

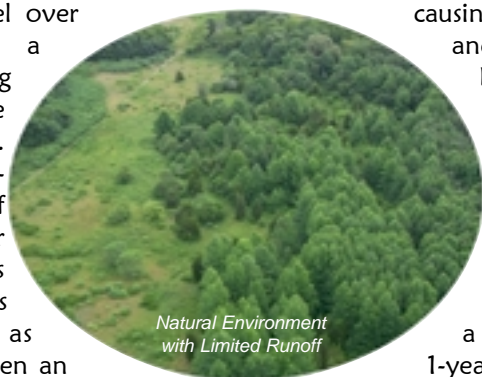
# STORMWATER MANAGEMENT BASINS AND THEIR MAINTENANCE



Over the last decade, they have become part of our suburban landscape and are increasing in number at a phenomenal rate. No, we're not talking about resident Canada geese; we're talking about stormwater management basins. As part of a large, growing family of "best management practices" or "BMPs" to control impacts of stormwater runoff, stormwater management basins help prevent flooding and improve water quality by controlling the rate water is released into streams and wetlands.

## WHY DO WE HAVE BASINS ?

Before an area is developed, rainwater can readily soak into soils, be absorbed by trees and other plants, evaporate into the air, or travel over land to a receiving stream, lake or wetland. The component of rainwater that travels over land is known as runoff. When an area is developed with driveways, buildings and roads, more water travels over these impervious surfaces as runoff and reaches a waterway much more quickly. Stormwater basins are built to temporarily hold this water and slowly release it to the waterway, mimicking the natural runoff rate before development. Without stormwater management basins, a huge peak of water would enter a stream at once, causing flooding and bank erosion.



*Natural Environment  
with Limited Runoff*

For flood control, engineers must design basins to handle the runoff rate and volume of water produced by certain sized storms known as the 2, 10, 25 and 100-year storms. The number of years refers to the probability of that size storm occurring in that period of time. A two-year storm has an intensity that is statistically expected once every two years; a 100-year storm is expected every 100 years. Although historical records may show that a storm of such intensity occurs only once every 100 years, in reality such a storm can happen twice in a year or even twice in a month. As the runoff travels across a development, it picks up pollutants, either physically (sand and dirt) or in dissolved form

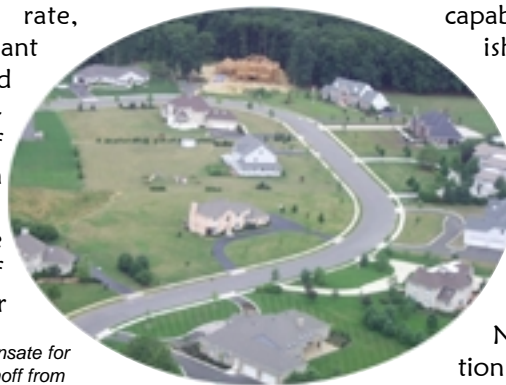
(nitrates and phosphorous from fertilizers). Faster moving water can carry more pollutants. Stormwater management basins intercept the runoff and slow it down causing many pollutants, like sediment and heavy metals, to settle out. Dissolved pollutants can also be absorbed by plants in the basin.

Research has shown that the concentration of pollutants in runoff is greater in smaller, more frequent storms. To improve water quality current regulations require a basin be designed to hold back the 1-year storm or 1.25" of rain falling uniformly over the contributing area for two hours.

The pollutants entering a basin reflect the landuse of the contributing drainage area. In residential development sediment and excessive nutrients from fertilizers, leaves, and grass clippings are typical. In commercial and highway development, the basin receives more hydrocarbons and heavy metals from vehicles as well as litter and debris.

Stormwater basins can also be combined with other best management practices, such as grassed swales, to further reduce the runoff rate, improve pollutant removal and reduce the volume of runoff coming from an area.

There are three basic types of s t o r m w a t e r



*Basins Compensate for  
Increased Runoff from  
Increased Impervious Cover*

## TYPES OF STORMWATER BASINS

basins and their names reflect their major differences.

Detention basins (or "dry ponds") detain water and are designed to be dry between rain events. When designed for both flood control and water quality improvement, they are also known as dual purpose or extended detention basins. Detention basins can also include artificial or man-made wetlands as part of the design. Wetland vegetation at the inlet or bottom of a basin can improve sediment capture and remove nutrient pollutants.

Retention basins (or "wet ponds") also detain water but are designed to retain a certain volume of water known as the permanent pool and may include artificial or man-made wetlands as part of their design. Retention basins are engineered to mimic natural lakes. Therefore, they often have healthy aquatic ecosystems, including fish and waterfowl populations, and can be beneficial resources to a community.

With an infiltration basin, collected water slowly infiltrates into the ground. Infiltration basins improve water quality by filtering runoff as it gradually passes through the soil. These basins are also capable of recharging or replenishing ground water.

Unfortunately, infiltration basins often clog and fail. Consequently, the use of infiltration basins is discouraged by most agencies, including NJDEP, except where recharge is desired. Most of the basins built in New Jersey are either detention or retention basins.



## DETENTION BASIN ANATOMY

Detention basins are the most common type of stormwater management facility in our area.

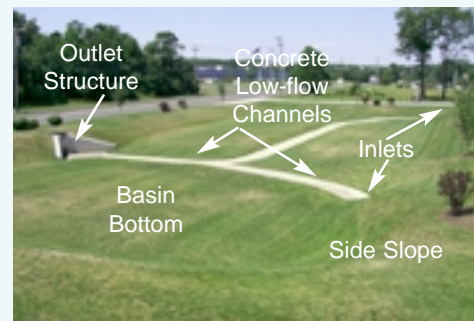
### DESIGN WITH MAINTENANCE IN MIND

The ease of maintenance is related to the design and construction. Some standard tips to ease later maintenance:

- Require concrete low-flow channels
- Basin side slopes no greater than 3:1 to allow mowers and other machines to work without tipping
- Basin floor slopes 2% from side slope toe to low-flow channel to allow proper drying
- Trash racks at all outlet structures; even with racks, clogging by leaves is common. Inspect often!
- Minimize the use of riprap to inlets and spillways; riprap collects sediment and encourages weed growth, is difficult to clean and must often be replaced
- Use perennial grass seed
- Do not plant trees and bushes in the basin; as they grow they take up volume and their leaves and branches can clog the outlet

They are large, man-made depressions or basins often located near parking lots or tucked in between houses. Depending on space constraints, a detention basin can be shallow and broad or small and relatively steep. They can be round or elongated. In elongated basins the time and distance of travel for the runoff is increased allowing for better pollutant uptake and settling.

Detention basins have one or more inlet pipes which deliver the runoff to the basin. Rocks are



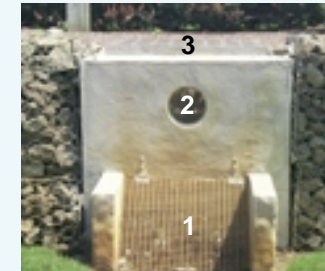
often placed around inlets to prevent scouring around the pipe. These rocks also slow water, helping pollutants settle out.

Basins should have a low-flow channel that runs from the inlet to the outlet structure. They are usually concrete but can be grass. They transport flow from small storms and ground water that seeps into the piped system. The bottom

and sides of the basin are usually grass. Trees and bushes can be added around the basin edge for aesthetic purposes.

At the other end of the low-flow channel is the outlet structure, which is the key component for accomplishing the basin's function. The outlet structure is usually a concrete box with various sized holes at various heights on the side facing the basin. At the very bottom, there may be a slot or hole to allow the low-flow to leave the basin. Above that is a small hole also known as the "3 inch orifice" that slowly releases water

from the water quality design storm, 2-year storm and smaller storms. Above the 3 inch orifice there are one or more larger round or square openings to release water from larger storms. Finally, there is an emergency spillway or grate that allows water from very large, intense storms to leave the basin. Sometimes a riprapped emergency spillway leads to an outfall ditch. When it rains, water fills the basin and is slowly released through the highest opening the storm runoff reaches and any opening below. A properly functioning basin



Typical Outlet. (1) 3" orifice for water quality, behind trash grate; (2) opening for 10, 25 or 50 yr. storms; (3) overflow grate for emergency flood control.

should empty almost completely within 18 hours in residential developments and 36 hours in commercial developments. From the basin, water can travel through an outlet ditch, connect with a piped stormwater system or be released directly into a waterway.



Detention basins can be used for recreation. This basin makes up a backyard. A playset and fence have been installed. However, these basins temporarily fill with water. Nothing inside the basin should impede water flow or block an outlet.

## MAINTENANCE MUSTS

- Inspect outlet structures often for clogging; leaves and grass clippings can clog up low-flow outlets
- Remove trash and debris. Outlet structures can be clogged by styrofoam cups and small flower pots, it doesn't take much
- Mow grass monthly during growing season; rake up and remove large clippings and leaves
- Shovel sediment from low-flow channel at least once a year; sediment should be removed from basin, not just tossed to the side
- Maintain grass and landscaping in and around basin
- Control animal burrowing and side erosion
- Inspect concrete outlet structures, low-flow channels, inlets and grates yearly for structural integrity

## RETENTION BASIN ANATOMY

Retention basins also have inlets and outlet structures; however, a retention basin is designed to hold a volume of water (known as the permanent pool) by having the basin intersect the ground water table, intercept stream baseflow or by lining the bottom so water cannot seep out. Retention basins are still designed to handle the runoff from storms and slowly release

the extra volume. Fundamentally, a retention pond improves water quality because water entering the basin displaces water that has been in the pool for a longer amount of time; hence, water leaving the outlet structure is theoretically cleaner. By mimicking a natural pond or lake, pollutant removal also is increased by biological action either through uptake by aquatic plants or through



Retention Basin Outlet. An outlet pipe may also release water mid-depth; water at that level is assumed to have longer residence time and be cleaner than surface water.

breakdown by bacteria. If not contaminated by droppings of nearby wildlife, a retention basin can be effective in reducing fecal bacteria levels because of the longer holding time between rain events.

Similar to a detention pond outlet, a retention basin outlet has several openings of various sizes at various elevations to control different intensity storms. The outlet can be a concrete box riser or standpipe and is usually incorporated into the dam embankment. Often, the orifice for the water quality storm is just above the water level of the permanent pond. The low-flow pipe is usually a negatively sloped outlet pipe that releases water from the mid section of the pool's water column. Sometimes, the water quality

## MAINTENANCE MUSTS

- Establish monitoring program of the aquatic ecosystem; healthy systems require little maintenance
- Remove trash and debris on a regular schedule to avoid clogging and container-breeding mosquitoes
- Remove sediment from forebay at least every 5-10 years, sooner if needed
- Inspect basin structures, including concrete structures and embankment integrity on a regular basis

storm and flood control orifices are also negatively sloped from mid water column. This increases the likelihood that the water released by the basin has been stored for a sufficient time for pollutants to settle out or breakdown through biological action.

Retention basins look like small, man-made lakes and can be aesthetic additions to the landscape. The permanent pool

is designed to be deep enough to support a healthy aquatic ecosystem including fish. Often, fountains or other aerators are installed to reduce algae growth and maintain dissolved oxygen levels. Wetland aprons installed at the inlets increase sediment capture and nutrient uptake by plants, helping to prevent eutrophication of the pond.

If a healthy ecosystem is achieved, retention basins do not require much regular maintenance. In areas of high sediment loadings, the basin could fill up more quickly and require dewatering and excavation relatively soon. An easily accessible forebay at each inlet would prolong the life of a basin. On average, a retention pond is cleaned out every 10-20 years.



## IMPORTANCE OF MAINTENANCE

If not maintained, a stormwater basin can become a hazard to the community as well as an eyesore and nuisance to nearby residents. Once a detention basin starts holding water, even small puddles, it can breed mosquitoes. Containers and other trash in basins can also hold water and harbor mosquitoes. If a retention basin fills in, becomes shallow and stagnant, mosquitoes can breed. Mosquitoes can transmit agents that cause serious diseases such as Eastern Equine Encephalitis (EEE) and malaria. On a nuisance level, large populations of mosquitoes breeding in neglected basins can be annoying and decrease the quality of life in an area.

As a detention or retention basin collects sediment and debris, the volume available to hold the extra runoff from rain events is reduced - essentially defeating the original purpose of the basin. This is particularly true for degraded detention basins that permanently hold water. Although they

might be viewed as healthy wetlands, they do not control the runoff they were designed to handle. This loss of storage volume can cause the local stormwater system to backup as well as flooding along the receiving waterway.

## CONSIDER THE COST

Basin maintenance follows the old adage of an ounce of prevention is worth a pound of cure. Detention basins require short-term maintenance such as mowing and removal of sediment from the low-flow channel. Although time consuming, these activities are relatively inexpensive and uncomplicated. A basin's demise is often caused by something simple blocking the outlet. Ignoring regular inspection and maintenance can quickly lead to an expensive overhaul involving heavy equipment and extensive labor. In addition, once wetlands are involved, maintenance work will require a Freshwater Wetlands general permit #1 from the NJDEP.



Improper maintenance can quickly lead to a malfunctioning, smelly and unsightly basin that could be a health hazard.

Cleaning sediment from retention basin forebays may require heavy equipment. However, the periodic cost of emptying these sections is less than dredging the entire basin. Like a natural pond or lake, the "health" of a retention basin is a balance of many factors. Monitoring the retention basin's ecosystem can allow for corrective action before the pond "dies" from nutrient and sediment overloading. Maintaining fountains for proper aeration helps sustain oxygen levels, prevents algae blooms and, by disturbing the water surface, reduces mosquito breeding.



*Restoring a detention basin after years of neglect requires heavy equipment and is expensive. The above basin was full of water and more than two feet of mud buried the low flow channel.*

Restoring a failed stormwater basin can easily cost tens of thousands of dollars. Many municipalities now require developers to provide money "up front" for long-term maintenance of stormwater management basins. The amount set aside, however, often only covers regular

maintenance costs and may not be enough for the high cost of repairing a neglected basin.

## MAINTENANCE RESPONSIBILITY

The responsibility for maintaining a stormwater basin varies from municipality to municipality. Some towns now assume ownership and responsibility for maintenance of basins in residential developments. In other towns, responsibility lies with Homeowners' Associations. A few towns have the basin associated with one lot, making that single property owner responsible for maintenance. For commercial and industrial development, responsibility usually remains with the corporation or management company.

Currently, through its Flood Hazard Area Control rules (stream encroachment rules) and Stormwater Management Rules, the NJDEP regulates the design of stormwater basins. The stream encroachment rules require a long-term maintenance plan for stormwater facilities including identification of a responsible party. The Department of Community Affairs' Site Improvement Regulations also require maintenance responsibility to be identified as part of the site plan approval process. Usually the responsible party is the property owner and is recorded with the property deed.

## WHAT A HOMEOWNER CAN DO

If you live near a basin and have access, you can help by removing trash and debris from the basin during dry periods. For safety reasons, do not enter a basin during rain events. Do not put grass clippings, leaves or trash in or near a stormwater basin or catch basin. Debris entering a catch basin on a street will end up either in a stormwater basin or directly in a stream or lake!

When ponded water remains in a basin longer than 3 days, call your local public works department or mosquito commission. Often, proper drainage can be restored using a stick or rake from atop the outlet structure to clear debris from the trash grate and orifice. If the basin has standing water, either in isolated puddles or due to a clogged outlet, the basin could be breeding mosquitoes. If mosquito larvae are present, the mosquito commission can treat the area and take proper action to have the situation corrected.



*Simply clearing the outlet opening can help prevent a detention basin from clogging and failing to function.*

## FOR MORE DETAILED INFORMATION

"Stormwater and Nonpoint Source Pollution Control Best Management Practices Manual," NJDEP, 1992. Available from NJDEP, Maps and Publications, (609) 777-1038.

Flood Hazard Area Control Rules, N.J.A.C. 7:13, promulgated by the NJ Department of Environmental Protection

Site Improvement Standards, N.J.A.C. 5:21-7, promulgated by the NJ Department of Community Affairs

Stormwater Management Rules, N.J.A.C. 7:8, promulgated by the NJ Department of Environmental Protection.

"Stormwater Management Facilities Maintenance Manual," 1989, NJ Department of Environmental Protection and Ocean County.

"Standards for Soil Erosion and Sediment Control in New Jersey," 1999, NJ Department of Agriculture, State Soil Conservation Committee, Trenton, NJ. (Available from local soil conservation districts.)

Freshwater Wetlands Protection Act Rules, N.J.A.C. 7:7A, 1992, NJ Department of Environmental Protection, Trenton, NJ.

Urban Runoff Quality Management, 1998, American Society of Engineers and Water Environment Federation, Alexandria, Virginia.

Urban Runoff Pollution Prevention and Control Planning Handbook, 1993, USEPA, Office of Research and Development, Washington, D.C. EPA/625/R-93/004

Informative Website on Stormwater Management: [www.txnpsbook.org](http://www.txnpsbook.org)

The Monmouth County Mosquito Extermination Commission  
 P.O. Box 162  
 Eatontown, NJ 07724  
 (Tel) 732-542-3630 • (Fax) 732-542-3267  
[mcwra@shore.co.monmouth.nj.us](mailto:mcwra@shore.co.monmouth.nj.us)  
[www.monmouth.shore.nj.us/06270\\_mcmec](http://www.monmouth.shore.nj.us/06270_mcmec)

