STORM WATER DETENTION PONDS

Your homeowner association has a storm water detention pond. Storm water detention ponds come in many shapes and sizes. The physical makeup of the pond is determined by the engineer that was hired to design your subdivision. The different types of storm water detention ponds are wet ponds, dry ponds, biodetention/rain garden ponds. The primary reasons that storm water detention ponds are required is to slow down water runoff from your subdivision and to treat the runoff to remove phosphorus, nitrogen and other pollutants from the water.

Water Runoff

Development activity has increased flooding in both frequency and severity. Prior to the development of your subdivision, rainwater drained slowly off of the property because it was 100% pervious. Since the majority of the rainwater soaked into the ground, there was very little sediment that made its way to creeks, rivers and lakes. The development of the subdivision created impervious surfaces such as roads, sidewalks, driveways, rooftops, etc. The rainwater that hits these surfaces sheds off quickly and is discharged into the storm drainage system which empties into the adjacent water bodies. Storm water detention ponds hold back the majority of this runoff and discharges it slowly off the property. The pond is designed to simulate the same discharge rate as when the property was a vacant field. These ponds are designed to allow water to discharge at a higher flow rate during a large rain event by providing a spillway.

Storm Water Detention Pond Design

Wet ponds are constructed by digging a pond adjacent to the subdivision to handle the storm water runoff from the subdivision. One or more inlet structures empty the storm water into the pond from the storm drainage system. Most wet ponds are designed with a forebay which is a deeper area of the pond that is designed to try and catch most of the sediment from the subdivision runoff. The pond size is based on predetermined calculations to try and hold most of the storm water from a normal rain event. The outlet structure that discharges the water from the pond is usually a masonry or concrete box with an orifice and weir.

1. Orafice: This is an overflow that restricts flow of water out of the pond. It is designed to slow down the transfer of water from the pond to an adjacent ditch. The theory is that slowing down water coming out of the neighborhood will reduce flooding in downstream ditches, creeks and rivers. It also allows the

wetland plants installed in the ponds to treat some of the water before the water leaves the pond.

2. Spillway/Weir: This is the overflow that takes excessive water out of the pond to prevent the pond from overflowing its pond banks. This is necessary during large rain events in which a flooded pond may cause destabilization to the pond banks or submerge the wetland plants and possibly cause damage to those plants. Without the spillway during a large rain event, the pond could overflow its banks and flood the yards of surrounding homes or cause the subdivision drainage system to backup.

Wet ponds usually include wetland plants that are planted during the construction of the pond. These plants are installed to treat the water runoff to remove phosphorus and nitrogen. These two chemicals can cause algae blooms in our creeks, rivers and lakes.

Some ponds are incorporated into a ditch that is adjacent to the subdivision. They are similar to the above ponds, but they may be longer in length but not as wide as a wet pond. Dry ponds are dry most of the year and typically have a larger footprint than a wet pond. In dry ponds, most of the water filters into the ground so there's no need to have plants to treat phosphorus and nitrogen on the surface.

Storm Water Treatment

The water that leaves a subdivision contains phosphorus and nitrogen from normal landscaping activities. This water also contains other pollutants that comes from the streets and yards of a residential subdivision. Wet ponds are constructed to include plants that treat the water to remove some/all of the phosphorus and nitrogen. Without this treatment, the phosphorus and nitrogen will escape into our creeks, rivers and lakes and cause algae blooms, algae blooms can cause fish kills.

HOA Responsibilities

Federal and state agencies require subdivisions to have storm water detention ponds to address the issues noted above. The requirement to create storm water detention facilities started around 2005. Subdivisions constructed prior to this date emptied directly into any adjacent water body. When a subdivision is created, cities, towns and counties require the developer to enter into an agreement where the developer will assume 100% responsibility for the maintenance of the pond. **WHEN THE DEVELOPER TURNS THE SUBDIVISION OVER TO THE HOA, THE HOA BECOMES RESPONSIBLE FOR THE EXPENSE AND MAINTENANCE OF THE POND.**

Most municipalities will conduct annual inspections of subdivisions storm water detention ponds. These inspections are designed to identify issues that have come up in the past 12 months that need to be addressed by the HOA. Common maintenance issues include but are not limited to:

1. Pond banks need to be mowed regularly to allow groundcover to grow. Low groundcover is better at controlling pond bank erosion over taller weeds and plants. Pond bank erosion will empty sediment into the pond that will eventually have to be cleaned out.
2. Evasive plants such as cattails need to be removed from the pond at regular intervals. Evasive plants grow quickly and will overtake the plants installed by the developer and evasive plants don't perform well at treating the water to remove nitrogen and phosphorus.
3. Woody vegetation (trees and bushes) need to be removed from the pond at regular intervals. If trees are allowed to grow in the pond, they could shade out the wetland plants.
4. Pond inlet structures need to be free of debris so that water flows easily into the pond.
5. No trash in ponds.
6. Pond outlet structures need to be maintained to allow water to flow out of the pond into adjacent ditches.
7. Pond Banks need to be maintained to address erosion or cave-ins.
8. Rodents that cause pond bank failures need to be removed.
9. Excessive algae bloom needs to be addressed.
10. The pond's orifice and spillway are not preventing water from leaving the pond. The orifice has a small 2" hole and can become easily clogged. If the water level of the pond is above the pipe (see pic) and it has not rained in a few days, there's a good chance the orifice is clogged.

Costs:

There are companies that will inspect your ponds on a monthly basis to ensure they comply with the Best Management Practices (BMPs) for your pond. Most municipalities recommend monthly inspections, but these inspections are expensive, and many subdivisions do not hire companies to inspections at this frequency. During the required annual inspections, municipalities will make recommendations for repairs to the pond. The HOA will have to hire someone to perform these maintenance items. The cost may range from a few hundred dollars to several thousand dollars. Pond banks need to be mowed frequently to maintain low groundcover. Low groundcover reduces the amount of sedimentation that gets into the pond from the pond banks.

Storm water detention ponds are designed to trap sediment runoff. State and federal regulations currently require that when area of the pond that is designed to trap sediment at 51% capacity, the sediment has to be removed. Sediment removal is expensive. The ponds are typically in an area that is difficult to access, and large equipment has to be brought in to dig out the sediment, set it aside to de-water it and then haul it away in dump trucks.

The biggest expense for an HOA for pond maintenance is the removal of sediment from the pond and repair to the inlet and outlet structures. Most wet ponds have a forebay area. The forebay area of the pond is usually deeper than the rest of the pond and is designed to try and trap most of the sediment that comes into the pond from the storm water drainage system. The sediment will have to be periodically removed from the forebay and the entire pond. Engineers estimate the forebay sediment will have to be removed every 10 years while the entire pond every 30 years.

Most wet ponds have wetland plants. The plants are planted at the water's edge based on when the pond is full of water. If the outlet structure becomes clogged and the water level rises, water could go over the wetland plants and drowned the plants. If plants die due to flooding or drought, municipalities make you replace those plants.

RPM recommends that you hire an engineer to determine the current costs to perform capital repairs on your pond. The cost will vary depending on the size of your pond. For a typical subdivision of 80 homes in 2020, it may cost $30,000.00 to remove the sediment from the forebay area of the pond. If the sediment expands out past the forebay, the sediment removal may reach $100,000.00. Outlet structure failures may range in cost around $10,000.00.

Based on these large capital costs, HOAs need to start saving for future expenses of this magnitude. When a municipality informs an HOA the pond needs major maintenance, it has to be done quickly in order to avoid fines from the municipality.

Developer Turns over a Pond:

One word of caution on a new subdivision where the developer wants to turn over the subdivision/pond to the HOA. Most of the sediment that enters into a pond occurs as result of new construction. Sediment runoff from subdivision lots enters the pond and forebay and quickly starts to build up inside the pond. If the municipality and developer do not control this sediment during new home construction, the HOA could be responsible to remove the sediment a few years after taking ownership. With this cost being in the tens of thousands of dollars, it is very important for the HOA to meet

with the municipality to determine if the developer was negligent in allowing too much sediment to get into the pond or the pond is not in a good condition when the HOA assumes responsibility for the pond. The same is true for subdivisions where new construction activity is occurring and the HOA is responsible for the pond, if sediment is making its way to the pond from new construction activities, the HOA should work with the developer and municipality to address this and even make the offending parties responsible for the removal of the sediment.

Wet Pond Outlet Structure:

The white pipe is a Orafice that restricts the flow of water out of the pond. The rectangular opening at the top of the masonry box (below metal grate) is the Weir/spillway that allows the additional water to flow out of the pond during large rain events.

Best Management Practices Fact Sheet

Detention Ponds

PURPOSE: Detention ponds temporarily store stormwater runoff, thereby reducing the peak rate of runoff to a stream or storm sewer. They help to prevent localized flooding and, if designed to do so, provide some water quality benefits and reduce streambank erosion downstream.

During a storm, runoff drains from impervious surfaces directly to storm sewers or waterways. Large storm events contribute a significant volume of runoff moving at an increased rate, which raises the potential for erosion and flooding downstream. Detention ponds are basins that receive and hold runoff for release at a predetermined rate, thereby reducing the peak runoff delivered to storm sewers and streams. The ponds generally are earthen structures constructed either by impoundment of a natural depression or excavation of existing soil. Detention ponds are designed to release all captured runoff over time, and do not allow for permanent pooling of water. Captured runoff is released through multi-level outlet structures consisting of weirs, risers, orifices or pipes, which provide for increased discharge as water levels in the basin increase *(see reverse side)*.

Detention ponds are generally ineffective at removing pollutants in runoff because they do not provide adequate holding time for solids to settle before water is released into a stream or storm sewer system. However, extending the detention time of the basin and/or including a forebay to the basin in the design when space allows will enhance water quality and quantity benefits. Extended detention will require a larger basin. Forebays trap sediment to pretreat runoff prior to release to the main pond, and also provide additional temporary storage of runoff.

In areas where thermal impacts to receiving waters, such as trout streams, are a consideration, extended detention times should be shortened. Typical extended detention time is 24 hours but may be longer. Time should be reduced to 12 hours if thermal impacts are an issue.

Due to their ability to contain a substantial volume of runoff, detention ponds are suited for placement at all sites, including large sites. Detention basins are most frequently used at sites where other stormwater BMPs do not apply or are not effective.

General Design Considerations

- Suitable for capturing runoff from a drainage area of at least five acres
- Inflow and discharge hydrographs should be calculated for each selected design storm
- Location of basin should be down gradient of disturbed/developed areas on site
- Construction on or near steep slopes or modifying existing slope is not recommended
- Planting of native vegetation on floor of basin and embankments is recommended
- Floor of basin should be at least two feet above high water table
- Design for maximum water depth of 10 feet
- Design for length to width ratio of 2:1, minimum width of 10 feet; side slope ratio no greater than 3:1, maximum height of side embankments less than 15 feet
- Site placement should be at least 10 feet from property line and 50 feet from private well or septic system to address water quality concerns
- Forebay for should contain 10% to 15% of total pool volume
- Compaction of basin bottom should be avoided
- Outlet structures must be resistant to corrosion and clogging by debris, sediment and plant material

Benefits

- Reduces peak rate of runoff
- Alleviates flooding
- Cost effective
- Can be designed to address water quality
- Space surrounding pond can be landscaped to enhance aesthetics and provide habitat for wildlife

Additional Resources

PA Department of Environmental Protection
- www.dep.state.pa.us
- Pennsylvania Stormwater Best Management Practices Manual

US Environmental Protection Agency
www.epa.gov

Center for Watershed Protection
www.cwp.org

Stormwater Manager's Resource Center
wwww.stormwatercenter.net

Metropolitan Council of Minnesota Environmental Services - Urban Small Sites BMP Manual
www.metrocouncil.org and click on "Environmental Services" to find the link to the manual

Produced by:
Dauphin County Conservation District
1451 Peters Mountain Road Dauphin, PA 17018
www.dauphincd.org p: (717) 921.8100

How a Riser Outflow Structure Works

A riser is an outflow structure used in conjunction with a detention basin for the purpose of maintaining a given amount of flow released from the detention basin to a stream or storm sewer system. Drainage holes placed along the height of the riser connect to a drain under the detention basin that has an outlet to a stream or storm drain. When the water level in the detention basin reaches the height of the entry holes of the riser, the water enters the holes and flows into the drainage pipe for release from the basin.

Crushed stone placed near the outlet point absorbs the energy of the water being released from the riser, which helps decrease runoff velocity and maintain an acceptable rate of runoff to the stream or storm sewer.

Detention Basin Side Profile

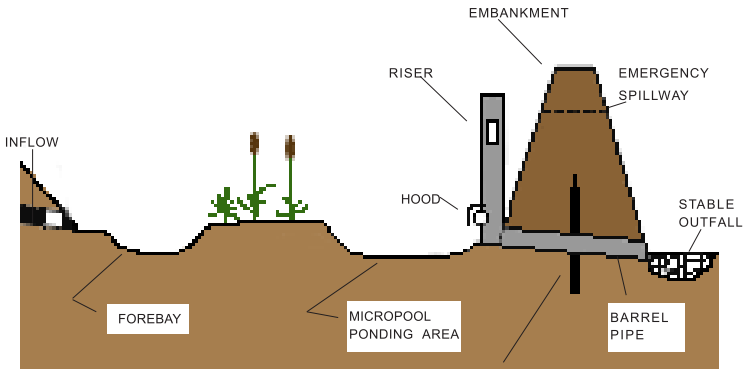

Diagram courtesy of Maryland BMP Manual

Basin at DCCD Tour Site #7

Detention Basins Featured in the BMP Tour

Two types of detention basins are featured in DCCD's stormwater BMP tour. Each is designed to illustrate how a detention basin can be incorporated with site features.

The first basin (#7 on the tour) uses a riser structure to aid with regulating the volume of runoff released from the site. The second basin (#10) takes advantage of the site's natural characteristics. Note that the contour of the land makes a natural depression suitable for detaining water. Surrounding existing vegetation will aid with absorption of water through plants' roots. A rock outfall has been added near the basin inlets to reduce the energy of runoff entering the basins.

Basin at DCCD Tour Site #10

Detention Basin Overhead Profile

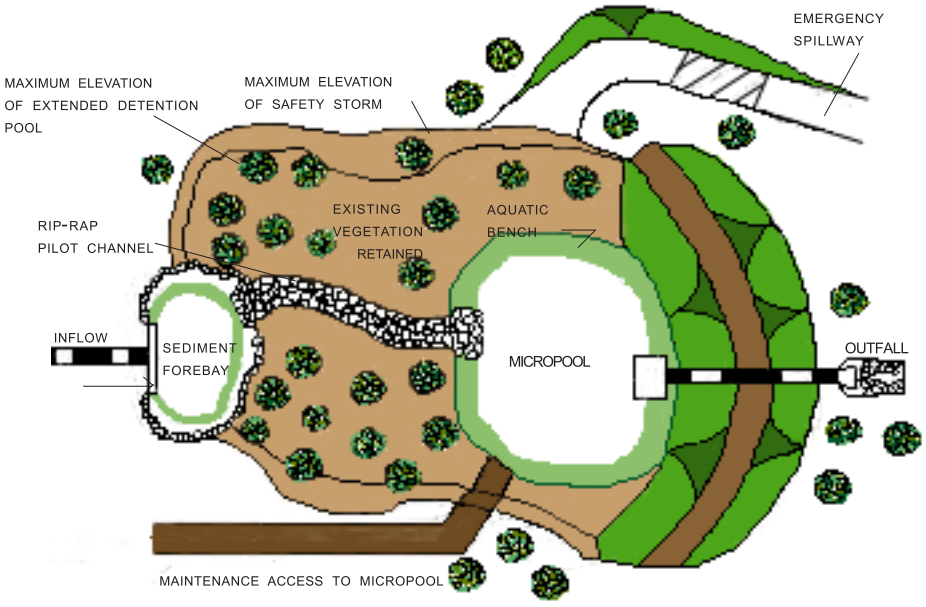

Diagram courtesy of Maryland BMP Manual

Detention vs. Retention

What's the Difference?

At times, the terms detention and retention seem to be used interchangeably - both are designed to capture and store runoff and they appear to be similar in design. However, they differ in purpose.

Retention is defined as "maintaining posession of; holding in a particular place"; detention refers to delaying an action. For stormwater objectives, this refers to the amount of time water is left to stand in the basin.

Detention ponds, whose primary function is to delay the release of runoff to streams, are designed for the eventual release of water. Retention basins are designed to allow sediment and pollutants to settle out of the water after it is captured through use of a permanent pool. Additional water received from a storm remains in the basin until it infiltrates into the ground or it reaches a depth that flos into a pipe or overflow structure. As it infiltrates, the water is filtered through the soil for removal of pollutants.

Stormwater Management Facility Parts

by: SOLitude Lake Management | Aug 25, 2015

Written by Industry Expert, J. Wesley Allen, Environmental Scientist

Stormwater management rules and regulations were formalized in the 1990's, developing from the Clean Water Act. While a lot of things have changed and continue to change in stormwater management, being informed on what your stormwater pond is designed to do and what its design elements, or parts, are, is key to understanding and implementing a sustainable maintenance and pond management program for your community, property, or commercial facility.

Today, more and more stormwater management is done with a variety of Best Management Practices (BMPs), such as infiltration basins, bio-infiltration areas, bio-swales, and rain gardens, but we still see a large number of stormwater management "wet" ponds or "dry" detention basins. These ponds are designed to hold water, capture sediment and pollutants, and then release the water slowly to mimic run-off from the site before development. These ponds not only function as stormwater management facilities, but are often designed as key features in communities. Most of these ponds have similar basic parts:

POND EMBANKMENT

Typically, stormwater ponds have an embankment surrounding them. Part, or all, of the embankment acts as a dam to keep the water in the pond. The embankment is usually sloped and should be stabilized with herbaceous vegetation and grasses. Large trees, animal burrowing, and exposed soils can lead to erosion and failure of the embankment. A beneficial vegetative buffer can also be allowed to grow. Buffers can help reduce sediment and nutrient loading in the pond, while providing greater stabilization for the embankment. Buffers should be composed of herbaceous vegetation and be kept free of invasive species and trees.

OUTLET STRUCTURE

These structures are designed to hold and release the water from the stormwater pond at different rates based on the amount of rainfall or run-off. They are mostly concrete structures now, but older ponds may also have galvanized steel structures or other types of pipe risers. Outlet structures may also have trash-racks on the low-flow (bottom orifice) and overflow (top of the structure). Trash racks need to be secured and kept in place. Outlets and the associated trash-

racks should be kept free of trash, debris and vegetation. They also need to be checked for any structural weaknesses or leaks that could jeopardize the function of the system.

INLETS

An inlet is an area, often a pipe, that conveys run-off from surrounding paved areas and property to the stormwater pond. Inlet pipes are typically concrete, high strength plastics, or galvanized steel. Where inlets enter the pond there are rip-rap (stone) dissipaters or aprons designed to reduce run-off velocity to prevent erosion and catch sediment and debris before it enters the pond. The inlet should be periodically checked for sediment buildup in the pipe. The rip-rap dissipater should also be kept free of vegetation and checked for erosion or sediment build-up. Sediment, invasive vegetation, or erosion at inlet areas can cause drainage issues and reduce the life-span of the pond.

FOREBAY

Forebays may be located at inlet areas. They are small zones segregated from the rest of the pond by rip-rap, stone gabions or earth embankments. The purpose of a forebay is to collect sediment before it enters the rest of the pond, making maintenance and sediment removal easier. Forebays need to be check for sediment build-up to function properly. They should also be kept clear of trees and invasive vegetation.

EMERGENCY SPILLWAY

The emergency spillway is a cut-out in the top of the basin's embankment where water can leave the pond during an extreme storm or rain event. These areas can be stabilized with concrete, rip-rap or herbaceous vegetation. The emergency spillway should be kept clear of trees, sediment, and debris. They need to be checked for any erosion or structural weaknesses.

SAFETY BENCH

Depending on the age and jurisdiction of your stormwater pond, it may have safety benches. There are normally two benches, one is one foot above and one is one foot below the permanent pool of the pond (normal water level). They are designed to prevent someone from falling into deep water if they fall near the edge of the pond. These areas should be kept free of trees and invasive vegetation and stabilized with grass and/or beneficial wetland plants.

It is important to note that design elements may differ in some ponds and stormwater BMPs, but by recognizing these basic pond parts, you can work with a stormwater management professional to develop an annual pond maintenance and management plan that keeps your stormwater area functioning properly and reduces longterm capital expenditures.

Design elements and regulations will also differ from jurisdiction to jurisdiction, so it is important to work with a certified stormwater BMP inspector when developing stormwater inspections and maintenance programs. Contact your local pond professional to discuss your pond or to schedule an inspection.

.