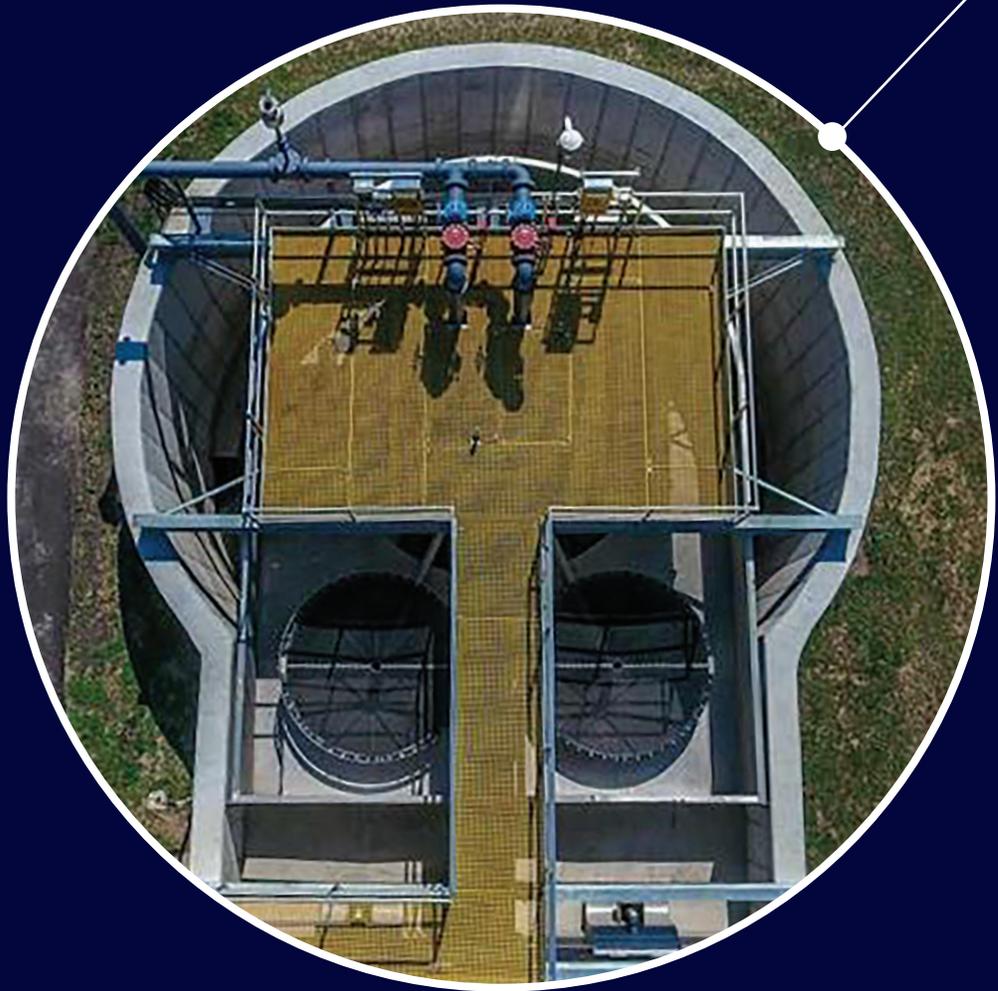


Storm King[®]



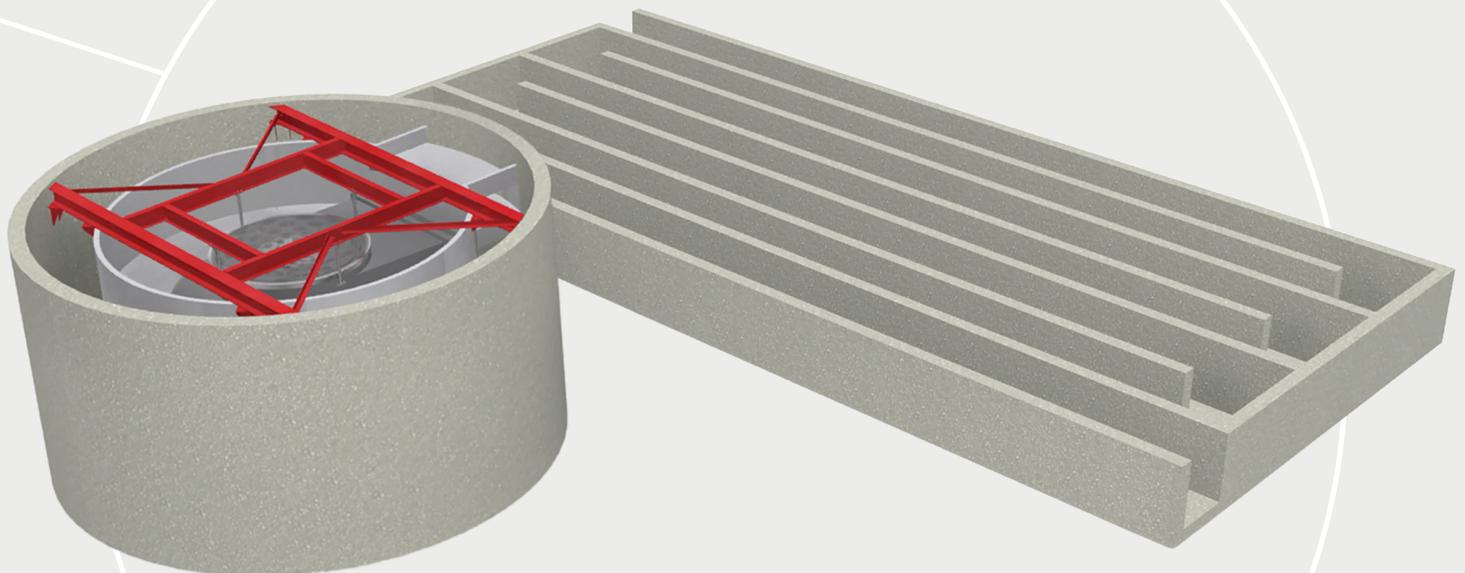
**Sedimentation, Floatables Capture,
and Disinfection in One Device**

Engineered by Hydro International

Storm King®

Primary treatment equivalency, floatables control, & in-vessel disinfection.

The Storm King® is an advanced hydrodynamic vortex separator that utilizes proven technology providing a combination of grit removal, primary treatment equivalency (TSS and BOD reduction), floatables control and in-vessel disinfection within a single unit process. Engineered by Hydro International, the system is ideal for satellite or centralized treatment at overflow sites because it is self-activating, has no moving parts and requires no power to separate solids.



Storm King®

Conventional Serpentine Tank

Performance

- Standard performance of 30-50% TSS and up to 30% BOD reduction for primary treatment equivalency
Additional removal capable with chemical addition
- Proven high rate disinfection in less than 8 minutes

Applications

- Floatables capture, primary treatment equivalency and disinfection of combined sewer overflows (CSOs) and wet weather induced flows
- Remote or unmanned treatment facilities
- Treatment of excess wet weather flows at centralized facilities or POTWs, either through direct discharge through a CSO outfall or blending of the Storm King effluent at the plant discharge.
- Retrofit or new wet weather treatment facilities
- Preliminary treatment prior to storage or equalization

Benefits

- No power and no moving parts
- Self-activating with a small footprint
- Fine grit removal, primary treatment equivalency, in-vessel disinfection, and additional storage
- Combines multiple unit processes in a single device
- Captured material returned to sanitary flow thereby eliminating the need for residuals handling capabilities at remote sites
- Additional benefits include additional storage volume prior to discharge and passive floatable reduction due to internal baffling

Capacity

- Sized for peak flow at peak grit loads
- Virtually no turndown ratio limits
- Modular and expandable combinations to fit any size plant



Visit the Storm King® product page to learn more. [Storm King®](#)



How it Works

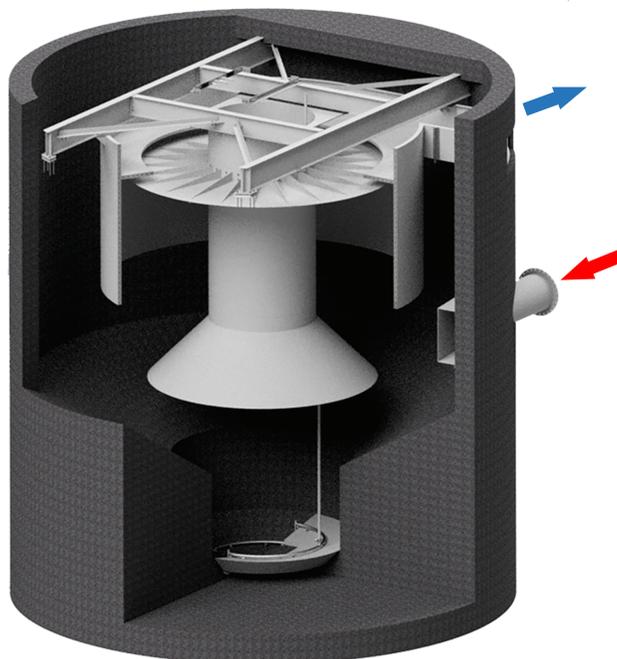
Flow is introduced tangentially into the side of the Storm King barrel (red arrow) causing the contents to rotate slowly about the vertical axis. The flow spirals down the perimeter allowing solids to settle out by gravity. This process is aided by rotary forces, shear forces and drag forces at the boundary layer on the wall and base of the vessel.

The internal components direct the main flow away from the perimeter and back up the middle of the vessel as a broad spiraling column, rotating at a slower velocity than the outer downward flow. A dip plate locates the shear zone, the interface between the outer downward circulation and the inner upward circulation, where a marked difference in velocity encourages further solids separation. Settled solids are directed to the collection chamber located under the center cone and are conveyed out by gravity or through a recessed impeller pump. Treated effluent is discharged into a receiving watercourse, a storage facility, or continues on to receive further treatment. (blue arrow).

The collected solids accumulate in the base of the unit and are returned to the sanitary flow (pumped or gravity flow) to continue on to the wastewater treatment facility.

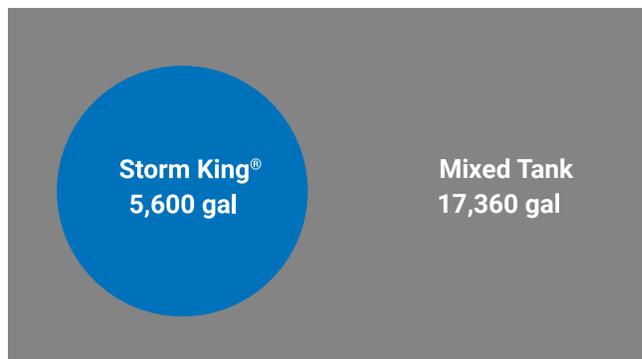
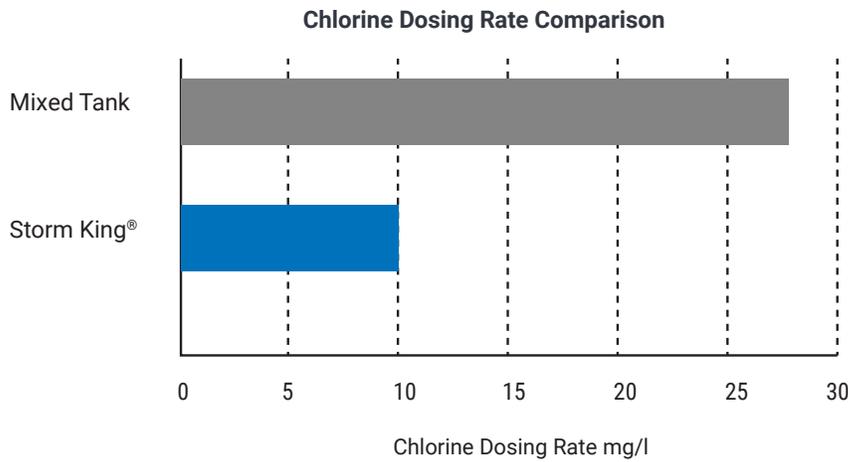
Bacteria reduction is achieved within the Storm King by introducing chemicals such as Sodium Hypochlorite, Peracetic Acid, or Chlorine Dioxide into the upstream diversion structure or into the inlet pipe of the vessel. The spiraling action integral to the system combined with the predictable flow path of the separator allows the unit to combine its solids and grit removal duties with disinfection. Dechlorination (if applicable) is performed at the discharge of the unit (by others).

Storm King® Flow Pattern



Space Efficient Treatment

The Storm King has a long history of providing protection to watercourses. One of the benefits the Storm King can provide is solids removal and disinfection in the same vessel. Taking advantage of the separator's complex flow paths created by the unique internal components, the Storm King can provide excellent efficiencies, potentially using a fraction of the disinfection agent while occupying less than 30% of the area required for conventional disinfection solutions. The Storm King is able to achieve 3 to 4 log kills of total or fecal coliform bacteria within an 8 minute hydraulic retention time and handle commonly available disinfectants such as Sodium Hypochlorite, Peracetic Acid, or Chlorine Dioxide.



Comparisons of Disinfection Area Required for Storm King and Conventional Disinfection Tanks

Maintenance

The Storm King has no moving parts and typically requires no higher maintenance commitment than the sewer system in which it is placed. The maintenance requirement is dependent upon the influent characteristics, which in turn are dependent upon the nature of the contributing system. Once the device has been brought on-line, the Storm King should be visually inspected after the first two spill events. After the initial inspections, visual inspection of the equipment should be carried out twice per year, or as deemed appropriate for the location.

Storm King[®] satellite treatment significantly reduces project costs.

Owner

City of Saco, Maine

Project Highlights

Storm King[®] unit combines screening, sedimentation and disinfection

Storm King[®] System achieves primary treatment equivalency

The system showed up to 83% BOD removal and 72% TSS removal during an intense 4-day spring storm

Objective

Untreated sewage was overflowing into the Saco River during intense storm events. The city had separated 7 of 8 combined sewers, but needed an alternative solution for the 8th sewer due to its downtown location.

Solution

A 22' (6.7 m) diameter Storm King[®] was smaller, more economical and more efficient than conventional clarifier tanks.



Like many other urban communities in the Northeast, the city of Saco, Maine, has been working hard to correct problems caused by combined sewer overflows (CSO). The city's storm sewers were built to collect wastewater and stormwater runoff, and during particularly heavy rains untreated sewage has overflowed pipes and spilled into the Saco River.

The city opted for a hybrid solution to the problem: Eliminating seven of the eight CSO outfall sites by separating the stormwater and wastewater sewers, and pursuing an alternative solution for the eighth. The eighth site served the downtown area. City officials decided against separating the sewers in the downtown area to avoid the high costs of land acquisitions and the ensuing traffic disruptions that would be caused by the digging up of large sections of downtown streets.

The eighth CSO site would require a mechanism at the overflow site to treat the effluent before it reached the river. The question was whether to use a "conventional" primary clarification system or to try a system that employed an alternative technology promising a higher degree of treatment.

Conventional primary clarification systems, typically contact chambers and settling basins, can be prone to "short circuiting", and require prolonged contact times with disinfectants to ensure proper treatment. To avoid this short circuiting, many municipalities

simply utilize much larger tanks to lengthen the amount of time that water is residing within the tank and exposed to coagulants and disinfectants. However, larger tanks require a considerably larger capital investment and far greater maintenance costs. For the effluent to meet the water quality standard required by the Maine Department of Environmental Protection, the city would have had to more than double the size of the tank.

The challenge was two fold: First, how to treat excess stormwater, and second, how to control the flow of water to ensure proper treatment and avoid polluting runoff. To gauge the storm system needs, the city analyzed precipitation in the Saco River catchment from the 1980s and 1990s, as well as a recent five-year period. Based on the findings, city officials felt confident they had a good gauge on estimating future storm events.

“Treating storm water isn’t a finite process” explained the senior consulting engineer from the firm that worked on the Saco sewer project. “We had to be careful to only send enough water so that we can perform within the vortex separator’s rated range.”

The city implemented a new conveyance line at the treatment plant. To control the flow, the city installed two Hydro-Brake® Vortex Valve flow controls from Hydro International, now a part of Oldcastle Infrastructure. To avoid the cost and performance challenges of conventional tankage systems, the city chose to deploy this alternative system to treat the excess flow to the same standard.

The first vortex valve restricts the flow to the treatment plant and the second valve splits the flow, allowing the design peak volume to go through the normal wastewater treatment process and the balance to go to the city’s new CSO treatment system based on the Storm King Advanced Hydrodynamic Vortex Separator. When that capacity is exceeded, the overflow is treated by the 22-ft (6.7 m) diameter Storm King prior to discharge.

In the new CSO treatment system, sedimentation, screening and disinfection are all accomplished in the Storm King. The disinfectant, sodium hypochlorite (NaClO), is injected into the flow of the vessel. The disinfectant and combined sewage then mix in the Storm King, where the sewer solids are removed by gravitational and rotational forces. These forces increase the time it takes for water to flow through the tank, thereby increasing its contact time for disinfection. This increased contact time provides a more efficient “kill rate” for pollutants in the water. Because of the improved efficiency of the Storm King, a smaller tank could be used to achieve the required level of treatment, vastly reducing the up-front capital investment and ongoing maintenance costs.

As settleable solids collect in the base of the vessel, the flows are directed upward through the central area of the vortex chamber. The disinfected effluent is discharged from the system through an air-regulated siphon, which also provides an effective self-activating backwash mechanism to prevent the screen from blinding. After screening, the treated sewer flows are directed through a de-chlorination process prior to being discharged into the Saco River. The collected screenings and settleable solids are then pumped a short distance back to the wastewater treatment plant for processing.

Prior to the project, storm overflow caused discharge of untreated sewage right into the river. With previous storm events Saco might see TSS levels of 300 mg/L. Current removal rates are down to 60mg, and in most instances better than that.

Maintenance upkeep for this type of CSO treatment is minimal. After storm events all solids are pumped back into the treatment system and disposed of. The maintenance crew simply performs a quick washdown of the tank to prepare for the next storm. Alternative conventional systems are far more mechanical in nature requiring a more intensive washdown as well as a drawdown with significantly more manual effort after each storm event.

During a major April storm event that lasted for four days, the Storm King unit treated sustained flows between 0.26-3.9 Mgal/d (11.4-171 L/s). During that time, samples drawn from the system showed that the Storm King removed up to 83% BOD and 72% TSS. With the Storm King system Saco can now capture and treat far greater volumes of water with consistent results from varying degrees of storms.



Two Hydro-Brake® Vortex Valve flow controls are used at the Saco CSO Treatment Facility



The efficiency of the Storm King® unit is derived from the unique configuration of its internal components used at the Saco CSO Treatment Facility



www.oldcastleinfrastructure.com | (888) 965-3227

Trusted partnerships.
Full scale solutions.