DESCRIPTION OF STORMWATER STRUCTURAL CONTROLS IN MS4 PERMITS

Phase I MS4 permits require continuous updating of the stormwater system inventory owned and operated by the MS4. They also include inspection and maintenance requirements for the stormwater structural controls listed in Table II.A.1.a of the permits. This document provides a description of the various types of structural controls contained within MS4 permits to provide a common definition and understanding of the controls. The most commonly used structures and definitions are listed here, but this document does not include all structural controls that might be part of an MS4. Additionally, many MS4s have their own names for similar structures.

INFILTRATION CONTROLS

A family of structural controls in which a specified volume of stormwater (e.g. treatment volume) is retained on-site and allowed to infiltrate into the soil and evaporate rather than being discharged. These controls reduce the stormwater volume and pollutant load. Infiltration controls include basins, exfiltration trenches, French drains, and treatment swales.

Dry Retention Systems (basins) are infiltration systems that are excavated into the ground. Typically they are vegetated to minimize erosion and the roots help maintain the permeability of the soils.

Exfiltration Trenches / French Drains are shallow, excavated trenches in which stormwater is stored in perforated or slotted pipes and percolates out through the surrounding gravel envelope and filter fabric into the soil. In South Florida, these systems are called French drains.

Grass Treatment Swales – Swales are defined in Chapter 403.803(14), Florida Statutes, as follows:

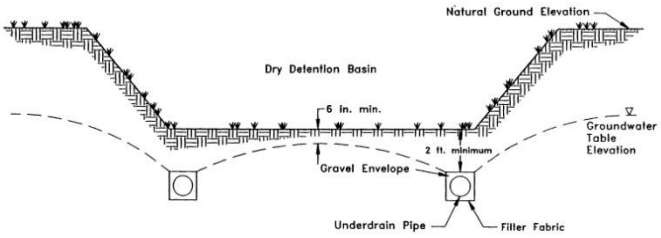
"Swale means a manmade trench which:

1. Has a top width to depth ratio of the cross-section equal to or greater than 6:1, or side slopes equal to or flatter than 3 feet horizontal to 1-foot vertical;
2. Contains contiguous areas of standing or flowing water only following a rainfall event;
3. Is planted with or has stabilized vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake; and
4. Is designed to take into account the soil erodibility, soil percolation, slope, slope length, and drainage area so as to prevent erosion and reduce pollutant concentration of any discharge.

Swales are online retention systems and their treatment effectiveness is directly related to the amount of the annual stormwater volume that is infiltrated. Swales designed for stormwater treatment can be classified into the following two categories:

- Swales with swale blocks or raised driveway culverts.
- Swales without swale blocks or raised driveway culverts.

Underdrain Systems consist of a dry basin underlain with perforated drainage pipe that collects and conveys stormwater following percolation from the basin through suitable soil. Underdrain systems are generally used where high water table conditions dictate that recovery of the stormwater treatment volume cannot be achieved by natural percolation (i.e., retention systems) and suitable outfall conditions exist to convey flows from the underdrain system to receiving waters.



Dry Detention Systems are designed to store a defined quantity of runoff and slowly release the collected runoff through an outlet structure to adjacent surface waters. After drawdown of the stored runoff is completed, the storage basin does not hold any water, thus the system is normally "dry." Dry detention basins are similar to retention systems in that the basins are normally dry. They are used in areas where the soil infiltration properties or seasonal high water table elevation will not allow the use of a retention basin. The main difference between the two systems is that retention systems are designed to percolate the stored runoff into the ground while dry detention systems are designed to discharge the runoff through an outlet structure to adjacent surface waters. There are two types of dry detention systems used in Florida, as follows:

- SJRWMD design – dry detention systems are limited to project areas less than 5 acres in size, and which serve a drainage area less than 5 acres in size. The SJRWMD design is similar in some respects to a retention basin with a sand filter at the outlet.

- SFWMD design – this design looks very similar to a retention basin except it has a bottom bleeder discharge structure.

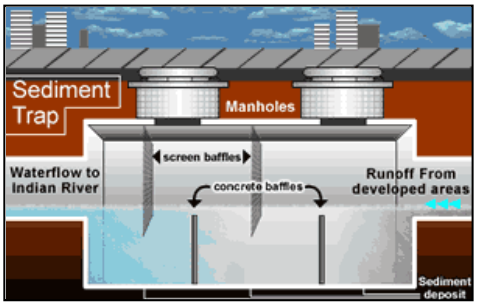
Detention with Effluent Filtration Systems usually are permanently wet ponds, but can include dry ones, that have a sand filter to provide effluent filtration. The filters usually are in the side banks of the pond but they may be in the bottom of the basin. The filters are maintenance intensive and do a poor job of removing nutrients. The filter may or may not be sodded to provide protection from erosion and increase longevity.

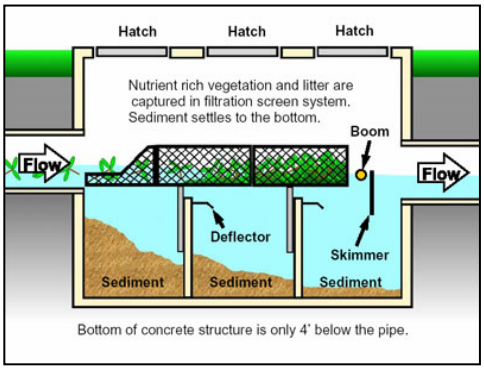
Wet Detention Systems are permanently wet ponds that are designed to slowly release a portion of the collected stormwater runoff through an outlet structure. Wet detention systems are the recommended BMP for sites with moderate to high water table conditions. Wet detention systems provide removal of both dissolved and suspended pollutants by taking advantage of physical, chemical, and biological processes within the pond. They also create "lakefront" property and provide a source of fill.

Alum Injection Systems are chemical treatment systems that inject aluminum sulfate into stormwater pipes to cause coagulation of pollutants. These systems include alum storage and a variety of mechanical parts that need regular inspection and maintenance.

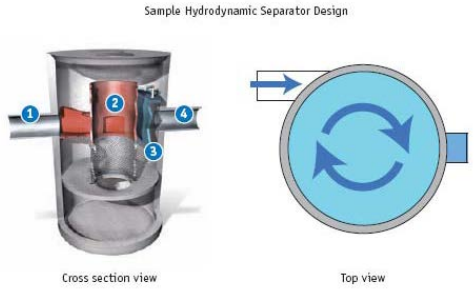
Pollution Control Boxes are a group of BMPs that usually are installed underground and are contained within some type of housing, such as a box or vault. They typically are used in areas without much land and they provide removal of particles, litter, and sometimes nutrients. Common types of pollution control boxes include:

- **Baffle boxes** are square chambers connected to a storm drain with partitions dividing the box into sections. Stormwater flows into the first section of the box where sediments and debris settle out of the water. As water rises above the next partition, it overflows into the second section to allow further settling. After detention in multiple chambers water overflows the baffle box into the stormwater pipe. Most baffle boxes are buried in-line with the storm drain system, leaving only manhole covers visible from the ground surface. Manholes provide access for regular maintenance, which is done with a vac-truck. The **second generation (nutrient separating) baffle box** includes a wire mesh box that captures vegetative debris, litter, and other materials from settling in the water in the bottom of the box, thereby preventing leaching of the nutrients.





- **Hydrodynamic separators** are small, flow-through devices that remove sediment, trap debris, and separate floating oils from runoff. While their proprietary designs vary, they all primarily rely on swirl action and particle settling to remove pollutants. They appear to be most effective when used for pretreatment in areas where runoff is expected to contain sediment particles greater than 100 microns in diameter. Types of hydrodynamic separators include Stormceptor, Storm Treat, VortSentry, Continuous Deflection Separator (CDS) and Aqua-Swirl.



- **Catch basin inserts** are devices installed in storm drain inlets that provide water quality treatment through filtration, settling, or adsorption. Catch basin inserts are commercially available products and are generally configured to remove one or more of the following contaminants: coarse sediment, oil and grease, and litter and debris. They may include oil absorbent bags that require regular changing.

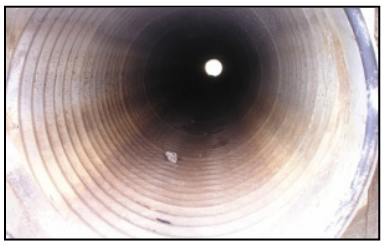
Stormwater Pump Stations are necessary for the removal of stormwater from areas where gravity drainage is impossible or impractical, such as in South Florida. However, stormwater pumping stations are expensive to operate and maintain, and have a number of potential problems that must be addressed. Therefore, the use of stormwater pumping stations is recommended only where no other practicable alternative is available.

Major Outfalls are municipal separate storm sewer outfalls that discharge from a single pipe with an inside diameter of 36 inches or more or its equivalent (discharge from a single conveyance other than circular pipe which is associated with a drainage area of more than 50 acres); or for municipal separate storm sewers that receive stormwater from lands zoned for industrial activity (based on comprehensive zoning plans or the equivalent), an outfall that discharges from a single pipe with an inside diameter of 12 inches or more or from its equivalent (discharge from other than a circular pipe associated with a drainage area of 2 acres or more).

Weirs, Channel Control Structures and Other Control Structures are structural components of a stormwater system that detain stormwater and allow its controlled release. Weirs

and other control structures are common components of most of the traditional structural controls discussed above. They also are found within conveyance systems, such as ditches or secondary / tertiary canals.

Pipes and Culverts are major components of the MS4 and serve as the backbone of the stormwater conveyance system. As such, assuring that flow is not impeded because of clogging by accumulated sediments or debris is crucial to their effective operation. Cracks and breaks may also cause inflow of groundwater and sedimentation in pipes and at outfalls.



Storm Sewer Inlets, Catch Basins, Grates, Ditches, Conveyance Swales and Other Stormwater Conveyances also are major components of the MS4 that serve an important function in safely conveying stormwater. Stormwater in urban areas typically enters the MS4 through storm sewer inlets that may or may not have a catch basin that can provide a small area for settling of sediments. To minimize entry of debris or to provide safety for the public, grates often cover storm sewer inlets or outlets. Ditches, conveyance swales (which are not designed for stormwater treatment) and other stormwater conveyances, such as inverted crowned roads, help to safely convey stormwater.