Going Toe to Toe With CSO

Two cities face CSO issues by using precast concrete to mitigate pollution

By Claude Goguen & Kirk Stelsel

Never has the saying "When it rains, it pours," been more apropos than after a heavy rain in a city burdened with an antiquated combined sewer system. In the face of scrutiny regarding combined sewer overflows (CSO) into public waterways, cities with combined sewer systems nationwide are looking for affordable, effective solutions.

CSOs pollute local waterways in more than 800 communities serving about 40 million people, with primary concentrations in the Northeast, Great Lakes and Pacific Northwest regions. A 2004 U.S. Environmental Protection Agency report to Congress estimated that there are 9,348 CSO outflows in the U.S. each year that discharge about 850 billion gal of untreated wastewater into the environment.

One solution to minimizing effluent runoff during a storm surge that was used effectively in Portland, Ore., is to detain the CSO in massive underground units. This method enables the city to hold the overflow, pumping the untreated wastewater to the sewer system once the treatment plant is no longer overwhelmed. Another method, used in New York City, includes removing solids from CSO via an underground unit.

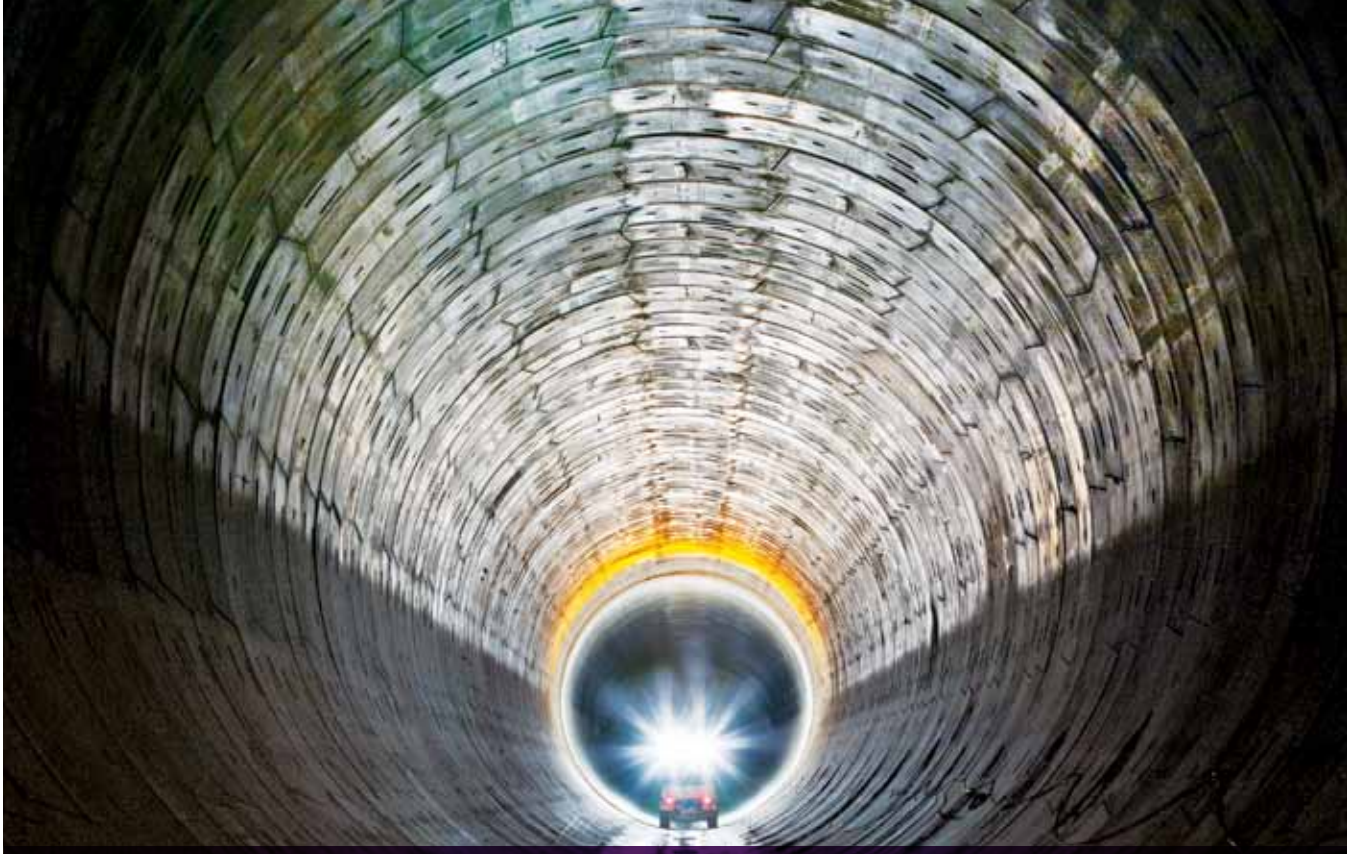
The following case studies provide insight into how precast concrete can be used to save time and money while dealing with combined sewer systems.

Under the River, Through the Pipes

Portland is the third most populous city in the Pacific Northwest, with a population of 2.2 million. As a result of CSO polluting the Willamette River and Columbia Slough watershed during major rain events, its combined sewer system threatened the local quality of life, according to a report by the National Marine Fisheries Service Northwest Region and the Oregon Department of Fish and Wildlife.

Part of the city's plan to combat the problem was the construction of two massive tunnels that parallel the east and west banks of the Willamette River, with the west pipe then crossing under the river to meet up with the east pipe. These pipes contain the overflow on each side of the river during storms. The Big Pipe project included the West Side Big Pipe, measuring 14 ft in diameter and 3.5 miles in length, and the East Side Big Pipe, which is 22 ft in diameter and 6 miles long. Both pipes are lined with precast concrete segmental linings.

A process called microtunneling, which has been used on projects such as the Big Dig in Boston and the tunnel under the English Channel, was employed for the near-surface sewer lines. These lines are smaller in diameter and divert flows from outfalls to the tunnels. The contractor used segments



The finished East Side CSO tunnel in Portland, Ore., is 22 ft in diameter and 6 miles long. *Photo courtesy of Sue Bednarz, Environmental Services, city of Portland, Ore.*

of precast pipe that were lowered into the launching station and then pushed forward by a hydraulic jack. Precast concrete pipe was specified because the process requires a material strong enough to push the drill head, which is not self-propelled, without buckling under the immense pressure.

Tom Gianotti, president of Cascade Concrete Products, the manufacturer of the concrete pipe sections, underscored the importance of the pipe's structural integrity. "If one link in the chain were to fail, the machine is stuck, and that could be a real problem," he said.

By using microtunneling, pipe was installed without interrupting commerce or utilities under streets and roadways, saving both time and money.

Tony Hollingsworth, tunnel superintendent, found the concrete pipe to exceed the needs of the project in terms of strength. "[The pipe] is designed to take these jacking loads," he said. "We've got jacking systems that are capable of producing 900 tons onto the pipe, and it can take way over those jacking loads."

As a result of the project, CSOs to the Willamette River have been reduced by 94%.

A CSO Battle in the Bronx

In New York City, 23 precast concrete sections manufactured by Garden State Precast were installed to create the Bronx River CSO Netting Facility. The facility enables the city to remove solids from the outfall before it reaches the river.

The outfall enters the netting chamber first, where bar screens and net mountings are installed. The chamber measures 18 ft 8 in. by 41 ft by 20 ft 4 in. Next, it enters the tidegate chamber, which contains a 7-ft-by-7-ft cast steel tidegate, before finally entering the turning chamber. This chamber reduces the flow back to the size of the precast outfall box culvert. Three sides of the facility are enclosed by a precast concrete gravity retaining wall as well. In total, the chambers encompass 300-plus yd of precast concrete.

The use of precast saved both time and money throughout the project. It enabled the pumps used for dewatering to be shut off following the installation of the lower level, and the contractor was able to use shoring from another project as a result of a reduced installation envelope. The small envelope also minimized the impact on traffic, which was particularly useful considering that a school was adjacent to the project. To maximize efficiency, the precast was delivered during times when the contractor had holes in his schedule, such as rainy days when other projects were stalled.

"The proximity of the chamber to the public school facility limited our available work hours," said Ralph A. Pedicini, P.E., project manager with Northeast Remsco Construction Inc. "Utilizing precast for the construction provided a tremendous savings in project time."

The precast segments had to meet stringent requirements, including watertight joints in three directions; the horizontal joint between the lower and upper sections of the netting chamber had to be watertight while allowing movement due to post tensioning operations. This was accomplished with the use of two different sealing methods at the seam. Match casting also was accomplished with less than 1 in.

In New York City, 23 precast concrete sections were installed to create the Bronx River CSO Netting Facility. *Photo courtesy of Garden State Precast.*

variance in 43.75 ft, and the precaster modeled the unit in engineering software to check design loads, handling and rotational stresses.

The facility submittal was reviewed by nine agencies, passing every inspection, and the installation went smoothly, finishing on time and on budget.

"Precast concrete enabled us to work within limited hours, while reducing the high labor cost and production time required for a cast-in-place structure," Pedicini said. "Garden State Precast was able to design, fabricate and deliver the structure within our tight schedule."

A Concrete Case

As with any major infrastructure project, key elements to consider when determining which building material to use when designing a system to reduce CSOs include cost, strength, durability, dependability and ease of installation. The material selected also needs to be resilient in order to withstand large-scale natural or man-made disasters, and to maximize service life. Precast concrete meets these key requirements, and because it is manufactured in a quality controlled environment off site, it can be delivered when needed, significantly reducing the footprint of the construction site. SWS

Claude Goguen, P.E., LEED AP, is the National Precast Concrete Association's (NPCA) director of technical services. Kirk Stelsel is the NPCA's director of communication. Goguen and Stelsel can be contacted at 800.366.7731.

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