

Columbus, GA

Storm King® satellite treatment significantly reduces project costs.

Wet Weather Case Study - Project Profile

Objective

In partnership with the client, the engineer and the community help turn an unfunded mandate into the future of CSO treatment technology.

Solution

Developed an innovative solution based on satellite treatment using Storm King® Separators at two CSO locations, showing significant cost reductions.

The City of Columbus, GA knew firsthand the pollution problems that combined sewer systems caused. In dry conditions, the city's combined sewer overflows (CSOs) were not a problem, but during heavy rain events the rapid influx of stormwater caused the system to overload — resulting in untreated water to flow directly into the Chattahoochee River. The river provides drinking water for over half of all Georgians and recreational opportunities for more than 25 million people each year.

Not only did the overflows cause exceptionally high fecal coliform levels in the hundreds of thousands of colony forming units (CFU), they also discharged aesthetic pollutants directly into the river. "It was not unusual to see the river covered shore to shore with floatable materials," said Cliff Arnett, Senior Vice President for the Division of Water Resource Operations, Environmental Compliance and Managed Maintenance at the Columbus Water Works.

With the help of a \$20 million appropriation from Congress and the U.S. Environmental Protection Agency, the Columbus Water Works was able to implement a CSO control program that encompassed a technology demonstration site. The agency evaluated 44 different options to determine the most cost effective and meaningful way to address more than 5,200 acres (21 km²) served by combined sewers in the downtown area of Columbus.

The agency discovered half of the area already had its own separate stormwater sewer, but that it had been flowing into the combined sewer area. To resolve this problem, the Water Works installed an interceptor to redirect the flow to the wastewater treatment plant. However, this still left approximately 2,600 acres (10.5 km²) in a highly urbanized area to be addressed.

"We're saving an estimated \$20-30 million in capital costs alone."

Cliff Arnett, Senior VP for the Division of Water Resource Operations, Environmental Compliance and Managed Maintenance at the Columbus Water Works

Project Highlights

- The final solution included 12 Storm King® separators, 28 Hydro-Brake® vortex valves and 3 Grit King® separators at two locations on the Chattahoochee River
- \$20-30 million project savings
- The project won Columbus Water Works the 2001 EPA Award for CSO Program Excellence

Using a traditional wastewater treatment approach would have required an extremely large and expensive facility.

Alternatively, the agency could separate all of the sewer and stormwater lines, but this would also have cost hundreds of millions of dollars and caused major disruptions across the city while roads were torn up to separate the sewers. "The cost of separation is extravagant, and it completely interferes with the normal operation of the city," Arnett said. "While we did separate two relatively small sub-basins we didn't feel that was a good approach for the bulk of our CSOs."

The engineering firm, Parsons Engineering Science, approached the agency about using vortex separator units. Thanks to a grant from the Water Environment Federation, along with capital donations from private and municipal entities, the agency was able to test out the vortex separators. The Water Works set up a pilot test on the banks of the Chattahoochee River to evaluate the vortex separators side by side with the traditional treatment approach.



Storm King® overflow vortex separators provide a cost effective, sustainable solution for the City of Columbus, GA

Numerous organizations, including Parsons Engineering Science, the Water Environmental Research Foundation, and Trojan Industries (a manufacturer of ultraviolet disinfection technologies) supported the pilot project.

“One of our major concerns was whether the vortex separators could remove solids and that there was sufficient contact time within the separator to accommodate disinfection,” Arnett said. “This had never been done before. We were pleased to discover that the vortex separators could remove solids equivalent to a horizontal settling basin, and did indeed have enough contact time for disinfection - in roughly one tenth of the footprint of a conventional plant. This meant we were looking at significant savings. In addition, the filter operates at very high flow rates, which is ideal for stormwater problems.”

Based on the impressive results, the Columbus Water Works built two wet weather treatment plants, one on the upper end of the system and another on the lower end. Water flows from the combined sewer system to the two satellite wet weather treatment facilities where a portion of the flow is directed to the main wastewater treatment facility before flow is introduced into the facility. Wet-weather treatment involves three primary steps: physical separation of solids from the waste stream, removal of organic materials from the waste stream, and reduction of bacteria.

Storm King® units are advanced hydrodynamic vortex separators that augment gravitational forces to separate solids from water. The flow swirls through circular tanks, which separate concentrated solids to the bottom. These vessels have no moving parts, reducing maintenance issues.

“Stormwater picks up a tremendous amount of grit and gravel in the runoff process,” Arnett said. “Sand and grit are enemies in a stormwater system. They cause wear and tear and clog sewers. That’s always been a problem here in Columbus, requiring the sewer lines to be cleaned every two years. Using the Grit King® eliminates this problem altogether.” For this reason, Grit King® separators were installed in conjunction with the Storm King® to remove grit at the satellite facility as opposed to transporting it through miles of pipe to the wastewater treatment plant.

After grit is removed, water flows into a secondary Storm King® where it is treated with sodium hypochlorite within the vortex separator in tandem with UV disinfection after filtration to virtually eliminate all pathogens. This vortex separator (which now incorporates Swirl Cleanse screening technology) enables water to be treated in much less time than in conventional systems.

In extremely heavy rainstorms, water flow is controlled using Hydro-Brake® Vortex Valves. Designed with a conical shape, a Hydro-Brake® vortex valve restricts the flow of water as needed. As flow increases, an air core, accompanied by substantial backpressure, chokes the flow through the outlet aperture. Using this approach, the Columbus Water Works was able to significantly enhance flow handling capacity with no additional equipment. The entire system is automated. Rain sensors alert the treatment system when it needs to be initiated. The cost savings have been enormous. “We’re saving an estimated \$20-30 million in capital costs alone,” Arnett said. “Plus, since the system is unmanned,

it’s extremely easy and economical to operate. Our consulting engineers estimated that this technology could save billions of dollars if all cities across the country used it.”

To ensure the system was working to maximum efficiency, the agency conducted extensive water quality analyses to understand resulting pollutant loads. Test results confirmed that the new system reduced bacteria levels to less than 100 CFU per 100 ml, from a high of over 100,000 CFU per 100 ml.

“As a wastewater utility, we believe in being good stewards of the environment,” Arnett said. “As part of our program, we redeveloped the river interceptor, a 96-inch (2.7 m) diameter sewer along the edge of the river.

This included building a showplace river walk transforming a blighted area of downtown Columbus into a magnificent place.”

The EPA granted the agency a post-Phase II NPDS permit verifying that it is in total compliance with stormwater treatment regulations, and honored the agency with the 2001 EPA Award for CSO Program Excellence. Since that time, the Columbus Water Works has gained worldwide recognition for the project — serving as a model for cleaner communities.

“We’ve made presentations in the United Kingdom, Japan, Brazil – you name it,” Arnett said. “People from Mexico, India, Russia, Japan, South Korea, Australia, New Zealand and Hong Kong have all come to visit, too. We took a chance on a leading-edge solution based on vortex technology, and we’re happy to show whoever’s interested that it passed with flying colors.”



Piloting on the banks of the Chattahoochee River helped Columbus evaluate Hydro International’s vortex separator as an alternative to conventional options



The Grit King® vortex separator removes sand and grit from the flow stream helping protect downstream infrastructure from wear and tear as well as clogging



Entrance to underground facility where Storm King® units provide a sustainable solution for CSO treatment



The river walk in Columbus has become a popular destination for residents and tourists to enjoy the Chattahoochee River