STORM WATER

U.S. EPA Approves Cincinnati Plan to Reduce CSOs with Mix of 'Green,' 'Gray' Infrastructure

BY PURSUING A MIX of "green" and "gray" infrastructure approaches to reduce overflows from its combined sewer system, the Metropolitan Sewer District of Greater Cincinnati (MSD) expects to save hundreds of millions of dollars compared with its original plan, which called for constructing a large storage tunnel and a treatment facility. As part of a new plan recently approved by the U.S. Environmental Protection Agency (EPA), the MSD will implement a host of measures throughout the lower part of the Mill Creek watershed, including sewer separation, storm-water detention basins, bioswales, and an innovative stream "daylighting" project. Together, the various features will significantly reduce combined sewer overflows (CSOs) while conferring such benefits as improved water quality, enhanced flood protection, and urban renewal.

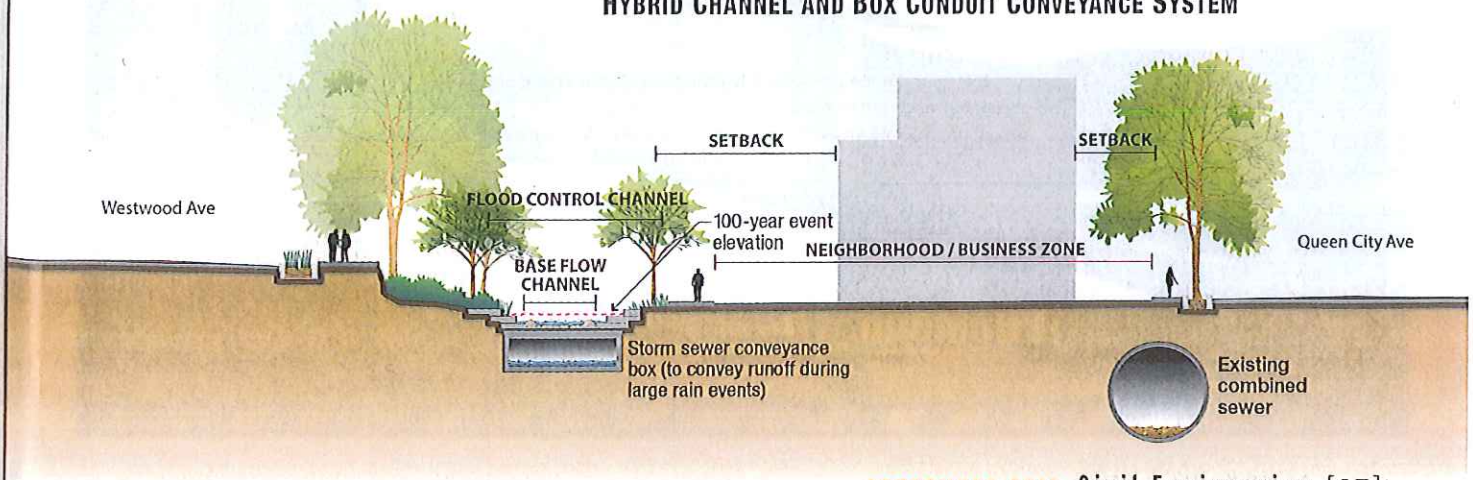
The lower part of Mill Creek, a tributary of the Ohio River, drains a 40,000-acre watershed that comprises nine subbasins. Outfitted long ago with combined sewer systems, the annual CSO discharges to the lower part of Mill Creek from the heavily developed subbasins amount to nearly 7 billion gal. Under the terms of two previous federal consent decrees, the MSD was required to reduce annual CSO volumes within the lower part of the Mill Creek watershed by 1.78 billion gal by the end of 2018. Under a plan approved in accordance with the consent decrees, the MSD was to construct a 7,600 ft long, 30 ft diameter tunnel and an 84 mgd facility for enhanced treatment alongside Mill Creek to capture and treat CSOs before discharging flows to the waterway. This project, which also called for an 84 mgd dewatering pump station, was expected to cost $414.4 million in 2006 dollars. However, the MSD was given the option to develop an alternative plan before the end of 2012. Last December the district submitted its new plan, which the EPA approved on May 30.

A waterway "daylighting" feature is planned as part of the valley conveyance system. Storm water that has been captured upstream by means of an underground collection system will enter the naturalized channel, and a bridge and access deck will facilitate observation of the feature while restricting public access.

HUMAN NATURE, INC./CINCINNATI, BOTH

Formally known as the Revised Original Lower Mill Creek Partial Remedy, the MSD's new plan focuses on reducing CSOs within four subbasins of Mill Creek: Lick Run, West Fork, Kings Run, and Bloody Run. Of these subbasins, Lick Run, which is located on the west side of Cincinnati, generates by far the highest CSOs annually, in large part because much of the original stream and drainage network within the 2,900-acre watershed has been diverted into a combined sewer system. More than 100 years ago, Lick Run itself was surrounded by

HYBRID CHANNEL AND BOX CONDUIT CONVEYANCE SYSTEM



a roughly 3,700 ft long, 19.5 ft diameter combined sewer that remains in operation today. Approximately 70 mi of combined and sanitary sewers discharge to this large brick sewer, which empties into the lower part of Mill Creek from an outfall known as CSO 5. One of the largest single sources of CSOs in the MSD's jurisdiction, CSO 5 is responsible for nearly 1 billion gal annually. Because much of the water entering the large sewer consists of natural drainage and runoff from nearby hillsides, the overflows from CSO 5 are currently estimated to consist of only 25 percent wastewater.

Rather than construct a storage tunnel and a treatment facility, the MSD intends to reduce the volume of groundwater and storm water entering the existing combined sewer systems within the Lick Run, West Fork, and Kings Run subbasins. (In the Bloody Run subbasin, controls will be installed to increase the storage capacity of its combined sewer system.) Because it is the largest source of CSOs, the Lick Run subbasin will receive the lion's share of the infrastructure upgrades, including 54,300 ft of new storm sewer, 3,600 ft of relocated combined sewer, four hydrodynamic separator units to remove sediment and other pollutants from runoff, and 9,900 ft of natural conveyance channels and stream restoration. Meanwhile, eight storm-water detention basins offering a total of roughly 22 acre-ft of storage will be constructed to facilitate storm-water infiltration and reduce runoff volumes. Other features that may be used to control storm-water runoff include pervious pavemen permeable pavers, and reforestation.

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However, a planned green corrid that is being referred to as the valle conveyance system (VCS) represents th "signature piece" of the MSD's effor to improve storm-water managemer in the Lick Run subbasin, says Mar Lynn Lodor, the district's deputy dire tor of shared services. The 8,700 ft lon VCS will consist of a naturalized cha nel at the surface with an undergroun box conduit located beneath it. Rur ning roughly parallel to the large exis ing combined sewer and between tw major arterials, the channel will be d signed to receive overland runoff fro bioswales, as well as flows from certai storm sewers, significantly reducing th amount of storm water entering the com bined system.

Describing the VCS as a "hybrid so lution," Lodor notes that the chann and the box conduit will be hydraul cally connected. As a result, water wi flow in the surface channel durin all but the driest periods, while th

underground conduit will be available to accept higher flows during periods of wet weather. Designed to work together as a system, the channel and the box conduit will be able to accommodate a 100-year storm. The aboveground portion of the VCS will comprise a flood control channel ranging in width from 40 to 250 ft, and a narrower channel within it will carry typical base flows. Depths in the flood control channel will range from 2 to 7 ft.

Upon completion, the channel is expected to significantly reduce localized flooding in the area, which has no source of drainage other than the existing combined sewer system. Both the channel and the box conduit will discharge to Mill Creek just south of CSO 5. Although Mill Creek will continue to receive nearly the same volume of water after wet-weather events, water quality will improve in the receiving body because of the reductions in CSO volumes. Meanwhile, installing the eight detention basins in the Lick Run subbasin is expected to reduce loadings of nutrients, total suspended solids, and total bacteria by respectively 25 percent, 61 percent, and 59 percent.

Beyond the primary goals of reducing CSOs and improving water quality, the MSD sought to devise solutions that would "create additional value for the community" over and above what would be achieved by simply constructing an underground storage tunnel and a CSO treatment facility, Lodor says. By including walkways and other features that will enable the public to experience the naturalized channel up close, the VCS project will provide an amenity that, it is hoped, will help to spur efforts to revitalize the adjacent, aging neighborhood.

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Overall, the Revised Original Lower Mill Creek Partial Remedy is expected to cost $244.3 million in 2006 dollars, the equivalent of $276 million in 2012 dollars. Of this amount, the Lick Run project will take $192.7 million in 2006 dollars, or $217.7 million in 2012 dollars. Conceptualized by the design firm Strand Associates, Inc., of Madison, Wisconsin, and the Cincinnati-based landscape architecture firm Human Nature, Inc., the overall plan for the Lick Run subbasin improvements will be carried out as 12 separate projects. Efforts to reduce CSOs within the West Fork and Kings Run subbasins will involve sewer separation, storm-water detention basins, storage tanks, and stream improvements. Construction work on the first project within Lick Run is almost complete. Meanwhile, the remaining Lick Run projects and the other watershed projects are expected to begin construction between the fall of this year and the spring of 2016. All must be completed by 2018.

—JAY LANDERS