

## **An urban hydrologic and hydraulic model for planning reductions in combined sewer overflows to the Missouri River**

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**Abstract.** The City of Omaha, like many older U.S. cities, collects stormwater runoff and sanitary sewage together in combined sewers that convey flows to treatment plants. Because larger storms can overwhelm the combined sewers, these systems are constructed with overflows that route combined sewage directly to water bodies during extreme storm events to protect the system. In 2002, the State of Nebraska required the City of Omaha to develop a plan for controlling its combined sewer overflows (CSOs) to the Missouri River and several tributaries to improve water quality. To develop a long-term control plan, an InfoWorks model of the urban hydrology and the combined and sanitary sewer collection system was developed beginning in 2003. Using the model, it was estimated that 3.5 billion gallons of combined sewage overflows to Omaha's rivers in an average year during 86 individual overflow events. The model was used to consider a number of alternatives for reducing CSOs, including increasing conveyance to existing treatment plants, separating sanitary and storm sewers, constructing CSO storage facilities, and implementing high-rate treatment of CSOs. Many factors were considered to select the best plan, including water quality improvements and costs. The final plan includes a mixture of control technologies and is expected to reduce the CSO volume (and its associated *E. coli* load) by more than 85% and to reduce the frequency of CSOs to only a few in an average year. The model was a critical tool in evaluating alternatives, sizing control facilities, and ensuring that the final plan would meet regulatory requirements. Omaha is now implementing the \$1.7 billion CSO Program.