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Wet Detention Basin

Description

Wet detention basins maintain a permanent pool of water which is completely or partially displaced by stormwater received from the serviced watershed. Of the detention/retention basins, this management practice may be the most effective in removing pollutants. Wet detention basins also require more planning, maintenance and land to construct than most other BMPs. As in other detention management practices, wet detention basins help minimize downstream erosion and reduce flooding.

Other Terms Used to Describe

Wet Pond

Pollutants Controlled and Impacts

Wet detention basins are effective at removing sediment, nonsoluble metals, organic matter and nutrients through settling. Soluble nutrients and organic matter are removed through plant uptake and bacterial activity in the permanent pool of water, and by rooted plants in the littoral (shallow) zone.

Wet detention basins provide full control of peak discharges for large design storms. Wet detention basins reduce flooding, stream bank erosion, and may actually help increase low flows.

Wet detention basins can significantly warm the water in the permanent pool. When the receiving stream is sensitive to increases in temperature, wet detention basins may not be appropriate.

Application

Land Use
Urbanized, urbanizing and agricultural areas

Soil/Topography/Climate
Ponds generally will not work in soils with high infiltration rates. In order to maintain a permanent pool of water, six inches of compacted clay or an impermeable geotextile liner are recommended for the sides and bottom of the basin.

When to Apply
This BMP may be applied to new or existing developments. These basins would be considered permanent, year-round control measures. They normally will not be placed into service until all other construction is complete.

Where to Apply

Basins should be sited based on a hydrologic analysis of the watershed. Improperly sited basins may actually increase flooding problems.

Wet detention basins can be used on very large watersheds. Too small a drainage area (less than ten acres) may not provide sufficient volume to support a permanent pool of sufficient size to be effective, unless the pool is also fed by springs.

Relationship With Other BMPs

Riprap may be needed to protect side slopes and inlet and outlet areas. A Sediment Basin may be used to pretreat incoming stormwater in areas receiving particularly high sediment loads, such as from construction sites. Filter fabric is often used to protect small outlets.

Specifications

Planning Considerations:

The **location** of basins must be determined through a hydrologic analysis of the watershed. If the peak discharge from a particular basin is delayed to coincide with the peak discharge from an upstream tributary or release from an upstream basin, the actual stream discharge peak can increase.

A minimum 25-foot **buffer** from the basin to any adjoining property should be provided. This buffer should be landscaped to improve the appearance for local residents, provide wildlife habitat and meet any other local design considerations.

Adequate **access** right-of-way must be assured. The access should be a minimum of ten feet wide and stabilized to provide for passage of heavy equipment.

A **spill response plan** must be developed which clearly defines the emergency steps to be taken in the event of an accidental release of large quantities of harmful substances to the basin. As a result of this plan, design changes such as shut-off valves or gates may be needed.

Design Considerations:

NOTE: All structural best management practices should be designed by a registered professional engineer.

A diagram of an example wet detention basin is shown in Exhibit 1.

Volume:

The minimum volume of the permanent pool should be equal to 0.5 inches of runoff from the entire contributing watershed, with two to four weeks of detention. Additional capacity to receive at least 0.5 inches of runoff during storm events must also be included. The basin is designed to displace the water in the permanent pool with water from storm events. Greater pollutant removal is gained with larger basin volumes. The basin must also be designed with adequate capacity to treat stormwater delivered from existing stormwater collection systems designed according to local criteria.

The basin should be designed to release the water displaced by the design storm over 24 to 48 hours, in order to provide for settling and to prevent stream bank erosion. The hydrologic analysis of the receiving stream and desired settling of particulates should be used to determine the optimum release rate. Several outlet structures may be used to provide extended detention of the design storm (see Extended Detention Basin BMP).

Several other methods can be used to determine pool size effectively.

Basin Depth:
The depth of the permanent pool should normally be between three to eight feet deep. A shallow zone one to two feet deep and approximately ten feet wide around the edge of the basin is critical to optimize pollutant removal and provide for safety. Aquatic plants must be established in this shallow area. Settling of particulates is dependent on particle size, surface area and discharge rate, and is not affected by depth.

Outlets:
The basin outlet will control the release rate from the basin. It must control both the design storm and lesser storms. Multiple outlets may be necessary to control discharge from a range of storms. Example outlets for wet detention basins are shown in Exhibit 3 of the Extended Detention Basin BMP. A hydraulic analysis of the outlet structures at the low flow and design storm will be necessary to size the outlets to achieve the desired release rate. All outlets should have an accessible, above-ground cap to allow easy cleaning. The outlet should be designed so that trapped trash and debris can be easily removed.

A stabilized outlet structure must be used to prevent scouring at the discharge point. Stabilized outlets are normally constructed using Riprap, corrugated pipe or concrete. Outlet design can be extremely complex. A detailed design method can be found in the "Stormwater Management Guidebook" by Bruce Menerey and published by the Michigan Department of Natural Resources, Land and Water Management Division.

Basin Shape:
The basin should be wedge shaped, and narrow at the inlet and wide at the outlet to promote good circulation and reduce the chance of short circuiting. The length of the basin should be at least threes times the width.

Side Slopes:
Side slopes of not more than 3:1 and not less than 20:1 are recommended. Gentle side slopes are recommended for safety, particularly in the shallow zone along the edge of the basin.

The banks should be constructed such that two feet of freeboard is above the emergency spillway.

Anti-seep Collars:
Anti-seep collars should be installed on any piping passing through the sides or bottom of the basin.

Emergency Spillway:
An emergency spillway must be included to handle storms greater than design. It is recommended that the spillway be placed such that the basin has sufficient volume to detain the 100-year storm.

Construction Considerations:
At the conclusion of construction, stabilize the surrounding area following the guidance in the Seeding and Mulching or Sodding BMPs.

Maintenance

Regular maintenance includes mowing the buffer/filter strip and removing debris from the basin. The side banks must be mowed regularly to prevent woody plant growth. If maintained as a lawn, mowing is much more frequent. If maintained as a meadow, mowing can be reduced to twice a year.

The basin should be inspected regularly during wet weather. Particular attention should be given to the inlet and outlet structures.

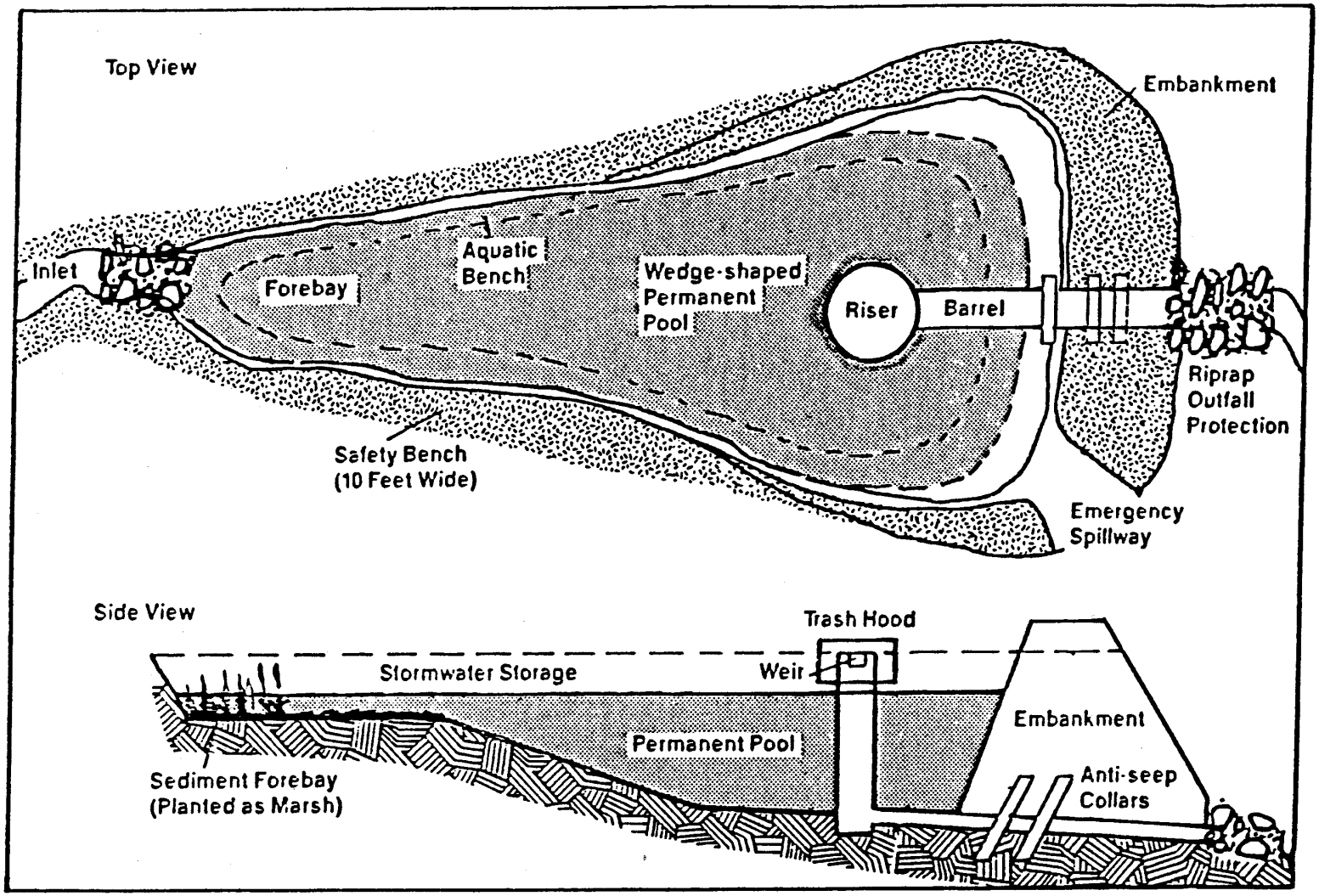
If properly designed, sediment removal from the basin will only be necessary every five to ten years. Excessive algae must be removed to prevent odors and to maintain nutrient removal capacity.

Any eroded banks must be stabilized as soon as possible.

Exhibits

Exhibit 1: Typical Wet Detention Basin. Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Metropolitan Washington Council of Governments (Schueler). 1987.

Exhibit 1
Typical Wet Detention Basin



Source: Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Metropolitan Council of Governments (Scheuler). 1987.