

# MOORE KNOWLEDGE

## **A FLOOD CONTROL AND POLLUTION SOLUTION**

### **Special Detention Basins are Beneficial to the Environment and the Project Budget**

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### **At a Glance**

1. Detention basins in highly urbanized watersheds are primarily designed for flood mitigation.
2. Designing the detention basins to be used also for storm water quality control makes them eligible for LEED® credit.
3. These detention basins are more economical over the life of the project when operating costs are considered and benefit the environment.

Land development or urbanization—by increasing impervious surfaces—increases surface runoff rates and boosts the generation of pollutants, causing surface water quality deterioration.

A detention basin typically is used to mitigate additional runoff that results from development. In many communities, watershed protection programs are successfully using detention basins for the dual purposes of reducing potential flooding by controlling induced surface runoff and reducing transportation of particulate pollutants found in urban runoff.

In certain communities, protection of water quality may be more critical than flood control. Leadership in Engineering and Environmental Design (LEED®) credit is granted for detention basins designed with the dual purpose of mitigating storm water quality and flood discharge.

### Design Considerations

Several factors need to be considered in the design of a detention basin to serve the dual purpose of flood mitigation and water quality control.

- For flood mitigation, the peak discharges during less frequent storms must be subdued to a lower level expected under undeveloped conditions.
- For optimal removal of pollutants, the first flush of runoff

resulting from the most frequent storms must be captured and treated. This is called “storm water quality capture volume” (SWQCV), although the way it should be quantified varies from community to community.

Most pollutants have a high affinity to be adsorbed by (i.e., they will accumulate on and interact with) the suspended solids in runoff. In most cases, a best management practice is achieved if the design and operation of a detention basin assure removal of 80% of the average annual total suspended solids and 40% of the total phosphorous, based on certain criteria.

Rainfall depth, duration and frequency in a particular region can usually be connected with a statistical relationship in an equation that uses constants specific to a particular location based on hydrological studies.

### Case Study: Mitigating Development's Impact

Sysco Corporation's 6.6-acre commercial development close to the Buffalo Bayou floodplain in Houston, Texas, is creating a 3.8-acre impervious area. Walter P Moore's design of a detention basin for the dual purpose of flood and storm water quality controls will add economic and environmental benefits. It is designed to serve the ultimate build-out of the project, for which LEED® certification is being pursued. To satisfy LEED® criteria for this project, we had to determine rainfall of the 1.5-year storm. Figure 1 shows the cross sectional schematic of the system.

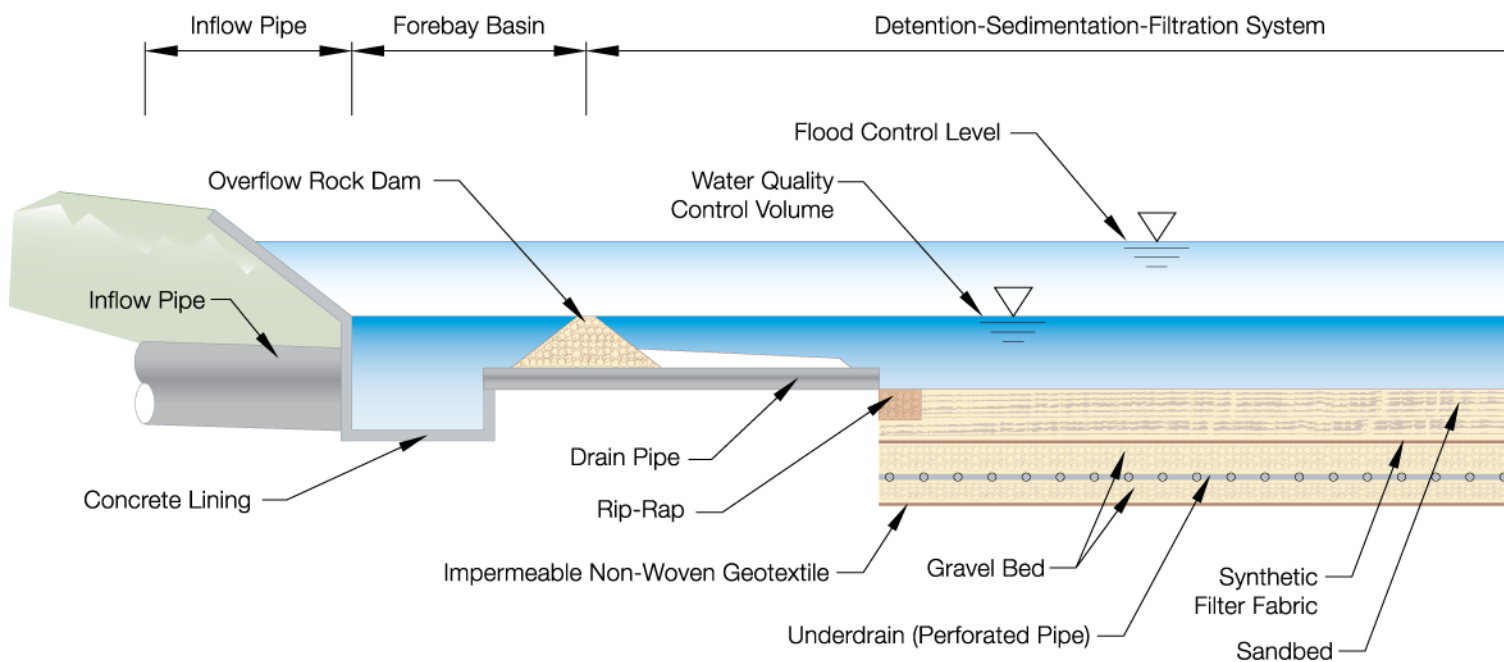


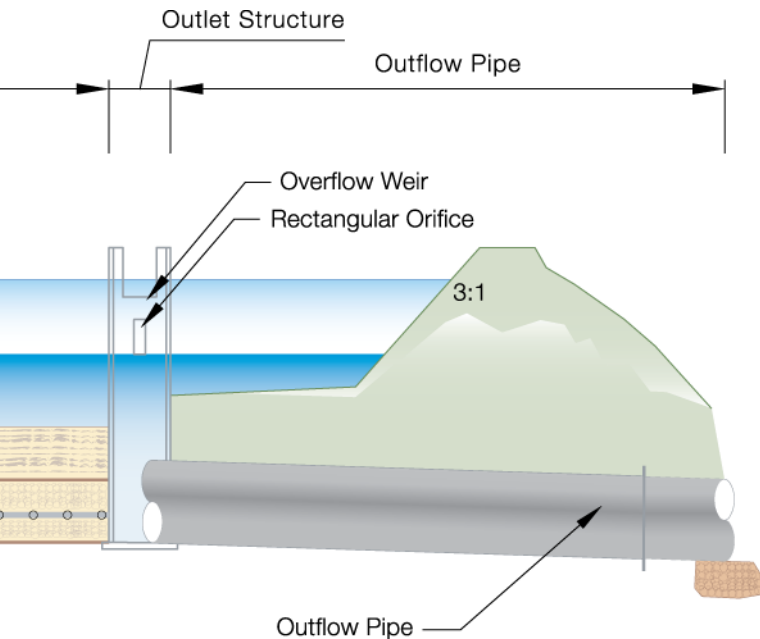
Figure 1. Shown in cross section is Walter P Moore's design for a dual-purpose detention basin that mitigates flooding and improves storm water quality.

The system consists of a sand infiltration basin or runoff storage zone integrated within the detention basin. The expected probable range of this system's removal efficiency is 80-90% for total suspended solids and 45-55% for total phosphorus. The bed is an 18" thick layer of sand on top of a 9" thick layer of gravel and lies beneath an underdrain system. During a storm, accumulated runoff ponds in the surcharge zone and gradually infiltrates into the sand bed. The underdrain consists of 4" perforated HDPE pipes, spaced 12' center to center. It gradually dewateres the sand bed and conveys the discharge to the main outflow structure.

For optimum filtration, the basin is designed to operate with a minimum detention time of 24 hours. The infiltration basin is preceded by a sedimentation basin where heavy sediments and floatable materials are removed. Flood discharge is controlled by an outflow control structure, consisting of an open top 6'x6' box with a rectangular orifice and a rectangular weir. This structure terminates in a 48" CMP outflow pipe, which travels to a small tributary of Buffalo Bayou.

### Conclusions: Advantage of Dual Use Detention Basins

Apart from controlling both flood and storm water quality through a single system, the dual-use detention basins offer many advantages over systems that employ mechanical storm water quality control devices. They are more economical than the prefabricated mechanical systems over the life of the project, more aesthetically pleasing and much more environmentally friendly.



The authors are members of the Civil Engineering Services Group at Walter P Moore, where civil engineering is about community service, intelligent development and quality of life. Our comprehensive flood mitigation services include risk evaluation, comprehensive design and operations protocol development. Our solutions incorporate all viable building codes, long-term facility goals, long-range improvements, implementation plans and coordination with funding sources and adjacent facilities.

### ABOUT THE AUTHORS

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