

Taking Stormwater Storage Savings to the Bank

Hydro-Brake® Optimum (Reg-U-Flo®) Cuts Stormwater Detention Costs by \$150,000

Project Profile

Objective

Water Quality Volume was required to detain stormwater on site, but the smallest allowable orifice - 2-in diameter – would over discharge, resulting in the need to increase the required storage volume by 42%

Solution

A 3.375-in Reg-U-Flo® Vortex Flow Control restricted more flow than the 2-in orifice and eliminated 100% of the excess storage volume, reducing the cost of the storage system by over \$150,000

Product Profile

- Reg-U-Flo® Vortex Flow Control is a non-mechanical, passive device that provided better flow control than the minimum orifice allowed
- The 3.375-in Reg-U-Flo® Vortex Flow Control used has an open area more than 350% larger than the 2-in orifice, reducing chance of blockages
- With more than 25,000 installations worldwide, the Reg-U-Flo® Vortex Flow Control offered a tried and tested solution

Find more about the Reg-U-Flo® at www.hydro-int.com

GAITHERSBURG, Maryland - The Chesapeake Bay in Maryland is North America's largest and most biologically diverse estuary, home to more than 3,600 species of plants, fish and animals. Unfortunately, this watershed is now in peril. Shellfish stocks including oyster and crab are at an all-time low, and even the health of striped bass, which made a comeback in recent years, is now in question.

Stormwater runoff carries contaminants including sediments, nutrients and thermal pollution into the Bay waters. In fact, stormwater pollution is responsible for 11 percent of the nitrogen and 15 percent of the phosphorus that enters the Chesapeake. To combat the problems associated with runoff contamination, the Maryland Department of Environmental Protection and Montgomery County enacted some of the strictest stormwater management regulations in the nation. The stormwater management code requires that for developments on Class 1 watersheds such as the Chesapeake, a predetermined Water Quality Volume of stormwater runoff generated by development must be stored on site in a stormwater storage system. The strict storage requirements prevent flooding downstream of the developed site and allows stormwater runoff to cool down substantially before it is discharged into the waterway, where warm water would promote algae growth and fish kills. Additionally, Montgomery County's Channel Protection Storage Volume requirement helps prevent stormwater runoff from developed sites from causing harmful erosion to stream channels.

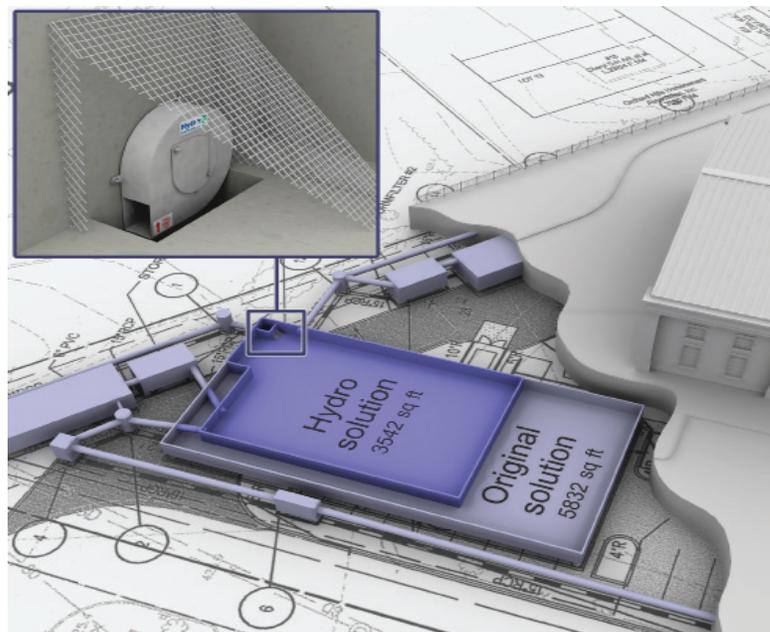


Fig.1 The Reg-U-Flo® Vortex Flow Control outlet flow control reduced the stormwater storage volume by 42% while still providing adequate storage for the "water quality volume" as required by local regulations.

In addition to stormwater storage volume requirements, Montgomery County has a 2-in minimum aperture requirement for orifice plates used as the outlet fixture for stormwater storage systems. Because stormwater runoff contains trash and other debris, any opening smaller than 2-in is at major risk of being blocked by debris, thereby causing upstream flooding. To comply with the minimum orifice requirement while meeting the required drain down from the storage system, engineers frequently reduce the driving head that controls the discharge rate from the orifice outlet by increasing the storage footprint.

Chevy Chase Bank of Bethesda, Md. set out to open a new branch in Gaithersburg, a town within Montgomery County. The bank tapped Loiederman Soltész Associates, a civil engineering firm in Rockville, Md., to design the stormwater site plan for the new bank branch (Fig.1).

The engineers at Loiederman Soltesz Associates opted to use an underground stormwater storage system that would meet the Channel Protection discharge rate and store the Water Quality Volume on site for a requisite time period. To meet the required detention time, the engineers knew they would need to use the smallest allowable outlet flow control – a 2” diameter orifice plate. However, hydraulic modeling revealed that the 2” diameter orifice would start over discharging at moderate levels of driving head. This posed a problem for the engineering team.

The footprint of a shallow, arched-chamber storage system would not fit within the space constraints of the site (Fig.2). But taller storage structures such as precast concrete chambers were too deep, providing too much driving head on the 2-in orifice to meet the maximum discharge requirement.

“The Reg-U-Flo® really cut back on [installation] time and money.”

Matt Baxter, Contractor
Humphrey Rich Construction

To resolve this issue, the engineers designed a precast concrete storage vault to spread the Water Quality Volume out over a larger area and lower the driving head to meet the discharge requirement. This resulted in a vault with 29,160 cubic feet of storage volume – approximately 42% more than was needed.

The problem, though, was that the system was oversized and had spare capacity. For a highly intense storm, the excess capacity of the storage volume would fill, increasing the driving head on the orifice, and the system would over discharge. Additionally, the developer would have incurred high construction costs associated with the oversized storage system.

The firm then evaluated Hydro International’s Reg-U-Flo® Vortex Flow Control, a highly effective vortex flow control for limiting the discharge rate of stormwater exiting a stormwater storage system.

Taking advantage of the Reg-U-Flo® Vortex Flow Control’s characteristics, the engineers at Loiederman redesigned the storage system using a 3.375-in SXH type Reg-U-Flo® Vortex Flow Control (Fig.3) that was able to limit the discharge rate with the entire storage system full, eliminating 100% of the excess storage volume required with the 2-inch orifice control (Table 1).



Fig.2 The site of the new Chevy Chase bank was constrained, with little room for surface stormwater storage.

Matt Baxter of Humphrey Rich Construction, the contracting firm on the project, reported that, “The Reg-U-Flo® really cut back on [installation] time and money.” By reducing the volume of the tank and reducing associated construction labor costs, the vortex valve saved over \$150,000 on the project.

In addition, with the new outlet control, the smallest dimension of the flow control opening was expanded from 2-in to 3.375-in resulting in a 350% increase in the area of the opening. This dimension easily meets the County’s 2-in minimum dimension requirement for an outlet flow control and offers more protection against blockage than the equivalent orifice.

The Reg-U-Flo® Vortex Flow Control can be sized to limit the flow of water as needed. It allows for lower discharge rates at higher heads than conventional flow control options and it operates on simple fluid hydraulics. Under low-head conditions, the valve acts as a large orifice where water and debris pass directly from the inlet to the outlet. As head increases, an aerated core forms and restricts the amount of flow that passes through to the outlet aperture allowing the valve to behave like a smaller orifice.



Fig.3 The 3.375-in SXH-Type Reg-U-Flo® Vortex Flow Control meets the discharge requirement while reducing required storage volume by over 40%.

The Reg-U-Flo® Vortex Flow Control proved to be an effective method of stormwater control, allowing for a storage system with a smaller footprint than a traditional orifice plate flow control solution. Chevy Chase Bank will stand as a model to other communities looking to maximize the economy of development while safeguarding precious waterways.

Table 1. Comparison of Outlet Flow Controls

Storage	Flow Control Options		Savings using Reg-U-Flo® System
	2” Orifice	Reg-U-Flo®	
Area	5,832 ft ²	3,732 ft ²	36%
Volume	29,160 ft ³	17,160 ft ³	42%