Innovative Technology Facilitates CSO Efforts

A state-of-the art CSO facility includes a massive underground storage cavern in rock that will fill and drain by gravity.

By Bill Gray and Lisa Eskew

Atlanta constructed its first combined sewer overflow (CSO) treatment facilities in the east area combined sewer basin in the mid-1980s to achieve federally mandated water quality standards in the South River. These facilities consisted of the Custer Avenue CSO diversion, the 26-ft diameter two-mile long Intrenchment Creek deep rock storage and conveyance tunnel, the Intrenchment Creek CSO treatment facility, and the McDaniel Street CSO storage facility.

The city's CSO control program continued in the early 1990s with construction of four CSO treatment facilities in the west area combined sewer area. These facilities are located at the headwaters of small, urban streams that are tributaries to the Chattahoochee River.

With these facilities, Atlanta was in compliance with the EPA's National CSO Control Policy, which provided procedures for cities to fully utilize their existing sewer systems to minimize overflows caused by wet weather and then develop facilities to reduce overflows to such an extent that receiving water quality would improve.

As the Georgia and federal water quality regulations changed subsequently, the city was required to continue its aggressive approach to mitigation of its CSOs, being mandated under a federal consent order to implement additional long-term planning and CSO controls throughout all of its combined sewer areas. The city's "Authorized Plan" included the west area CSO storage and transport tunnel, and the new west area CSO treatment facility; an east area CSO storage and transport tunnel; and modifications to the Intrenchment Creek CSO treatment facility and partial sewer separation in each of the city's three combined sewer basins.

Two of the three areas to be separated were the McDaniel Street facility and the Stockade basin (also known as Confederate) in the east area. As a result of this separation, the east area tunnel was reduced in length to one mile, starting at the north-western end of the existing Intrenchment Creek tunnel.

Before final design of this tunnel began, the city's Department of Watershed Management conducted a value engineering study of the CSO control plan. Its recommendations included replacement of the east area CSO storage tunnel with an above-ground CSO storage tank as well as modifications to the proposed CSO treatment facilities.

Ten-mgd cavern is a linear storage facility excavated out of granite and connected to the existing tunnel and shaft.

East Area CSO

The Clear Streams Objective Joint Venture (CSOJV), comprised of PB (www.pbworld.com), Brown and Caldwell (www.brownandcaldwell.com), and Williams-Russell and Johnson (www.wrjinc.com), began the design of this storage facility in the fall 2003. The first tasks during preliminary design were to review the operational hydraulics of the proposed above ground storage tank and find a suitable location for the facility. The site determined to be suitable was bounded by tall trees and residences to the east, Intrenchment

Combined sewer overflow (CSO) storage and transport tunnel.

Creek to the north, an access road to the south, and treed private property to the west. Based on this fact and the results of a hydraulics review, it was apparent that the preferred design for the required additional CSO storage would be an underground configuration.

Of three options considered—a shallow wide shaft, a deep narrow shaft, and an underground cavern—the city selected the underground cavern in the form of an underground linear storage facility (ULSF). This massive cavern with a capacity of ten MG has been excavated in granite rock and connected to the existing tunnel and shaft. The ULSF does not require additional controls, as it will fill and drain by gravity. This is the first time that a large rock cavern has been used to store CSO. The new system incorporates a unique use of the bending weir technology that was developed in Europe.

Before and After Operations

Atlanta has six combined sewer overflow areas, rather distant one from the other. The existing operation of the east area included chlorination of the CSO from the McDaniel and part of the Custer basins at the Boulevard regulator located on the Intrenchment Creek and chlorination of the Stockade basin at the Confederate regulator located on the Stockade Creek. These disinfected flows were screened at the Custer CSO and, as much as possible, taken for treatment through the Intrenchment Creek tunnel to the Intrenchment Creek plant. That flow not taken to the tunnel passed down Intrenchment Creek as overflow.

The new system will reduce the number of overflows to Intrenchment Creek to four or fewer occurrences per annum, as stipulated in the recent regulations. Flow from the McDaniel and part of Custer basins is still chlorinated at the Boulevard regulator. A new dechlorination facility will treat the chlorinated flows coming from the Boulevard regulator to the downstream Custer facility. A new stormwater by-pass channel in the nearby Intrenchment Creek will carry the future separated water from the upstream Stockade basin.

The flow will then be fine screened and passed to the Intrenchment Creek tunnel to go to the upgraded Intrenchment Creek plant for treatment. The existing Custer CSO screening facility is being modified to add new, fine-mesh, 500-mgd rated drum screens to minimize debris and solids passing into the tunnel. The existing tunnel was cleaned of large volumes of grit and the downstream pumping station was redesigned to handle grit as well as stored CSO.

Bending weirs will control the flood levels in the creek to ensure that the design flow is taken to the tunnel and Intrenchment Creek CSO treatment plant. The bending weirs will maintain a steady state upstream head capable of driving 500 mgd of CSO through a screening facility and into the tunnel and cavern for storage and, finally, treatment.

Construction Completed

Construction of all new facilities started in the spring 2004. By the end of January 2006, the approximately 20-ft by 20-ft pilot tunnel had been excavated.

The rock quality was excellent and type-two rock bolt supports were required in only one area. No type-three supports were required. Evacuation of the entire cavern—60-ft wide, 50-ft high, and 600-ft long—was completed in 2006. The ULSF and screening building was operational in late March 2007.

This unique cavern provided the city with many benefits. It reduced costs and had no impact at the ground surface except at the mining and later operations shaft located on the existing Custer Avenue site. The project required the acquisition of only one property and did not increase the operational concerns of the overall system.

Atlanta has followed a comprehensive approach to achieve compliance with its CSO mandates. By combining careful planning and use of innovative technology, the city has been able to realize its goals in a cost-effective way, with minimal impact on the community at large. GE

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At the Custer Avenue CSO, a new dechlorination facility will treat chlorinated flows coming from the Boulevard regulator.