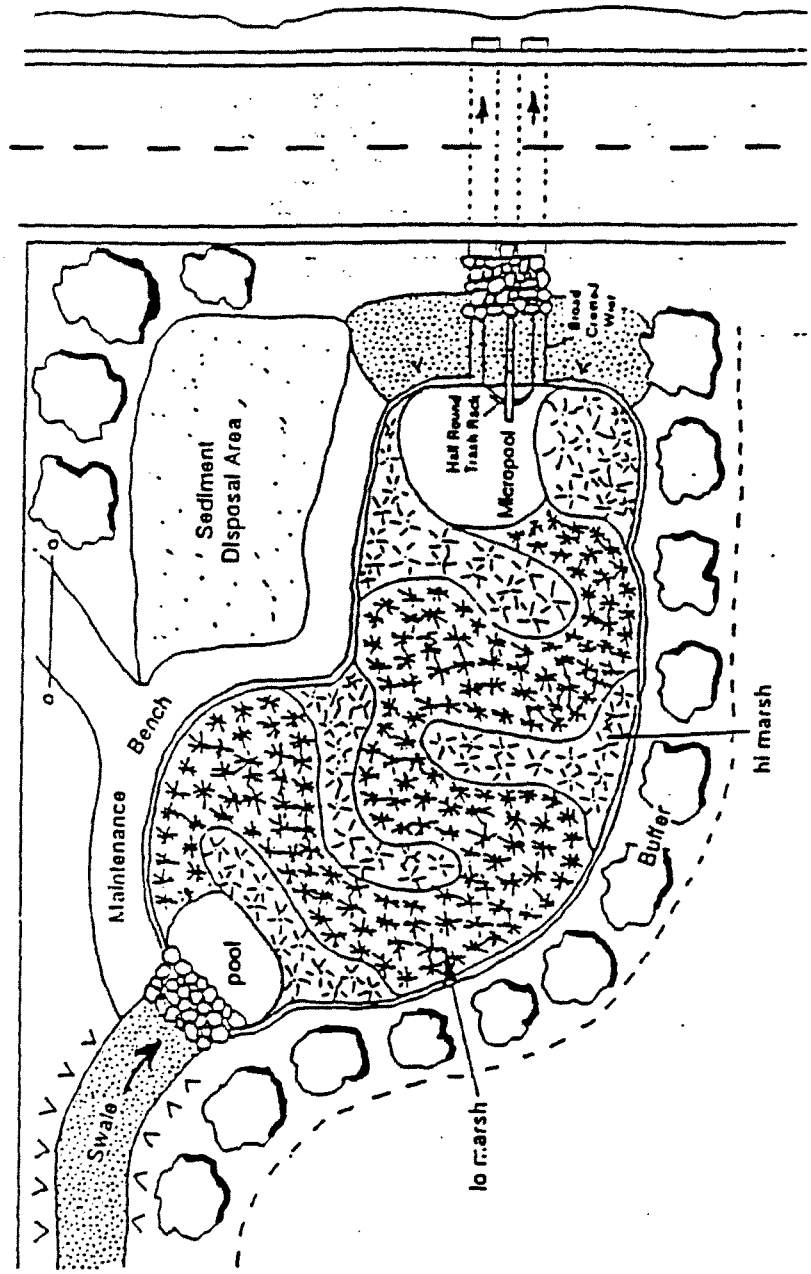
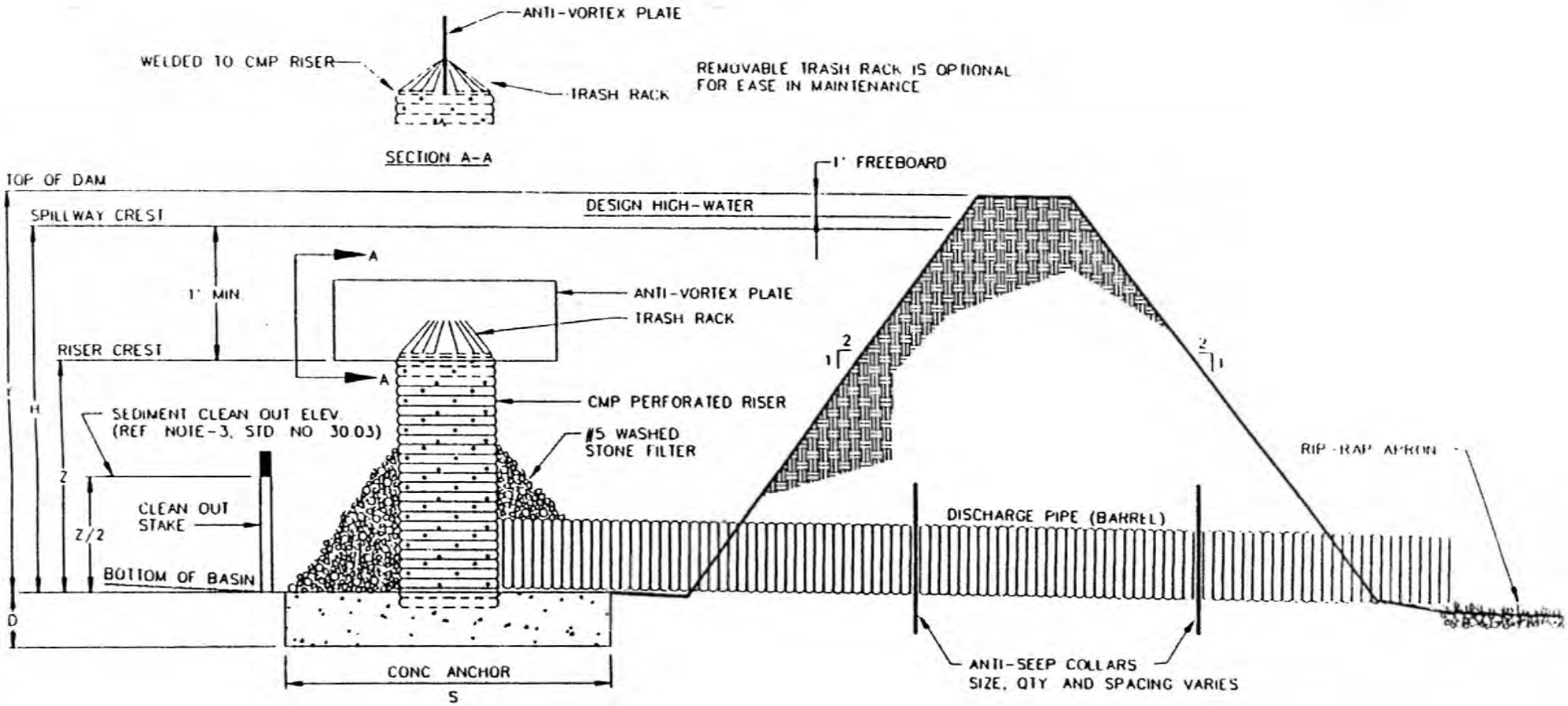


Figure 3, Stormwater Pocket Wetland, From Design of Stormwater Wetland Systems, Schueler, 1992



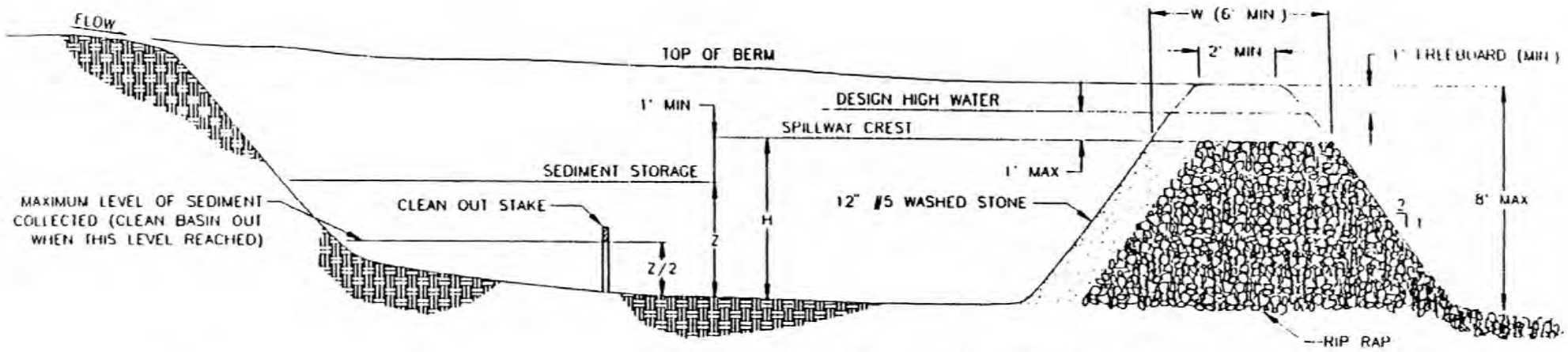


DATA BLOCK

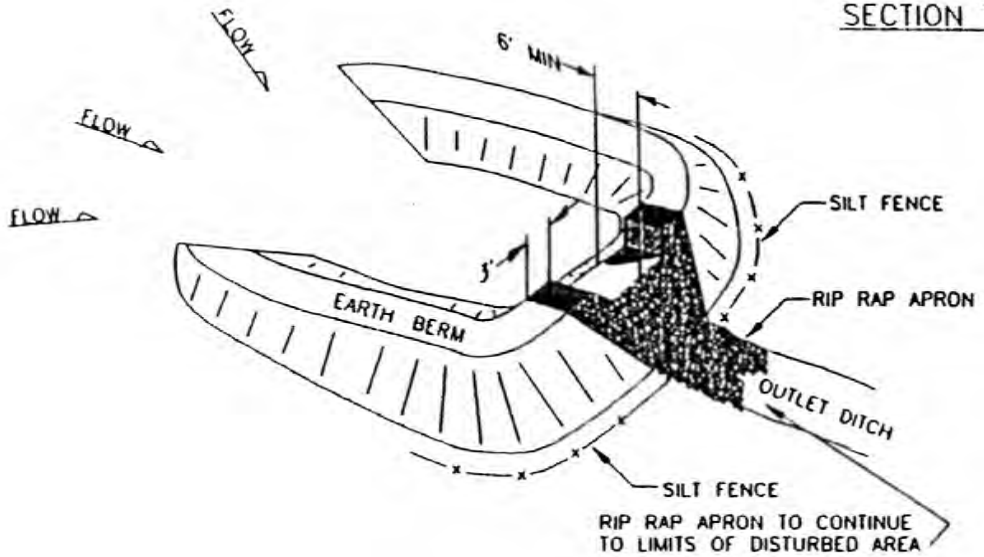
RISER DIAMETER	BARREL DIAMETER	BARREL SLOPE	D	S	Y	H	Z	SEDIMENT STORAGE REQUIRED
								..... (CF)

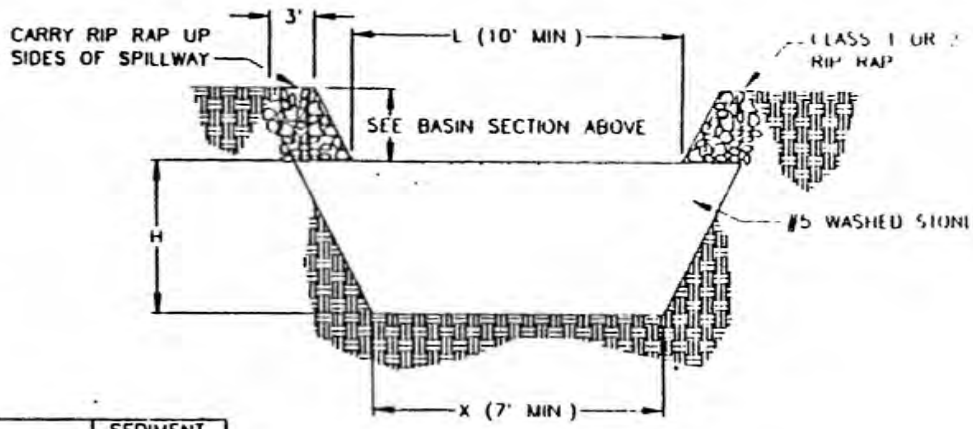
DATA BLOCK TO BE COMPLETED BY DESIGNER AND SUBMITTED WITH EROSION CONTROL PLANS

RISER TYPE SEDIMENT BASIN



SECTION THROUGH BASIN AND FILTER





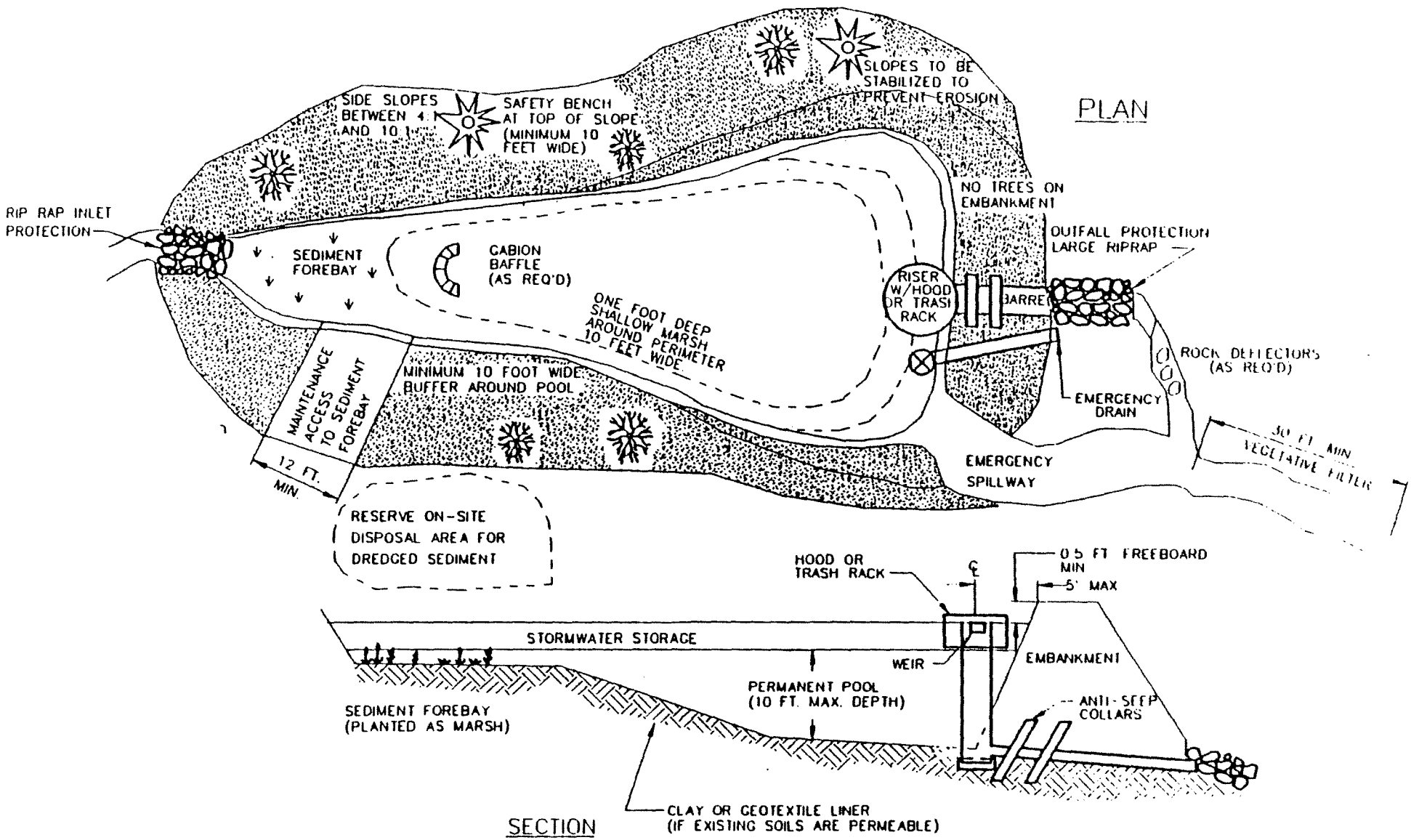
ELEVATION OF BERM AND FILTER

DATA BLOCK

X	L	H	Z	W	SEDIMENT STORAGE REQUIRED
					____ (CF)

DATA BLOCK TO BE COMPLETED BY DESIGNER AND SUBMITTED WITH EROSION CONTROL PLANS.

GRAVEL AND RIP RAP SEDIMENT BASIN



BEST MANAGEMENT PRACTICES (WET POND)

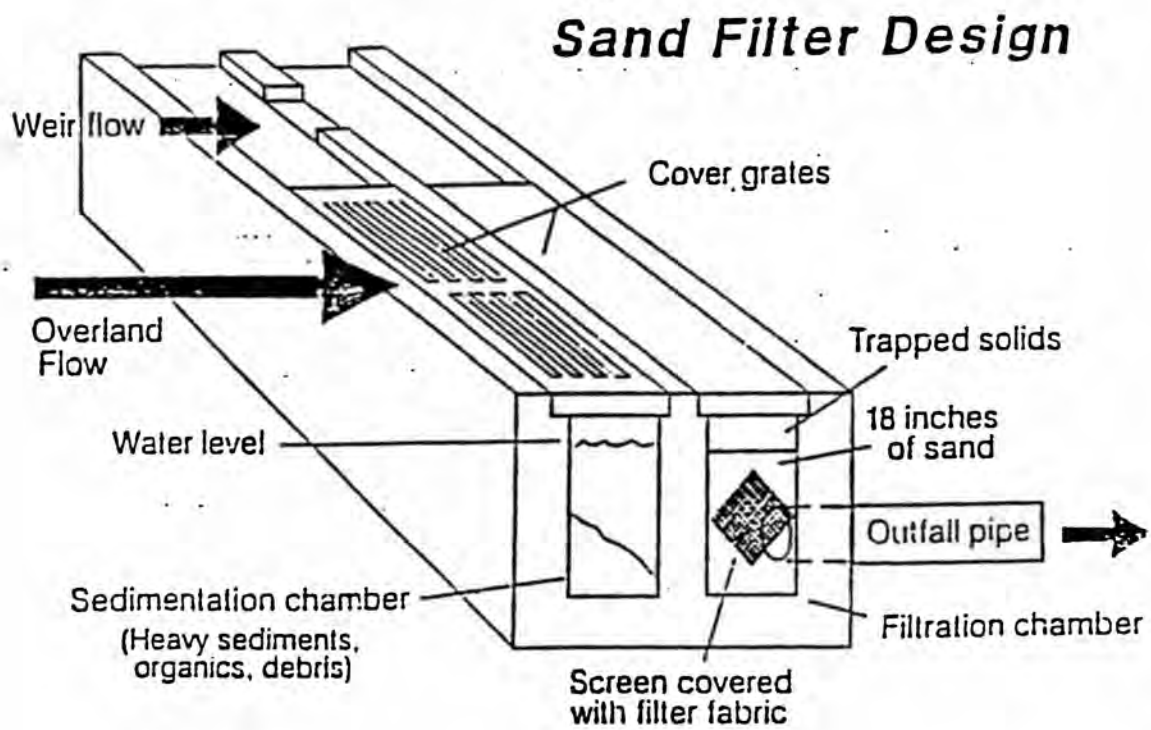



Figure 4, Delaware Sandfilter, From Shaver 1992