

Using Computational Flow Modeling for Improving Combined Sewer Overflow System Design

Case Study

CLIENT PROFILE

Hydro International is a worldwide supplier of innovative, environmentally sustainable products and services that meet the evolving regulations for the control and treatment of stormwater, combined sewer overflows, and wastewater. Hydro International's line of products provides an economical solution to control the quantity and improve the quality of water.

BUSINESS CHALLENGE

A number of cities in the northeastern US are investigating the installation of new combined sewer overflow (CSO) treatment units utilizing an Advanced Hydrodynamic Vortex Separator (HDVS) with a self-cleansing screen, such as that produced by Hydro International. Traditionally, Hydrodynamic Vortex systems have been utilized as high-rate solids liquid separators and only recently has their potential use as contact chambers for high-rate disinfection of CSOs been realized. Conventional disinfection of CSOs, using mixed basins, calls for achieving contact times on the order of 15 minutes, however a Water Environment Research Federation (WERF) report that monitored more than five years of a full-scale CSO disinfection system based on Hydro International's Storm King Advanced Hydrodynamic Vortex Separator installed at Columbus, GA demonstrated that these systems provide effective high-rate disinfection at contact times of the order of only three minutes¹. While the shorter contact times could save up to 50% of overall project costs for municipalities, regulators still expected to see longer contact times based upon the performance requirements of older systems. The challenge for Hydro International was to understand the basis for the shorter contact times and validate that high-rate disinfection is an acceptable alternative to the longer conventional disinfection methods.

ENGINEERING SOLUTION

Cardiff University and Hydro International successfully used flow modeling software from Fluent to:

- Develop a computational model for the Storm King HDVS
- Run the model through a range of flow speeds corresponding to full-scale laboratory experiments
- Use the results to compute contact times and compare these values with the experimental results

RESULTS ACHIEVED

By combining physical experiments with the computational program, Hydro International successfully:

- Demonstrated that modeled residence times and disinfection kill rates in the Storm King system agree with full-scale laboratory observations
- Provided insights into the basis for the observed disinfection efficacy
- Confirmed that disinfection kill rates are equivalent to (or in some cases better than) those of a conventional tank
- Utilized these results to support a proposal for regulatory agencies to relax the 15 minutes contact time mandate for CSO disinfection
- Enabled an average municipality to save up to 50% of project costs on combined sewer overflow systems, using one-tenth of the footprint
- Enabled Hydro International to offer its customers a less expensive, high performance solution to address combined sewer overflow requirements



COMPANY

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INDUSTRY

Stormwater & Wastewater

SOLUTION

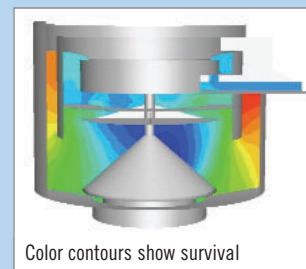
Verified accuracy of computational modeling and used results to explain enhanced performance of new combined sewer overflow system to regulators.

KEY IMPACTS

- Significant reduction in capital costs for combined sewer overflow disinfection systems
- Save space and land for municipal water authorities incorporating the new system

ADDITIONAL SOURCES

¹Bonner, M.C., 2003, Peer Review: Wet Weather Demonstration Project in Columbus, Georgia, Water Environment Research Foundation, WERF Stock No. 98WWR1P, WERF ISBN: 1-893664-61-9.



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