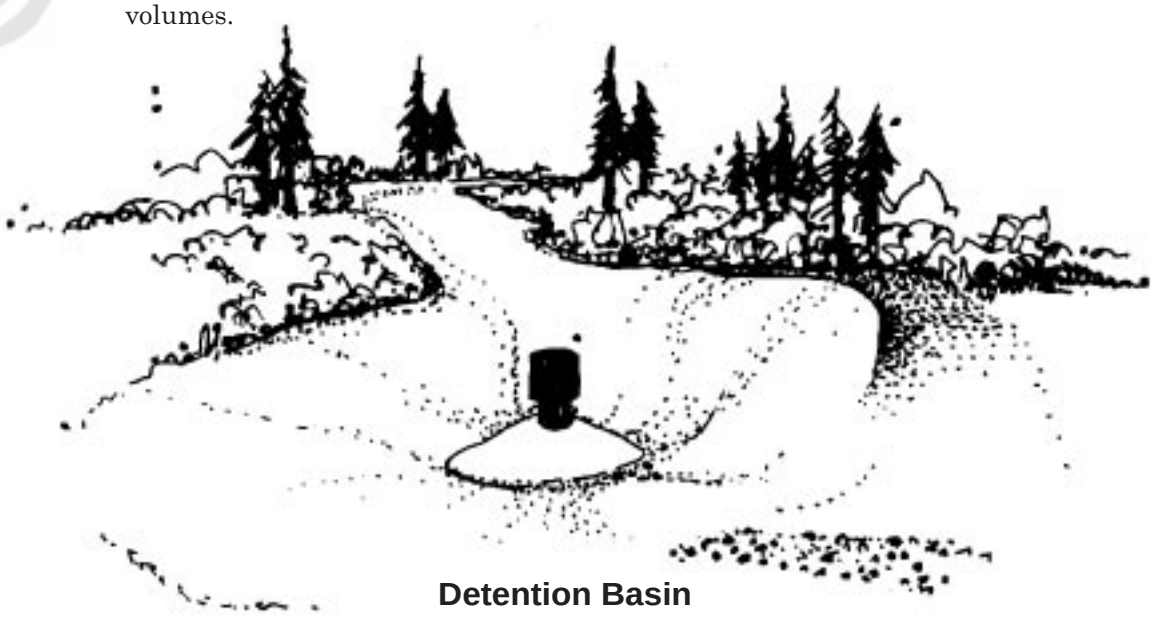
PRIMARY USE: To control release rate of stormwater to receiving streams.
ADDITIONAL USES: Remove sediment and other pollutants from storm water.

DETENTION BASIN

What is it? An impoundment or excavated basin for the short term detention of stormwater runoff from a completed development area followed by controlled release from the structure at downstream, pre-development flow rates. There are several types of detention devices, the most common being the dry detention basin and the extended dry detention basin. These are structures which hold a certain amount of water from a storm and which release the water through a controlled outlet over a specified time period based on design criteria. The extended detention basin drains more slowly or may retain a permanent pool of water.

Purpose

The main reasons for use of dry detention basins are reducing peak stormwater discharges, controlling floods and preventing downstream channel scouring. It is also probable that it will remove a limited amount of pollutants. It is the lowest cost alternative for large runoff volumes.



Detention Basin
Perspective View

Limitations

These systems frequently clog at inlets and outlets, dramatically effecting retention times and pollutant removal efficiency. This problem can be minimized through careful design (including adequate access) and regular maintenance.

Materials

Earth, riprap, risers, collars, overflow devices, and earth moving equipment.

Installation

There are two types of detention basins: the dry detention basin (designed to completely empty over a specified time period) and the extended detention basin (designed to maintain a permanent or semi-permanent pool). Both are designed to hold a certain amount of water from a storm and release the water through a controlled outlet over a specified time period based on design criteria. The extended detention basin provides a minimum residence time based on the inflow rate and the pool volume and so is assumed to provide some of the benefits of lagoon treatment.

Source: NRCS Planning and Design Manual, NRCS.

DETENTION BASIN

Additional Considerations:

Dry detention basin effectiveness is rated low to moderate compared to other stormwater BMPs. Typical dry basin removal efficiencies are listed below for selected pollutants.

Table: Typical Dry Basin Removal Efficiencies

Pollutant	Total Phosphorus	Total Nitrogen	Total Suspended Solids	Lead	Zinc	Oil and Grease	Bacteria	BOD
Estimated Removal Efficiency	Low	Low	High	Moderate to High	Moderate	Low	High	Moderate

Design of dry detention basins includes locating proper sites for construction of the basin, calculating the appropriate detention time, treatment of the expected range in volumes of stormwater from storms, and maintenance procedures and schedules. The stormwater should be held for at least 24 hours for maximum pollutant removal. Soils should be permeable to allow residual water to drain from these basins between storms.

The following design criteria are for relatively small structures. The larger, more important structures should be designed by a professional engineer using more extensive procedures and resources.

A cutoff to relatively impervious material should be provided under the dam. The cutoff should be located at the center line of the dam, extend up the abutments as required, and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall not be steeper than one horizontal to one vertical.

Seepage control is to be included if:
1. pervious layers are not intercepted by the cutoff;
2. seepage creates swamping downstream;
3. such control is needed to ensure a stable embankment; or
4. special problems require drainage for a stable dam.

Seepage may be controlled by:
1. foundation, abutment, or embankment drains;
2. reservoir blanketing; or
3. a combination of these measures.

Source: NRCS Planning and Design Manual, NRCS.

DETENTION BASIN

Additional Considerations:

1. The combined upstream and downstream side slopes of the settled embankments should not be less than two and a half horizontal to one vertical.

2. The minimum elevation of the top of the settled embankment for all dams shall be 1 ft (305 mm) above the water surface in the reservoir with the emergency spillway flowing at design depth. The minimum difference in elevation between the crest of the emergency spillway and the settled top of the dam shall be 2 ft (610 mm) for all dams having more than a 15 acre (6 hectare) drainage area or more than 15 ft (4.5 m) in effective height.

3. Unless soil settlement analysis is available, a minimum of 5 percent should be added to fill heights constructed with compaction equipment or having each layer covered by the wheel track of construction equipment during the fill placement process. Without compaction or wheel track coverage, 10 percent added fill height is required.

4. A pipe conduit, with needed appurtenances, should be placed under or through the dam, except where rock, concrete, or other types of mechanical spillways are used, or where the rate and duration of flow can be safely handled by a vegetated or earth emergency spillway. The pipe crest elevation should be no less than 6 in (152 mm) below the crest of the emergency spillway for dams having a drainage area of 20 acres (8 hectares) or less, and no less than 1 ft (305 mm) for those having a drainage area of more than 20 acres (8 hectares).

5. The capacity of the pipe conduit shall be adequate to discharge long duration, continuous, or frequent flows without flow through the emergency spillways. The diameter of the pipe shall be 4 in (102mm) or larger.

6. For dams 20 ft (6 m) or less in effective height, acceptable pipe materials are cast iron, welded steel, corrugated steel or aluminum, concrete, plastic, vitrified clay with rubber gaskets, and cast-in-place reinforced concrete. Concrete and vitrified clay pipe should be laid in a concrete bedding. Plastic pipe that will be exposed to direct sunlight should be made of ultraviolet resistant materials and protected by coating or shielding, or provisions made for replacement as necessary. Connections of plastic pipe to less flexible pipe or structures must be designed to avoid stress concentrations that could rupture the plastic.

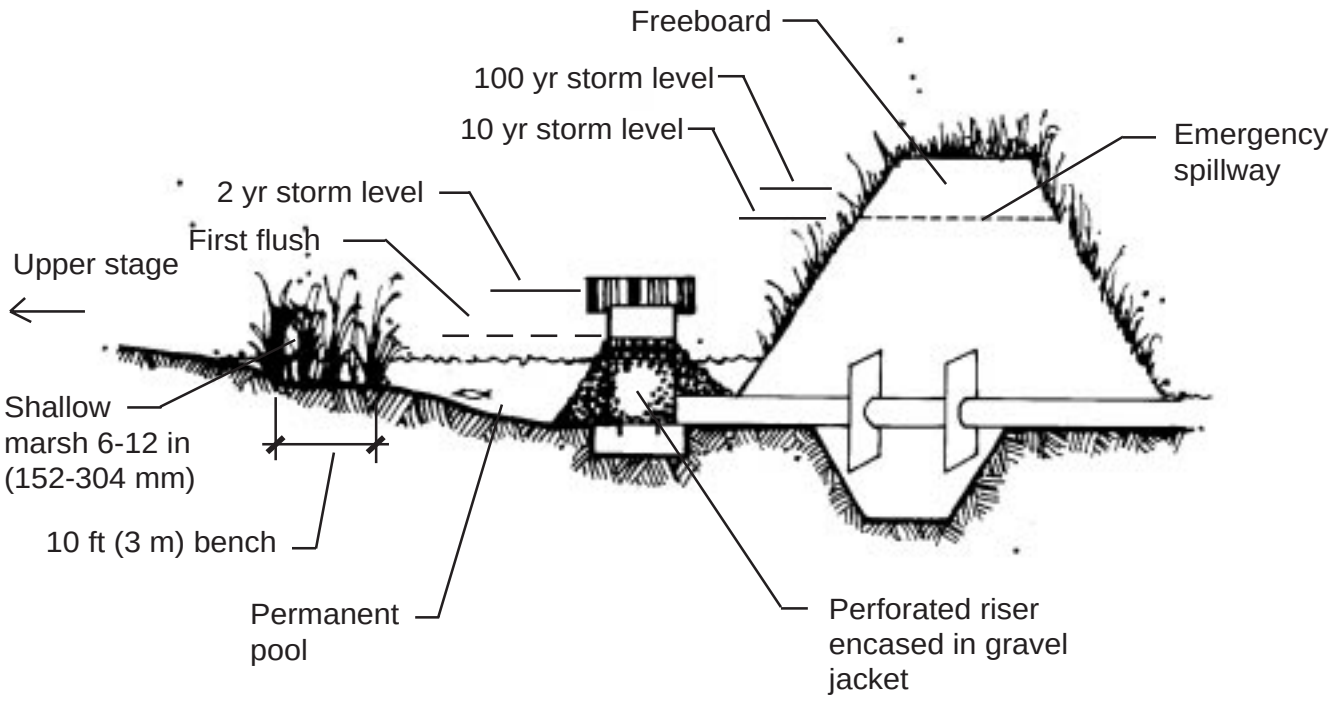
7. Seepage control along a pipe conduit spillway should be provided if any of the following conditions exist: the effective height of dam is greater than 15 ft (4.5 m); the conduit is of smooth pipe larger than 8 in (203 mm) in diameter; or the conduit is of corrugated pipe larger than 1 ft (305 mm) in diameter. Seepage along pipes extending through the embankment shall be controlled by use of a filter and drainage diaphragm, unless it is determined that antiseep collars will adequately serve the purpose.

8. An emergency spillway must be provided for each dam. The minimum capacity of a natural or constructed emergency spillway shall be that required to pass the peak flow expected from a 10 year (24 hour) design storm (criteria for small basin).

Source: NRCS Planning and Design Manual, NRCS.

DETENTION BASIN

Additional Drawings:



Detention Basin
Section View

Source: NRCS Planning and Design Manual, NRCS.