Rainfall and Water Resource Data for North Florida and Alachua County

Rainfall Characteristics (1981-2010)

- Alachua County has averaged 51.1inches (west Alachua gets around 54 in, east Alachua gets 50 in)
- There is a distinct dry season from October-May and an increased rainfall during the wet season from June-September.
- There was an average of 114 rainfall events per year (7.1 days/month during dry season, 14.3 days/month during the wet season
- The month of November is typically the lowest rainfall month (2.12 inches).
- The month of June is typically the highest rainfall month (6.91 inches), but can be highly variable depending on tropical storms.
- There is an average of 4.4 days between rain events during the dry season and 2.14 days between rain events during the wet season.
- 87% of rainfall events are less than 1inch

General Description of Commonly Used Stormwater Management Systems

There are two main categories that define conventional stormwater basins; 1) hydrologic condition between storm events and 2) how stormwater within the basin is released to the environment. The two types of hydrologic condition are “dry” and “wet” basins, and the two types of design to release water from the basin are “detention” and “retention”.

- **Wet basins:** are stormwater basins that typically have standing water in between storm events. This is typically because the groundwater table is higher than the bottom of the pond.

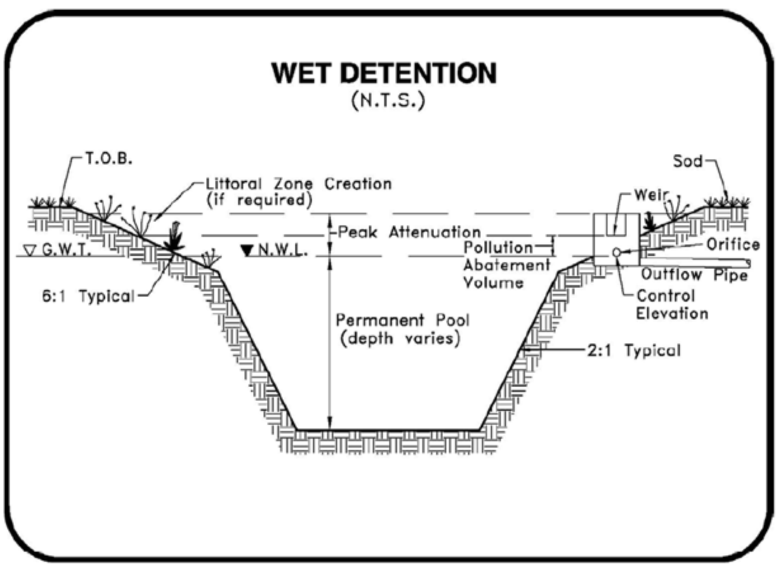
- **Dry basins:** are stormwater basins that are dry within 72 hours after the storm event. The bottom of these ponds is typically at least 2 feet higher than the seasonal groundwater table.

- **Detention basins:** The collection and temporary storage of stormwater, generally for a period of time ranging from 24-72 hours, in such a manner as to provide for treatment through physical, biological or chemical processes with subsequent gradual release of stormwater to downstream receiving waters.

- **Retention basins:** On-site storage of stormwater with subsequent disposal by infiltration into the ground or evaporation in such a manner as to prevent direct discharge of stormwater runoff into receiving waters.

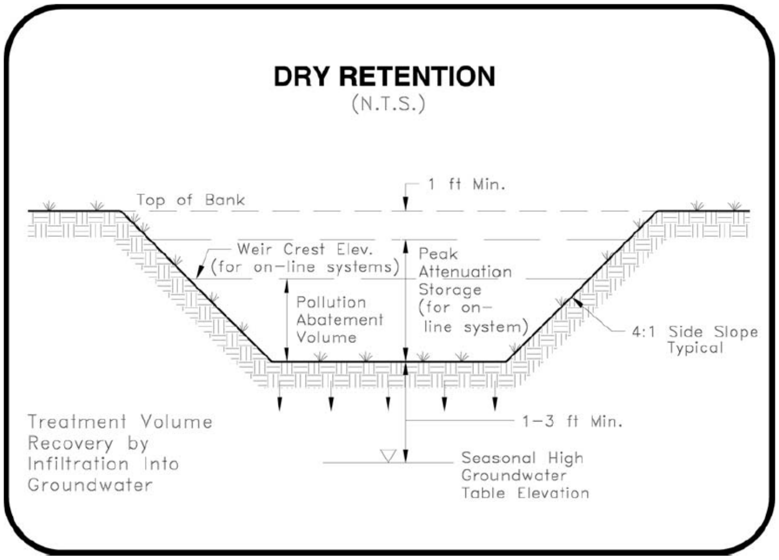
Therefore, stormwater basins are often defined by combining the above terms. Several examples of commonly used stormwater management systems are outlined below.

Wet Detention Systems



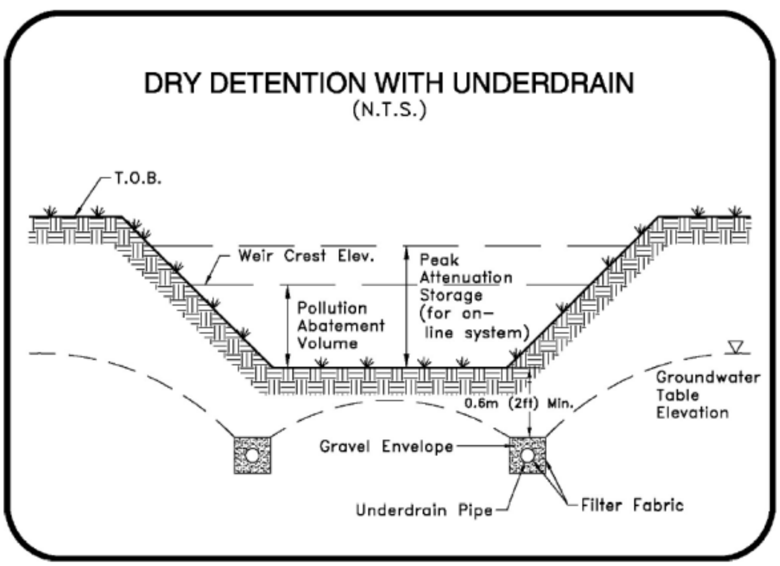
Wet detention systems are currently a very popular stormwater management technique throughout the State of Florida, particularly in areas with high groundwater tables. A wet detention pond is simply a modified detention facility which is designed to include a permanent pool of water. These permanently wet ponds are designed to slowly release collected runoff through an outlet structure.

Dry Retention Systems



Dry retention systems consist primarily of infiltration basins which are used to retain stormwater runoff on-site, thus reducing discharge to downstream waterbodies. Disposal of stormwater runoff occurs by infiltration into the groundwater and, to a lesser degree, evaporation from the water surface during periods of standing water. Because these systems rely primarily on infiltration of stormwater into the ground to regain the available pond storage, construction of these systems is limited to areas with low groundwater tables and permeable soils. The soil and water table conditions must be such that the system can provide for a new volume of storage through percolation or evaporation within a specified period, generally 72 hours following the stormwater event.

Dry Detention (With and Without Filtration/Underdrains)



Historically, dry detention facilities have been one of the most common stormwater management techniques used throughout the State of Florida, particularly in South Florida.

These systems are typically utilized in high groundwater table areas where the normal groundwater level makes the use of a retention type facility less feasible. Dry detention systems are intended to be dry basins which are designed to hold a specific quantity of stormwater runoff (treatment volume). Recovery of the design treatment volume occurs as a result of migration of the stormwater runoff through the pond bottom, discharge through an outfall orifice structure, or into an underdrain system or side bank filter constructed around the perimeter or bottom of the pond.

Design Criteria for Stormwater Management Systems

Stormwater infrastructure is designed to mitigate for increased quantity and decreased quality of runoff due to development. Stormwater quantity mitigation is typically designed so that the post-development peak runoff is not greater than the pre-development peak runoff. Stormwater quality mitigation is typically designed so that 80% of contaminants of concern will be intercepted and retained or treated if the water will be discharged into a class III water body, or 95% if discharged to an Outstanding Florida Water.

STORMWATER SYSTEM DESIGN STANDARDS OUTLINED IN CHAPTER 62-25 FAC

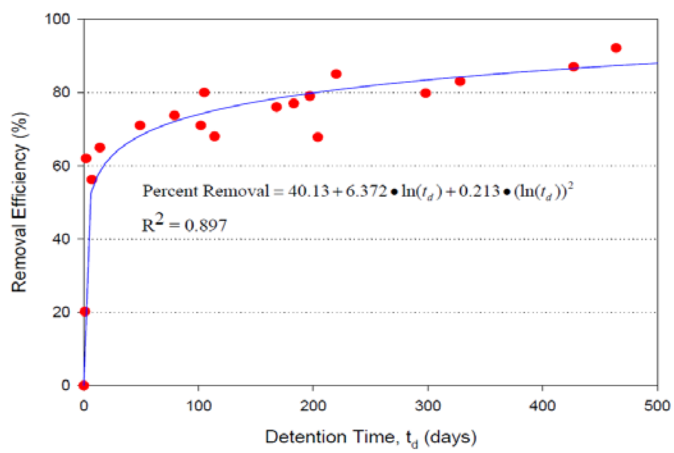
STORMWATER SYSTEM TYPE	DESIGN PARAMETER	CRITERIA
Retention	Treatment Volume	Runoff from the first 1" of rainfall; or as an option, for projects < 100 ac, 0.5" of runoff
	Volume Recovery	< 72 hours following storm using percolation, evaporation, or evapotranspiration
Swales	Treatment Volume	Percolate 80% of the runoff from a 3-year/1-hour storm within 72 hours following storm
	Volume Recovery	< 72 hours following storm using percolation, evaporation, or evapotranspiration
Dry Detention	Treatment Volume	Runoff from the first 1" of rainfall; or as an option, for projects < 100 ac, 0.5" of runoff
	Volume Recovery	< 72 hours following storm
Filter Systems (if applicable)	Filter Design	Permeability ≥ surrounding soil
		Media washed with <1% silt, clay, and organic matter
		Media uniformity coefficient > 1.5
		Effective grain size from 0.20-0.55 mm
		Designed with safety factor of 2
Wet Detention[1]	Treatment Volume	1.00" of runoff
	Volume Recovery	<50% in 60 hours following storm
	Detention Time	Minimum 14 days
	Littoral Zone	Minimum 30% of pond area
	Pond Depth	Maximum 8-10 ft below control elevation
	Fencing	Required for wet ponds unless side slopes are less than 4:1
Exemptions	Facilities designed to accommodate only one single-family dwelling unit, duplex, triplex, or quadruplex, provided the single unit, duplex, triplex, or quadruplex is not part of a larger common plan of development or sale	
	Facilities which are designed to serve single-family residential projects, including duplexes, triplexes, and quadruplexes, of less than 10 acres total land area and which have less than 2 acres impervious surface	
	Stormwater discharge facilities whose functioning treatment components consist entirely of swales	
	Facilities which discharge into a regional stormwater discharge facility	
	Facilities for agricultural lands, provided those facilities are part of an approved Conservation Plan	
	Facilities for silvicultural lands, provided that the facilities are constructed and operated in accordance with the Silviculture Best Management Practices Manual (1979)	

ESTIMATED POLLUTANT REMOVAL EFFICIENCIES FOR COMMON STORMWATER TREATMENT FACILITIES

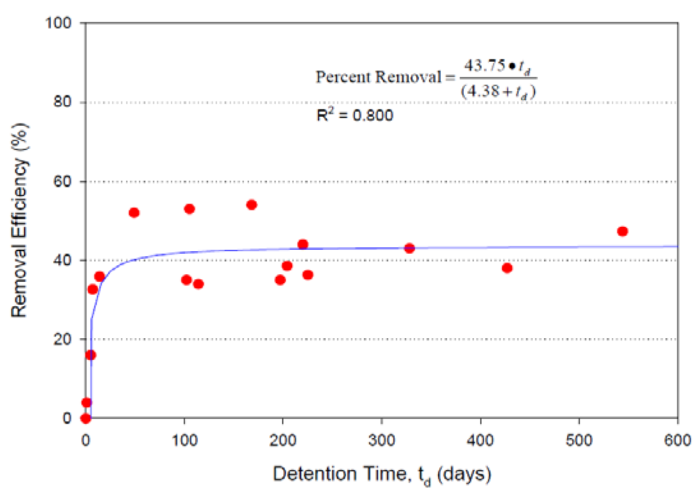
TYPE OF SYSTEM	ESTIMATED REMOVAL EFFICIENCIES (%)			
	Total N	Total P	TSS	BOD
Retention, Reuse, Source Reduction, Swales	100% for Retained Volume			
Wet Detention				
a. 7-day detention time	20	60	85	50
b. 14-day detention time	30	70	85	60
Dry Detention	0-30	0-40	90	0-50

From table 5-5, Harper and Baker 2007

Removal Efficiency of Total Phosphorus in Wet Detention Ponds as a Function of Residence Time



Removal Efficiency of Total Nitrogen in Wet Detention Ponds as a Function of Residence Time



Why aren’t the measured treatment levels meeting the design criteria targets of 80 or 95% load reduction?

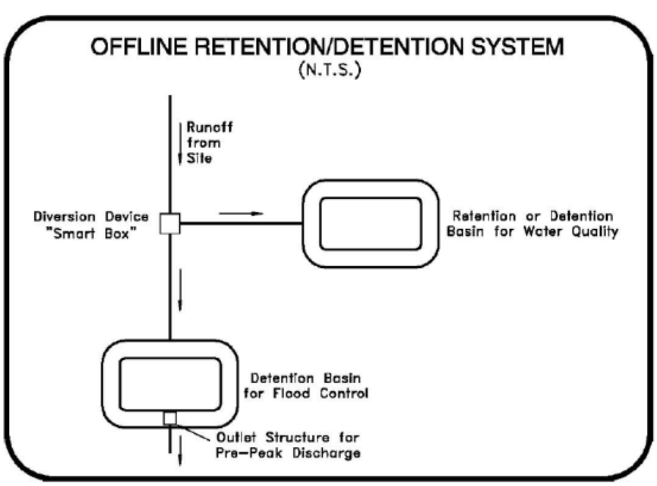
Both physical (particle settling) and biogeochemical (plant and microbial uptake/transformation, sorption to soil, precipitation from water column) processes occur in stormwater management systems. Much of the original design criteria were developed with the expectation that particulate contaminants were the main pollutant of concern and therefore could be easily settled out in stormwater basins. However, many contaminants including nutrients can be in a dissolved form and therefor are not easily settled out. In addition, contaminants that enter the stormwater basin as a particle and at first settle out can later be released into the water column as a dissolved nutrient. The more complex reality of stormwater runoff as well as contaminant cycling within the stormwater system makes achieving load reduction targets more difficult.

Alternative Approach to Improve Stormwater Quality

A wide range of practices, sometimes referred to as Low Impact Design, are being implemented to try and achieve the water quality targets we are presently permitting stormwater basins attain. These alternative stormwater management designs focus on source control and pretreatment of stormwater quantity and quality before it reaches the conventional pond. They also attempt to improve the biogeochecmical treatment functions within the pond. More information on the commonly used practices listed below can be found at http://buildgreen.ufl.edu/LID_fact_sheets.htm.

- Bioretention Basins and Rain Gardens
- Bioswales and vegetated Swales
- Cisterns and Rain Barrels
- Enhanced Stormwater basins
- Exfiltration Tanks and Trenches
- Green Roofs and Eco-roofs
- Low Impct Site Preparation
- Permeable Surfaces
- Stormwater reuse

Off-line Retention/Detention (Dual Pond) Systems



Off-line retention/detention systems provide an off-line retention pond for the treatment volume and an on-line detention pond for flood control and attenuation of peak discharges. A diversion device, often called a "smart box", is used to divert first-flush stormwater runoff into the retention pond. When the retention pond fills, the remaining stormwater runoff is diverted directly to a detention pond for flow attenuation purposes.

Literature referenced:

Harper, H.H and D. M. Baker 2007. ***Evaluation of Current Stormwater Design Criteria within the State of Florida***, final report. Contract #S0108 Florida Department of Environmental Protection. http://www.dep.state.fl.us/water/nonpoint/docs/nonpoint/SW_TreatmentReportFinal_71907.pdf