

Contents

- A** **Executive Summary**
- B** **West Sanitary Model Calibration Reports**
 - B-1 Northwest/Southwest
 - B-2 Helfrich
 - B-3 Allens Lane North
 - B-4 North Park
 - B-5 US Hwy 41/Millersburg
- C** **East Sanitary Model Calibration Reports**
 - C-1 E-11
 - C-2 Lloyd
 - C-3 Covert
 - C-4 Riverside-Vann

Figure

- 1 Sewers Included in SSS Hydraulics Models

Executive Summary

As part of the initial 2002 LTCP development effort, the Utility developed hydraulic models of the West CSS and East CSS. These models were updated and submitted to USEPA in 2009 and 2007, respectively. The USEPA has approved the models for use in the development of the LTCP portion of the IOCP. In addition, the Utility has also submitted the *Typical Precipitation Year Evaluation Report* (Clark Dietz, February 2008) to define the conditions that will be modeled to establish the level of control for CSO abatement projects.

Section E of Appendix C of the Decree requires the Utility to develop SSS hydraulic models and to integrate these models with the CSS models to support development of the IOCP. This section presents a summary overview of tasks completed to develop the SSS model calibration reports as well as the key findings observed during the model building and calibration efforts. The individual model development and calibration reports for each SSS basin will be included in the overall IOCP as a separate volume titled *SSS Model Calibration Reports* (CH2M HILL, Commonwealth Engineers, and Powers Engineering, November 2011), and they are incorporated into the System Characterization by reference.

Overview

The SSS hydrologic and hydraulic models were developed to include all of the SSS basins in the East and West Service Areas, recurring wet-weather SSOs, or other significant capacity restrictions. The SSS models include the trunk sewers (SSS mains 12 inches and larger) and areas that had reported recurring basement backups or SSOs. The Phase 1 (Spring 2010) flow monitoring was used to develop an understanding of the inflow/infiltration rates and to inform the selection of the leaky sewersheds. The Phase 2 (Spring 2011) flow and rainfall data were used to develop, calibrate, and validate the SSS models.

Flow and Rainfall Monitoring

Flow monitors were installed in each basin such that flows from the SSS model may be isolated from the CSS model. The year 2011 brought significant challenges to the region with severe and long lasting flooding of the Ohio River and its tributaries. This impacted the development of the model due to the extensive surcharging of the SSS. The flow monitoring data from the time frame most impacted by the flooding were not used in the calibration of the SSS models. The spring of 2011 also brought record amounts of rainfall. The total rainfall depths measured during the flow monitoring period (March 2011 to June 2011) was 27 in, which is 10 inches over the historic average. This record rainfall in conjunction with the Ohio River and tributary flooding impacted the flow monitoring. Most of the monitors indicated extensive surcharging of the system during even small (0.2-inch) rainfall events.

Hydraulic Model Development

The Utility's GIS initially was used to develop the hydraulic model. Field survey and invert measurements were collected and used to update the hydraulic model. The Utility is in the

process of updating the GIS with this information because the GIS did not always contain the actual rim or invert elevations for the modeled structures. The preliminary survey data were in some cases significantly different than the GIS data so the Utility responded to this issue by surveying all of the modeled structures. This extensive survey component was not expected when the Sanitary Sewer Evaluation Work Plan was developed, which required the modeling teams to build and calibrate the models while the nodes and pipes were being field investigated. There are currently a number of unresolved survey data issues that required conservative decisions to be made on the calibration. The data issues will continue to be investigated, and the models will be updated as these issues are resolved. The basins that are impacted the most by this are North Park, Allens Lane North, and Northwest/Southwest (NW/SW).

Model Calibration and Verification

The Utility's *Modeling Work Plan* (CH2M HILL, April 2011) was developed so that every SSS basin model would be constructed and calibrated the same way. The 11 basins were calibrated and verified to meet United Kingdom Wastewater Planning Users Group (WaPUG) standards, which has been accepted by USEPA as an appropriate method to develop and calibrate hydraulic models.

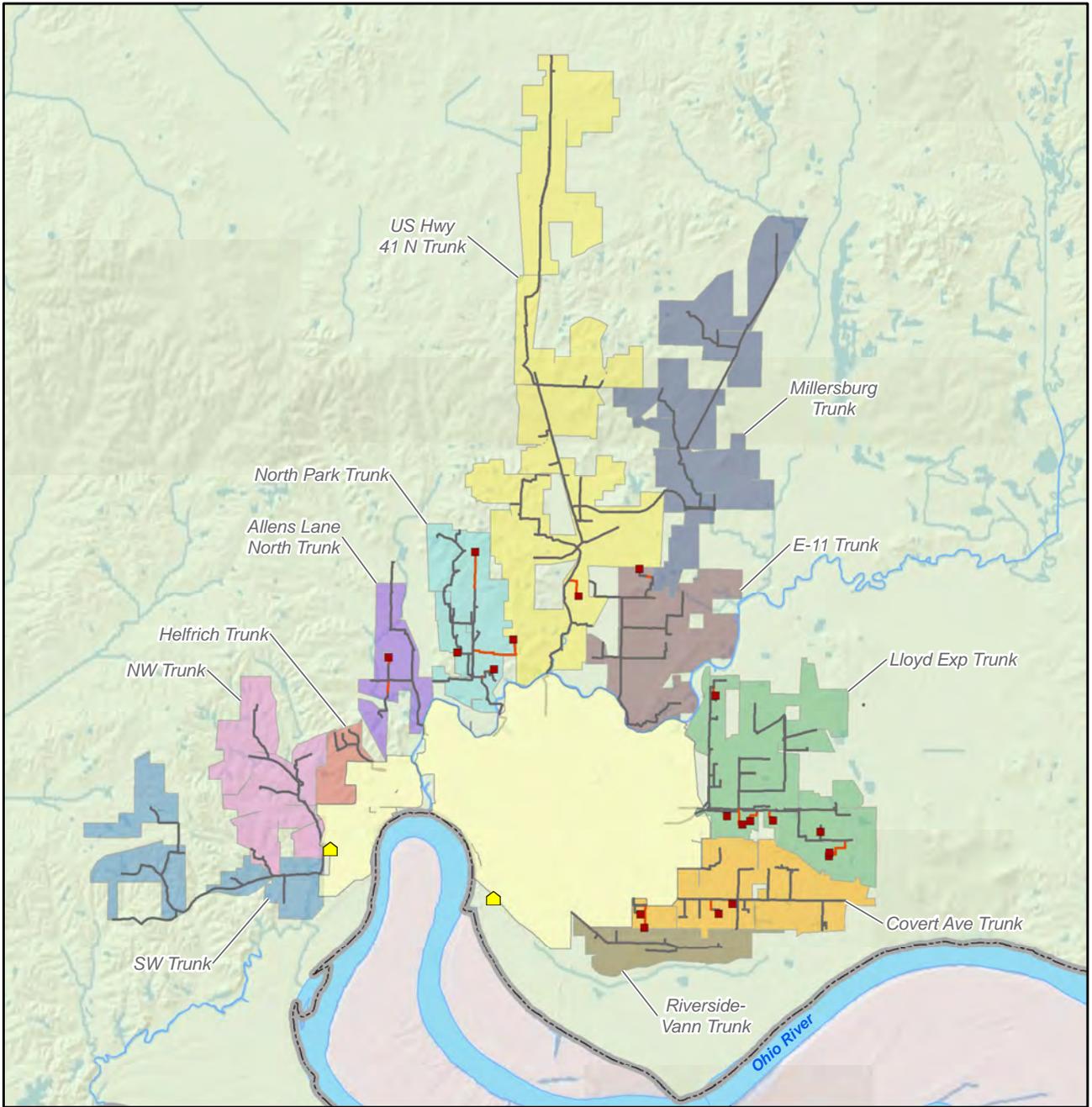
The calibration and verification effort for the West Service Area's SSS basins were complicated due to recurring flooding and lack of data. One basin that was affected by the lack of data, the North Park Basin, was not able to be calibrated due to an apparent loss of flow between Flow Monitor 8 and Flow Monitor 11. The Utility is currently analyzing the data obtained through the SSES field activities to identify the pipes coming into the trunk sewer and investigate and survey those pipes not currently modeled in this sewershed. Due to the outstanding items mentioned, the modeled parameters in the North Park model reflect a more conservative approach to simulating flow.

The Allens Lane North sewershed was calibrated at the time of this report submittal. The Utility is continuing to track down the invert elevations pertinent to this sewershed and will complete the validation step as soon as this data can be obtained.

The interactions between the West WWTP, the CSS, and the NW/SW SSS are also being explored further. A robust boundary condition between these three systems was not obtainable during the development and calibration/validation process. The Utility continues to work on this issue and is installing supplementary monitors in the spring of 2012 to further aid in its resolution.

The remainder of the basins in the Utility's SSS Service Area calibrated and validated well. The Utility remains committed to a program to investigate and understand the SSS and to continue process improvement. The interaction between the CSS and the SSS is an ongoing process and will continue to be explored.

As stated above, the details of the model construction, calibration, and verification of each basin are presented in the individual model development and calibration reports for each SSS basin and can be found in the *SSS Model Calibration Reports*.



VICINITY MAP

LEGEND

- Modeled Recurring Backup Location
- Modeled Sewer with Capacity Related Overflows
- Modeled Sewer
- 🏠 Wastewater Treatment Plant
- 🟡 Combined Sewer Area
- 🟦 Hydrography
- Indiana State Boundary

Sanitary Basins

- 🟠 Covert Ave Trunk
- 🟤 E-11 Trunk
- 🟡 Helfrich Trunk
- 🟢 Lloyd Exp Trunk
- 🟣 Millersburg Trunk
- 🟡 NW Trunk
- 🟦 North Park Trunk
- 🟤 Riverside-Vann Trunk
- 🟢 SW Trunk
- 🟡 Allens Lane North Trunk
- 🟡 US Hwy 41 N Trunk

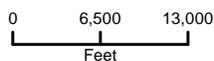


FIGURE 1
Sewers Included in
SSS Hydraulic Models
 Model Calibration Reports
 November 30, 2011

