

Case Study

Wet Weather

Reg-U-Flo® Vortex Valve

Inlet Control Saves City Over 50%

Project Highlights

- Combined sewer system was overloaded, backing up into residential basements
- The solution was a combination of rehabilitation, separation and upstream inlet control
- The inlet control approach using spigot-mounted Reg-U-Flo Vortex Valves cost the City 50% less than the alternatives
- In the past 15 years, over 2,800 Reg-U-Flo Vortex Valves have been installed in the City of Evanston



The combined sewer was overloaded, backing up into the basements of residential homes.

“I definitely sleep better at night knowing this system is in place.”

David Stoneback,
Superintendent
Water & Sewer
Evanston, IL

Evanston, IL Takes Action Against CSOs



During heavy rain events, Evanston residents were exasperated by basement flooding caused by the city's outdated Combined Sewer system.

Evanston, Illinois is a picturesque community just north of Chicago featuring an abundance of civic treasures and natural resources. It is home to lakefront beaches, nearly 100 parks, lovely boutique shopping, two renowned hospitals, and five colleges and universities including internationally renowned Northwestern. Its 78,000 residents appreciate the unique beauty and recreational opportunities offered by Lake Michigan.

Under the surface, though, Evanston has wrestled with a serious infrastructure issue. For years, during heavy rains, the city's sewer system became overloaded, with sewer backups flooding hundreds of basements up to six times a year. The issue was so prevalent that people living in Evanston got used to not using their basements. Many put their washing machines and dryers up on 2-foot-high platforms to abate water damage.

The problem dated back at least as far as 1938, when a consultant's report alerted the city to the fact that the city's sewer system was undersized based on the development in place at that time. Decades later, the problem grew worse, and in the late 1980s, a one hundred-year rain event convinced city officials to commission a large-scale overhaul of the city's sewers.

“Every basement in Evanston had water in it,” said David Stoneback, supervisor of the Evanston Water & Sewer Department. “That was the impetus to get going on this.” In 1991 the city embarked on a sewer upgrade to increase both the capacity and efficiency of its long-undersized system. The sewer separation portion of the project is now in its final phases, with an expected completion date of mid-2008. The city turned to MWH Global Inc. (then

known as Harza Environmental Systems) of Finland, Minn., to evaluate the situation and develop a cost effective abatement program for the City's combined sewer problems. Many different alternatives were evaluated, including traditional sewer separation and relief sewers. The traditional solution of relief sewers/sewer replacement, which would have provided a 5-year level of flood protection, was estimated to cost \$290 million. This solution would also cause major disruption, as up to 90% of the City's street would be affected by construction. The high cost of the traditional solution and the potential disruption to local residents caused the City to seek more affordable solutions including the use of inlet control devices and partial sewer separation. Table 1 identifies the then-estimated costs associated with each of the options and the level of protection provided by each solution.

Table 1 - Comparison of Alternatives Considered

Sewer System Facilities Plan City of Evanston			
Alternative Options	Estimated Costs (\$millions)	Level of Protection	
		Basements	Streets
1. No Action		2 Month	6 Month - 1 Year
2. Total Sewer Separation	320	100 Year	100 Year
3. Combined Sewer Relief	290	10 Year	10 Year
4. Inlet Flow Controls and Partial Sewer Separation with Overland street flow	125	100 Year	5 - 10 Year
5. Partial Sewer Separation without Overland Street Flow	210	100 Year	5 - 10 Year

Reg-U-Flo® Vortex Valve

A money saving solution for Evanston, IL

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The Reg-U-Flo Vortex Valve supplied by Hydro International was chosen to serve as the basis for the inlet control system.

MWH Global recommended Alternative 4, an innovative plan that coupled inlet flow control with partial sewer separation to alleviate basement backups without having to install storm sewers on every street. The firm recommended rehabilitating portions of the existing combined sewers, installing storm water relief sewers in downstream areas, and implementing an inlet control system in upstream catchment areas. The inlet control systems were designed to reduce the rate of storm flow entering the combined sewers and create overland flow routes, diverting storm water to the new storm water relief sewers.

Prior to the implementation, MWH Global studied three types of inlet control systems. The company built a test drainage structure to vet each solution. This involved throwing leaves and other debris into the test structures and observing whether they would flood. The company also metered the water to ensure the proper release rates were being met. Ultimately, the firm selected a spigot-mounted Reg-U-Flo® Vortex Valve model supplied by Hydro International to serve as the basis for the inlet control system.

At the time, the vortex flow control system was among the first of its kind to be installed in the U.S. Designed with a snail or conical shape, the Reg-U-Flo

Vortex Valve can regulate the flow of water as needed. Attenuated flow can be temporarily stored in underground tanks or in surface ponds for slow release into the sewer system. With the flow control in place, storm water for a two-block area can flow along the curb line. This ensures that the rate of inflow will not exceed the hydraulic capacity of the sewer system. Matching system inputs to hydraulic capacity can reduce flooding, backup and overflow frequencies. In addition, the unique design of the Reg-U-Flo Vortex Valve allows for a larger opening to avoid obstructions. When dealing with large debris like one finds in storm water, the opening should be as large as possible to prevent blockage from items that get washed down the storm grate during rain events. The Reg-U-Flo Vortex Valve has an opening up to 600 times larger than a conventional orifice of equivalent performance while still maintaining the correct discharge rate, making it less likely to become obstructed.

The implemented solution proved to be a great money saver. Utilizing the inlet controls enabled the city to adopt a staged approach to scheme implementation. This allowed the worst affected areas to be addressed first. Stoneback estimates that using Hydro International Reg-U-Flo Vortex Valves in combination with attenuation has cost \$210 million over a 12 year period, which is significantly less than what it would have cost to separate the sewers in those portions of the City.

Stoneback said the city has been happy with the performance of the system. After the first 12 months of operation, MWH Global determined that the level of performance was equivalent to a complete sewer separation, and that the system worked well without any maintenance problems reported. The city has made minor modifications along the way to gain additional benefits. For example, initially the city had not planned to replace the drainage structure before installing the vortex flow regulators. However, officials quickly realized that if they utilized the existing

structures the outfall pipes would vary in size, and getting the right flow regulator to fit could be a challenge. To alleviate this challenge, the city standardized the system to fit into an 8-inch outfall pipe. This way, a single model of Reg-U-Flo Vortex Valve – the 3.15" spigot-mounted S-type – could be fitted into all the drainage structures throughout the city. Stoneback said he is also pleased the city took MWH Global's recommendation to utilize a two-piece Reg-U-Flo Vortex Valve. The device is installed within the outfall pipe of the catch basin and has a pipe spigot with a mounting bracket for the flow regulator hood to slide into. Thus, if the flow regulator were to become plugged, it's easy for one maintenance person to pull the head off, clean it, and put it back in its proper location.

"If we had installed a one-piece valve, we'd be forced to set up a pump and pump out the drainage structure and then physically go into the structure with a two-man crew to remove the restrictor," Stoneback said. "That would have taken at least an hour. With our two-piece Reg-U-Flo Vortex Valve the work is done in about 15 minutes. Additionally, the mountings allow the unit to be removed from the catch basin for periodic inspection of the valves."

Now more than 10 years and 2,800 Reg-U-Flo Vortex Valves later, city officials are happy to report they made the right choice. Even during the rainiest weather, the vortex valve system has performed well. In the summer of 2007, the city experienced unseasonably high precipitation, 9.7 inches of rain, compared to the average rainfall of 4.62 inches. "We've virtually eliminated basement backups," Stoneback said. "Last August was one of the wettest months in recent memory. We had only two sewage-related calls, and those were in areas where the work was not yet completed. I definitely sleep better at night knowing this system is in place."